# Engine Controls - 3.8L

## Specifications

### Temperature vs Resistance

| °C | °F | OHMS |
|---|---|---|
| Temperature vs Resistance Values (Approximate) | | |
| 100 | 212 | 177 |
| 90 | 194 | 241 |
| 80 | 176 | 332 |
| 70 | 158 | 467 |
| 60 | 140 | 667 |
| 50 | 122 | 973 |
| 45 | 113 | 1188 |
| 40 | 104 | 1459 |
| 35 | 95 | 1802 |
| 30 | 86 | 2238 |
| 25 | 77 | 2796 |
| 20 | 68 | 3520 |
| 15 | 59 | 4450 |
| 10 | 50 | 5670 |
| 5 | 41 | 7280 |
| 0 | 32 | 9420 |
| –5 | 23 | 12300 |
| –10 | 14 | 16180 |
| –15 | 5 | 21450 |
| –20 | –4 | 28680 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

### Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| A/C Refrigerant Pressure Sensor | 6 N·m | 53 Lb In |
| Camshaft Position Sensor (CMP) Retaining Bolt | 10 N·m | 89 Lb In |
| Crankshaft Balancer Bolt | 150 N·m + 114° | 111 Lb Ft + 114° |
| Crankshaft Position Sensor (CKP) Bolts | 20 N·m | 15 Lb Ft |
| Engine Coolant Temperature Sensor (ECT) | 25 N·m | 18 Lb Ft |
| Engine Oil Level Switch | 20 N·m | 15 Lb Ft |
| Exhaust Gas Recirculation Valve (EGR) Bolts | 25 N·m | 18 Lb Ft |
| Fuel Filter Fitting | 30 N·m | 22 Lb Ft |
| Fuel Pipe Front Clip Bolt | 4.5 N·m | 40 Lb In |
| Fuel Pipe Rear Clip Bolt | 5.5 N·m | 49 Lb In |
| Fuel Pipe Shield Bolt | 5 N·m | 44 Lb In |
| Fuel Pipe Shield Nuts | 5 N·m | 44 Lb In |
| Fuel Pipe Shield Studs | 5 N·m | 44 Lb In |
| Fuel Rail Attaching Nuts or Bolts | 10 N·m | 89 Lb In |
| Fuel Sender Assembly Attaching Nuts | 6.5 N·m | 58 Lb In |
| Fuel Tank Retaining Strap Bolts | 33 N·m | 25 Lb Ft |
| Heated Oxygen Sensor | 42 N·m | 31 Lb Ft |

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**Fastener Tightening Specifications (cont'd)**

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Ignition Coil Retaining Bolts | 4.5 N·m | 40 Lb In |
| Ignition Control Module Retaining Bolts | 30 N·m | 22 Lb Ft |
| Knock Sensor | 19 N·m | 14 Lb Ft |
| Spark Plug | 27 N·m | 20 Lb Ft |
| Throttle Body Nuts or Bolts | 10 N·m | 89 Lb In |

## Fuel System Specifications

If you have the 3800 V6 engine (VIN Code K), use regular unleaded gasoline rated at 87 octane or higher.

If you have the 5.7L V8 engine (VIN Code G), use premium unleaded gasoline rated at 91 octane or higher for best performance. You may use middle grade or regular unleaded gasolines, but your vehicle may not accelerate as well.

It is recommended that the gasoline meet specification which have been developed by the American Automobile Manufactures Association (AAMA) and endorsed by the Canadian Motor Vehicle Manufacturers Association for better vehicle performance and engine protection. Gasolines meeting the AAMA specification could provide improved driveability and emission control system performance compared to other gasolines. For more information, write to: American Automobile Manufacturer's Association, 7430 Second Ave, Suite 300, Detroit MI 48202.

Be sure the posted octane for premium is at least 91 (at least 89 for middle grade and 87 for regular). If the octane is less than 87, you may get a heavy knocking noise when you drive. If it's bad enough, it can damage your engine.

If you're using fuel rated at the recommended octane or higher and you hear heavy knocking, your engine needs service. But don't worry if you hear a little pinging noise when you're accelerating or driving up a hill. That's normal, and you don't have to buy a higher octane fuel to get rid of pinging. It's the heavy, constant knock that means you have a problem.

***Notice:*** Your vehicle was not designed for fuel that contains methanol. Do not use methanol fuel which can corrode metal parts in your fuel system and also damage plastic and rubber parts. This kind of damage would not be covered under your warranty.

If your vehicle is certified to meet to meet California Emission Standards (indicated on the under hood emission control label), it is designed to operate on fuels that meet California specifications. If such fuels are not available in states adopting California emissions standards, your vehicle will operate satisfactorily on fuels meeting federal specifications, but emission control system performance may be affected. The malfunction indicator lamp on your instrument panel may turn on and/or your vehicle may fail a smog-check test. If this occurs, return to your authorized dealer for diagnosis to determine the cause of failure. In the event it is determined that the cause of the condition is the type of fuels used, repairs may not be covered by your warranty.

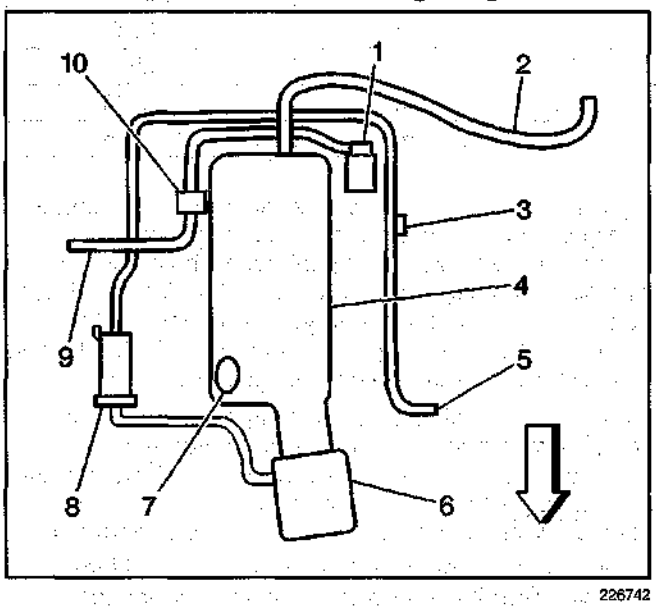
Some gasolines that are not reformulated for low emissions may contain an octane-enhancing additive called methylcyclopentadienyl manganese tricarbonyl (MMT); ask your service station operator whether or not the fuel contains MMT.

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# Schematic and Routing Diagrams

## Emission Hose Routing Diagram

### Emission Hose Routing Diagram

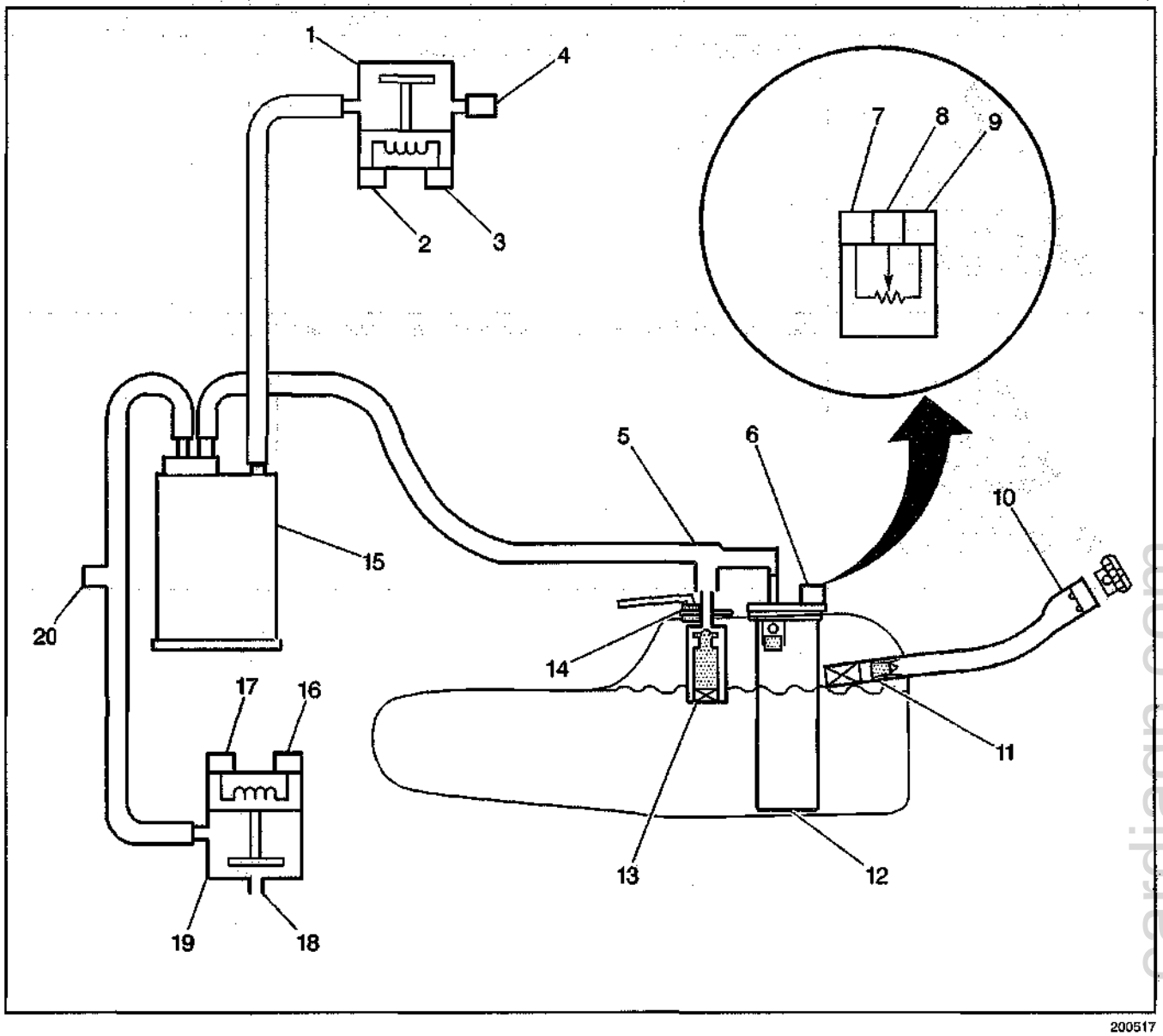



**Legend**

(1) Fuel Pressure Regulator
(2) To Vacuum Brake Booster
(3) EVAP Service Port
(4) Intake Manifold
(5) To EVAP Canister (Behind the Left Rear Tire)
(6) Throttle Body
(7) PCV Valve
(8) EVAP Canister Purge Solenoid Valve
(9) To Accessory
(10) Manifold Vacuum Source

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## Emission Hose Routing Diagram (EVAP Control System Overview)




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**Legend**

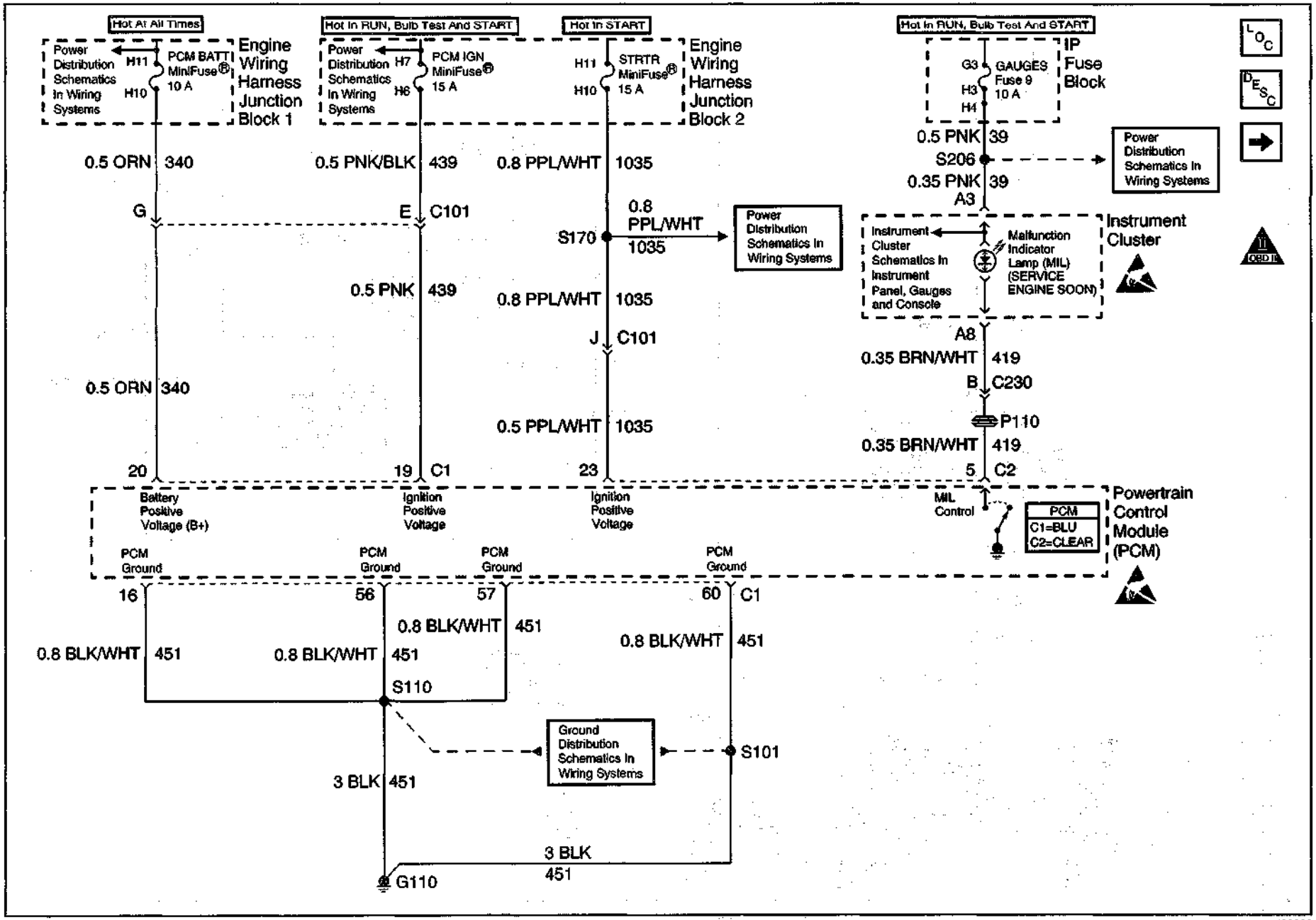
(1) EVAP Vent Valve/Solenoid
(2) EVAP Vent Valve/Solenoid Ignition Feed Circuit Terminal
(3) EVAP Vent Valve/Solenoid Control Circuit Terminal
(4) EVAP Vent Valve/Solenoid Filter
(5) EVAP Vapor Lines
(6) Fuel Tank Pressure Sensor
(7) Fuel Tank Pressure Sensor Ground Circuit Terminal
(8) Fuel Tank Pressure Sensor Signal Circuit Terminal
(9) Fuel Tank Pressure Sensor Circuit 5 Volt Reference Circuit Terminal
(10) Fuel Filler Pipe
(11) Check Valve (Spitback)
(12) Modular Fuel Sender Assembly
(13) Fuel Limiter Vent Valve (FLVV)
(14) Pressure/Vacuum Relief Valve (Optional)
(15) EVAP Canister
(16) EVAP Canister Purge Valve/Solenoid Ignition Feed Circuit Terminal
(17) EVAP Canister Purge Valve/Solenoid Control Circuit Terminal
(18) Intake Manifold Vacuum Source
(19) EVAP Canister Purge Valve/Solenoid
(20) EVAP Service Port

**Engine Controls Schematic Icons**

| Icon | Icon Definition |
|---|---|
|  19384 | Refer to *ESD Notice* in Cautions and Notices. |
|   19385 | Refer to *OBD II Symbol Description Notice* in Cautions and Notices. |

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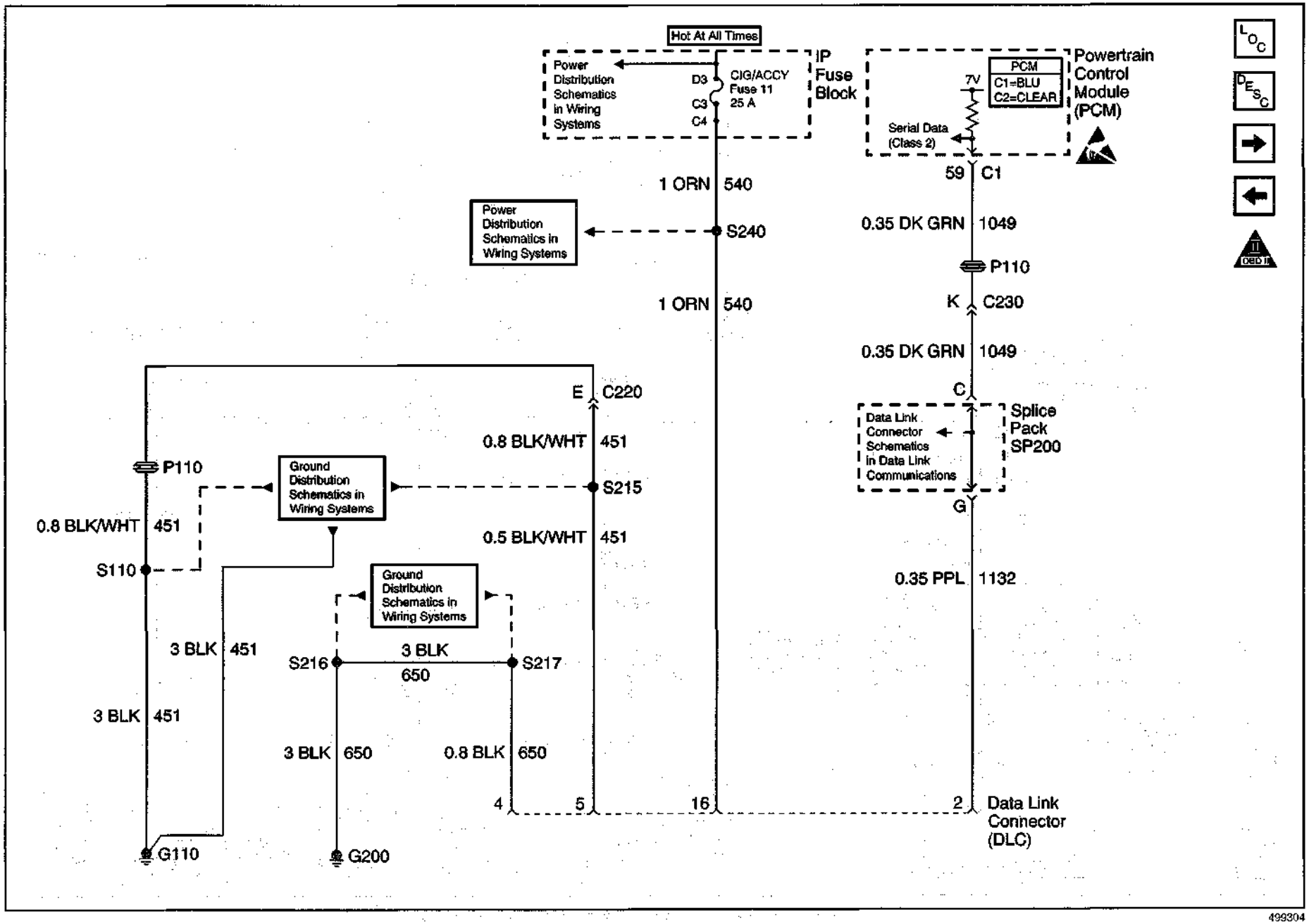
## Engine Controls Schematics (Power and Ground)






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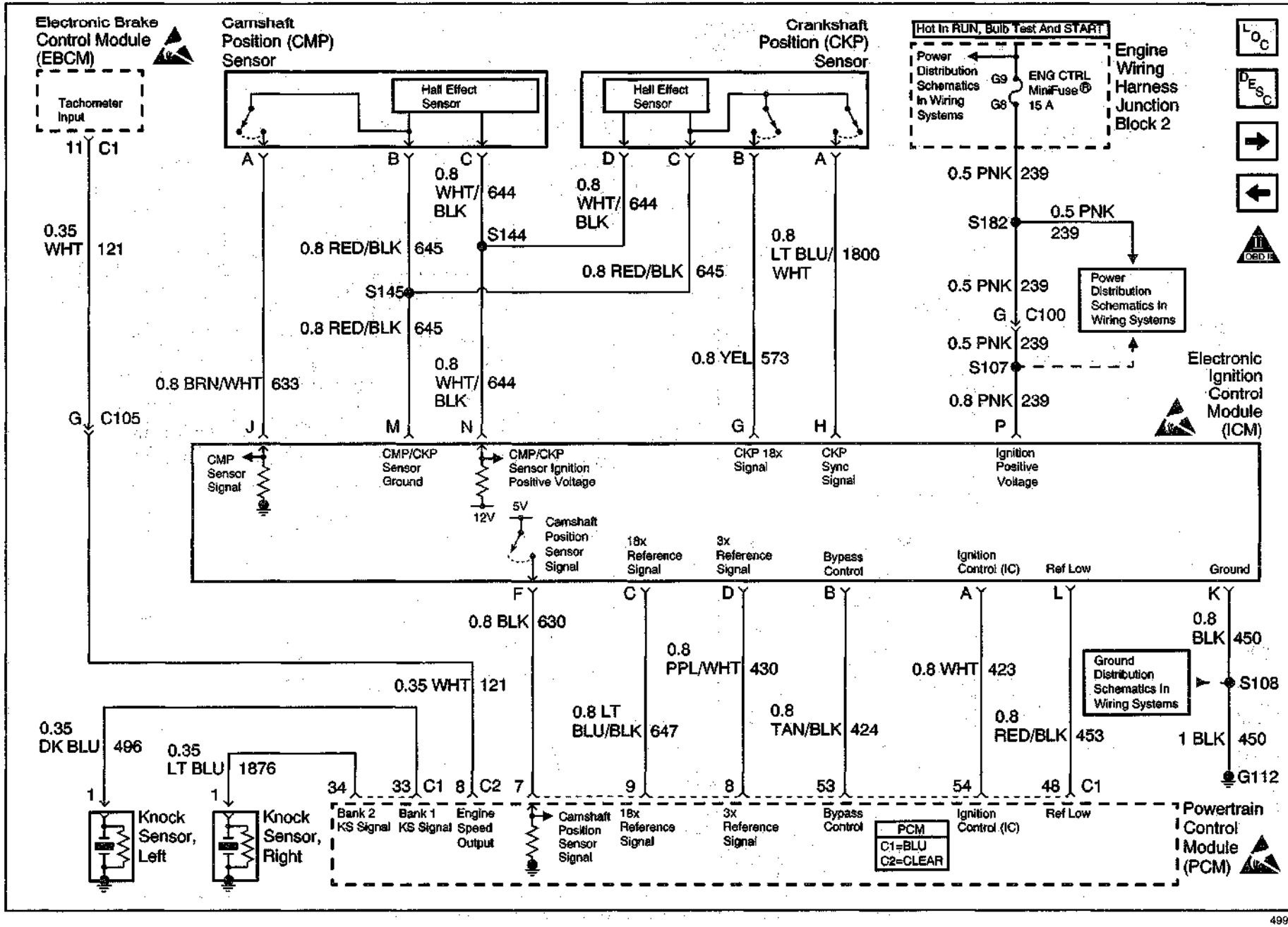
# Engine Controls Schematics (Class 2 Serial Data Line)






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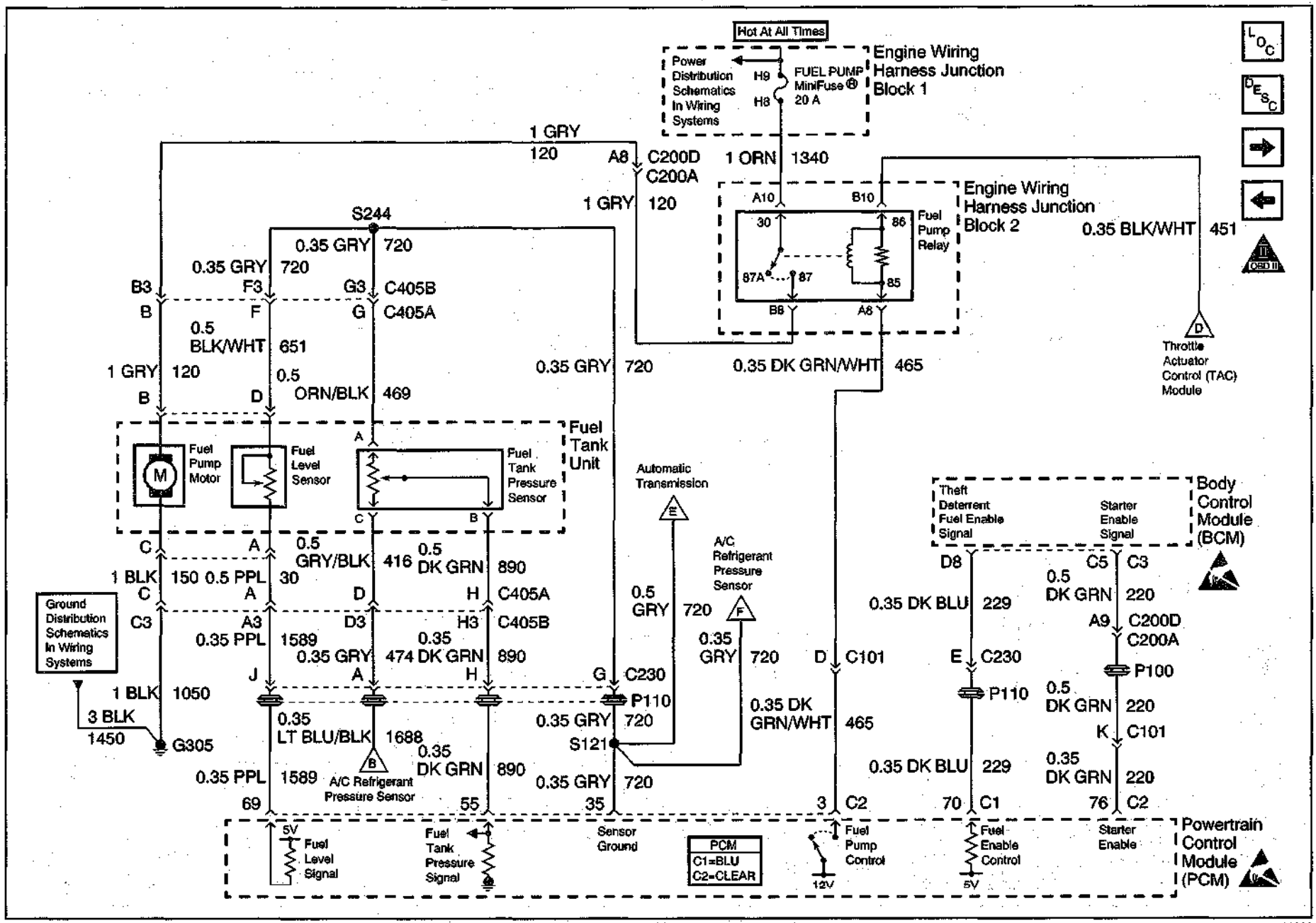
## Engine Controls Schematics (Ignition Controls, Knock Sensors)






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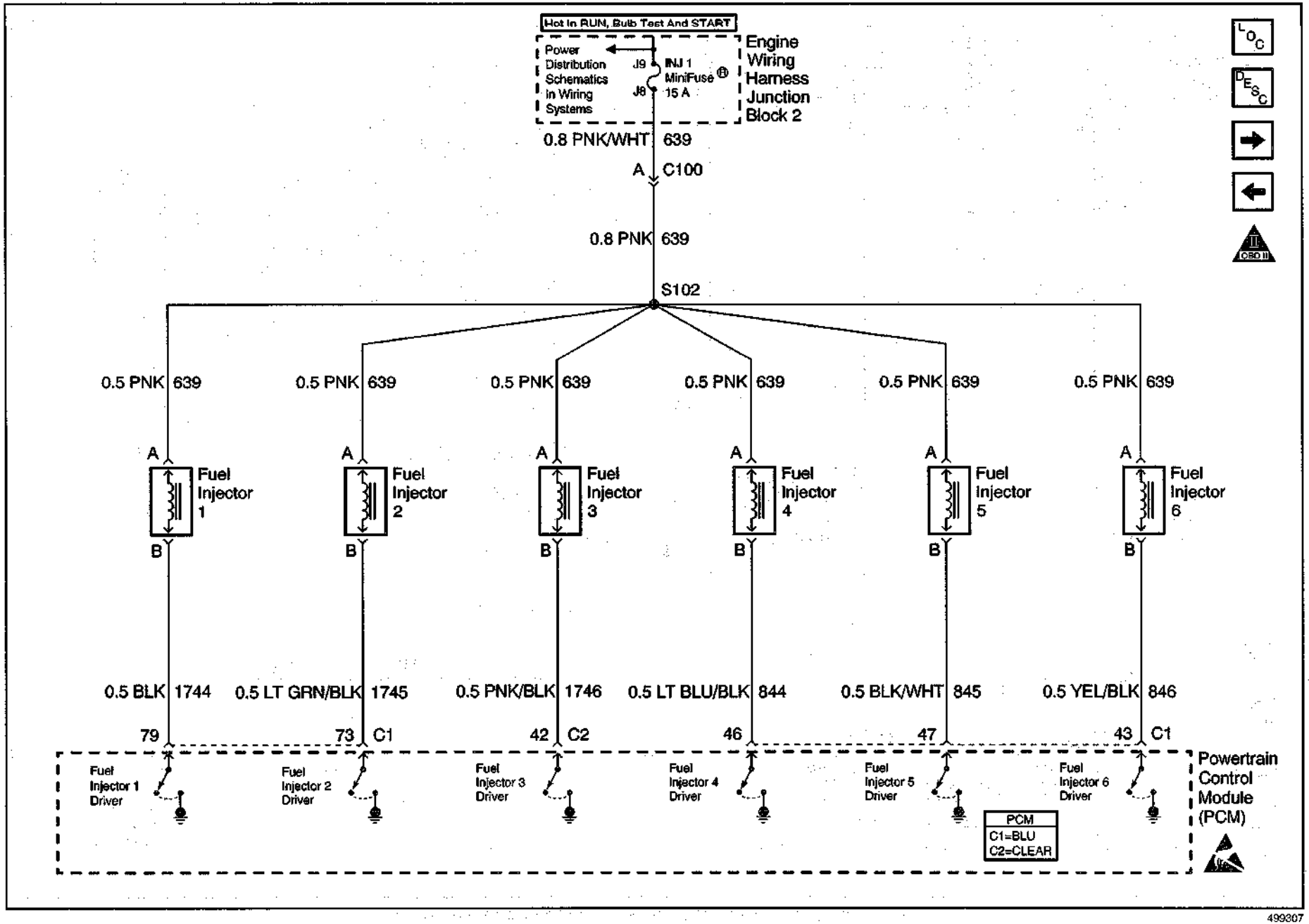
## Engine Controls Schematics (Fuel Pump Controls)






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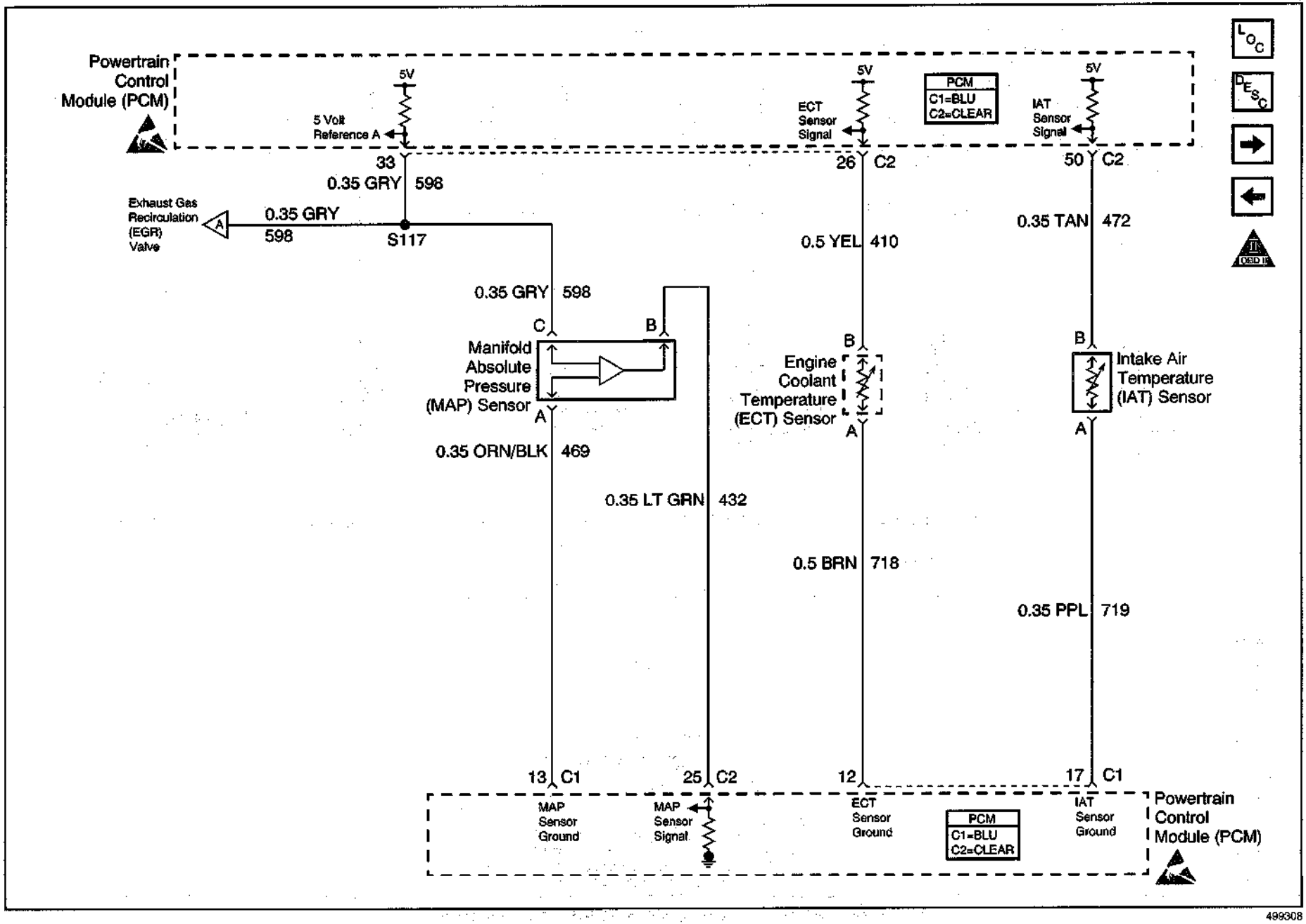
## Engine Controls Schematics (Fuel Injectors)






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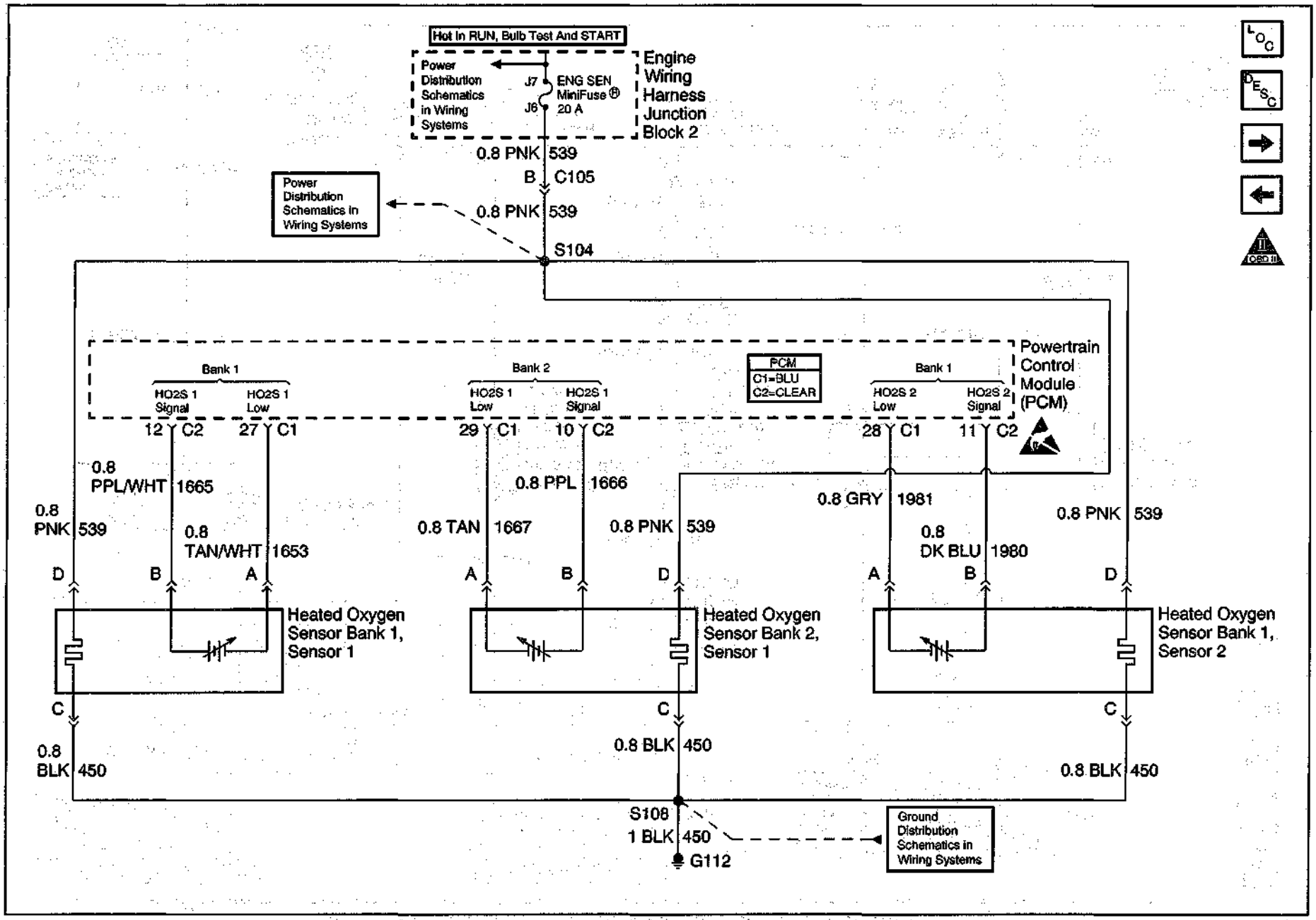
## Engine Controls Schematics (MAP, ECT, IAT Sensors)






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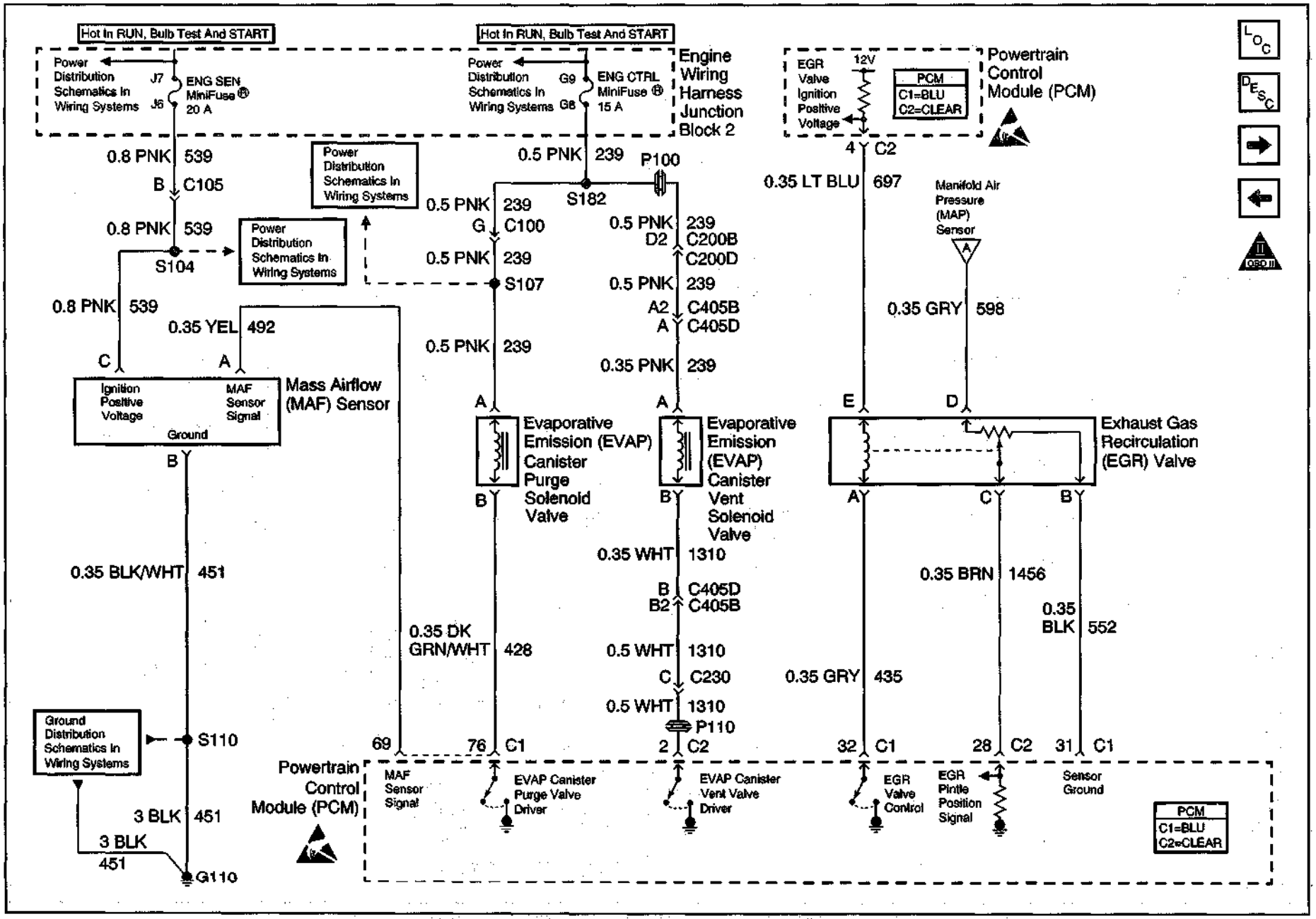
## Engine Controls Schematics (Heated Oxygen Sensors)






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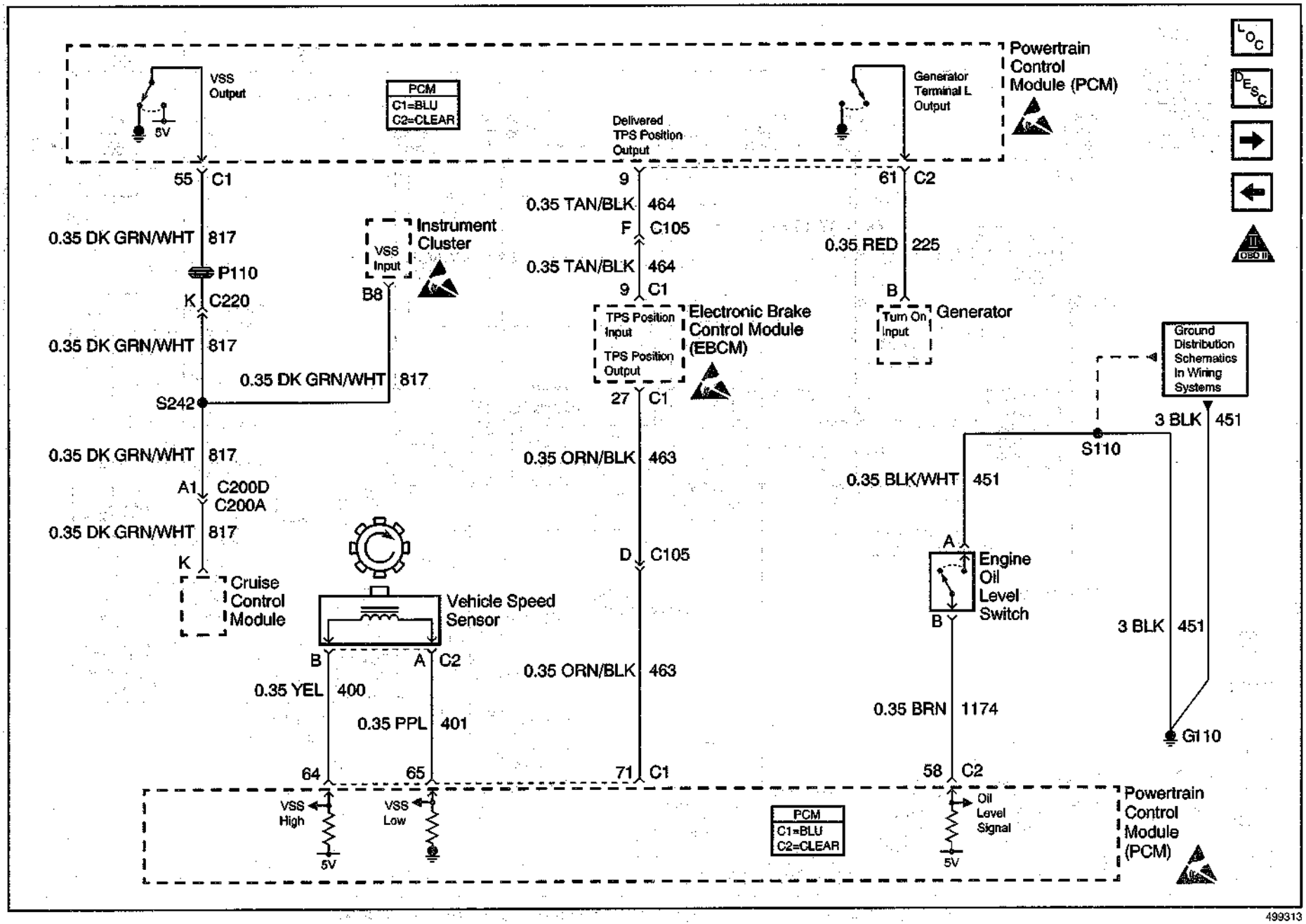
# Engine Controls Schematics (MAF Sensor, EVAP System, EGR Valve)






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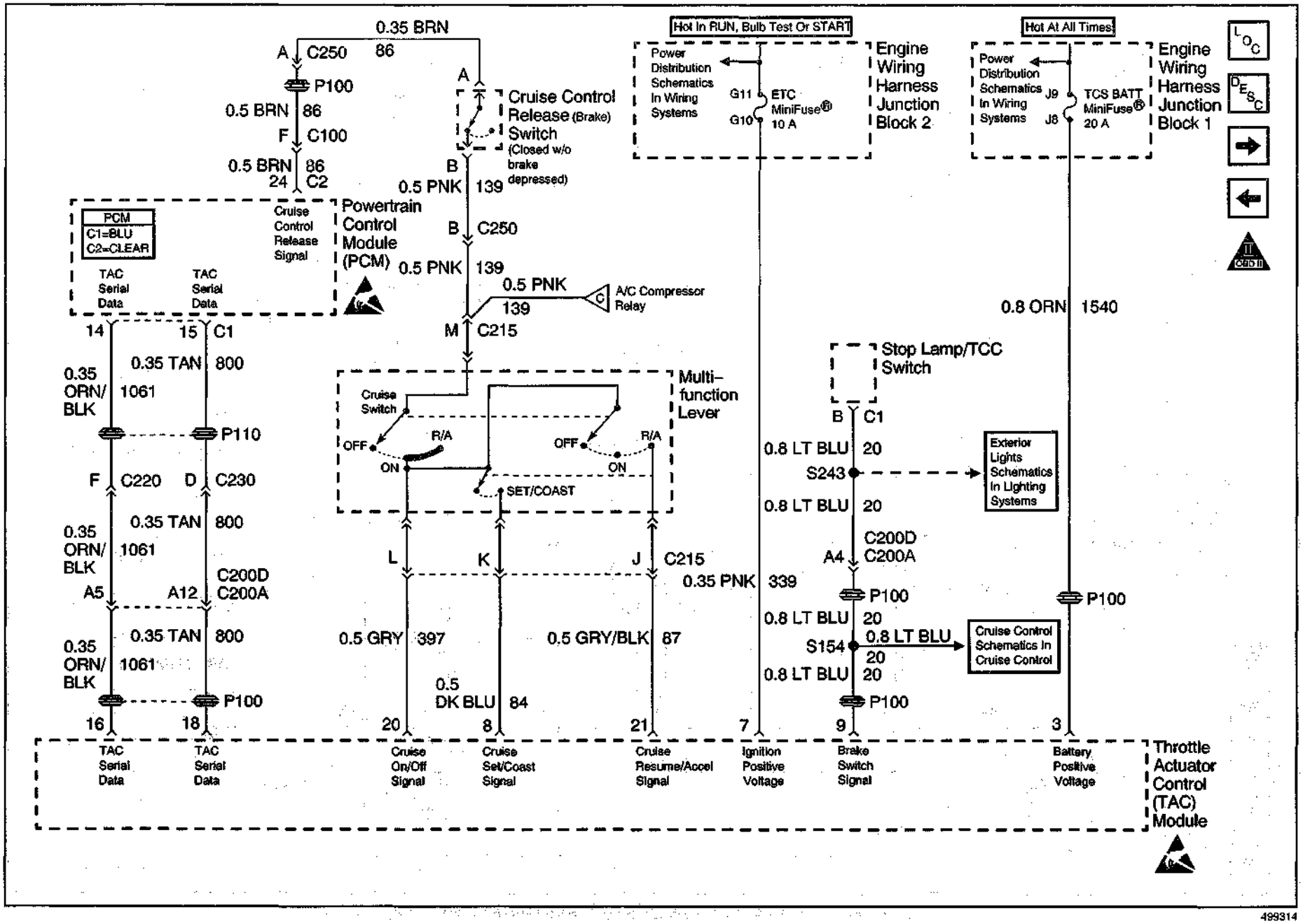
## Engine Controls Schematics (VSS, Cruise, Generator, Engine Oil Level)






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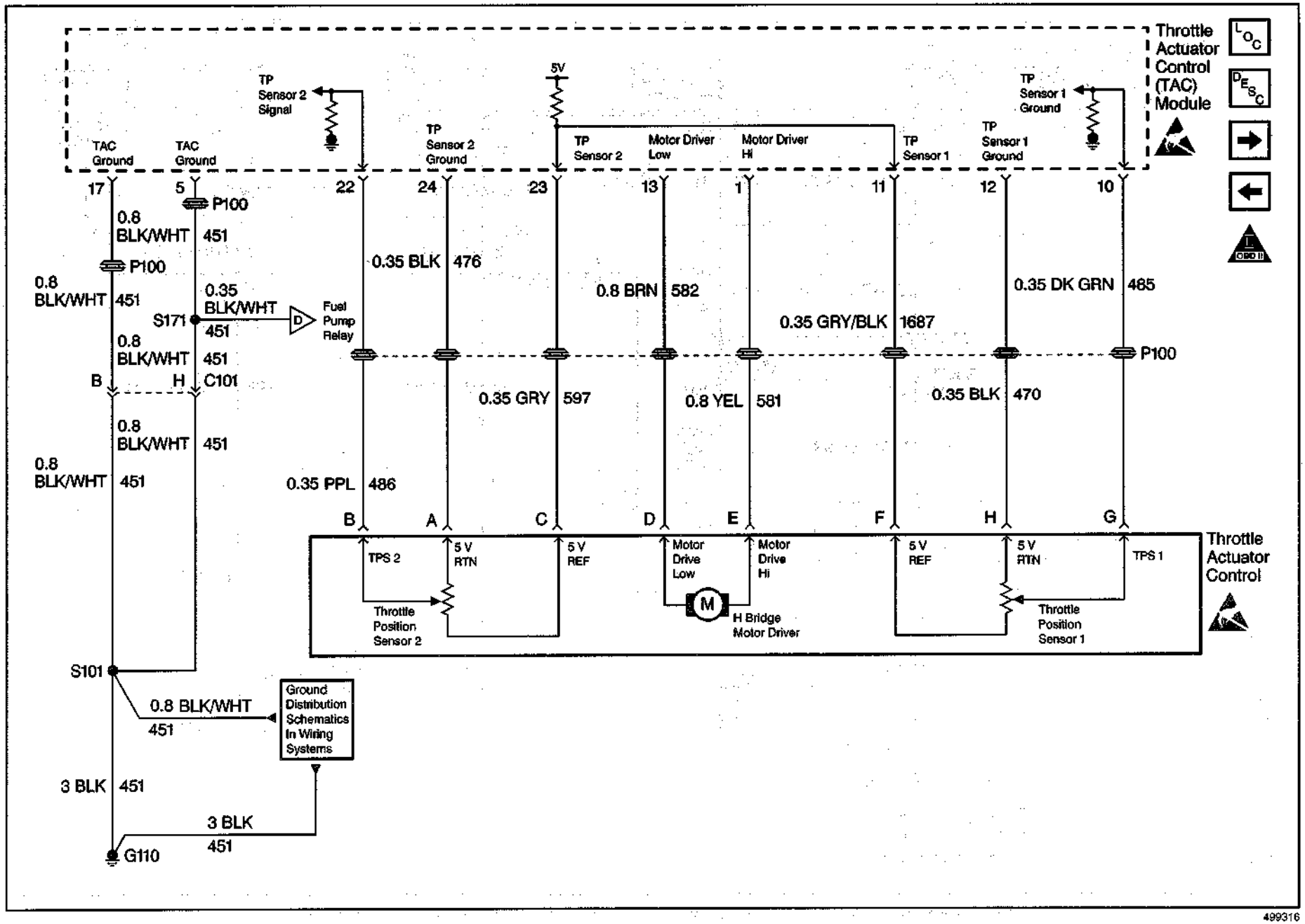
# Engine Controls Schematics (TAC Module, Brake Switch, Cruise)






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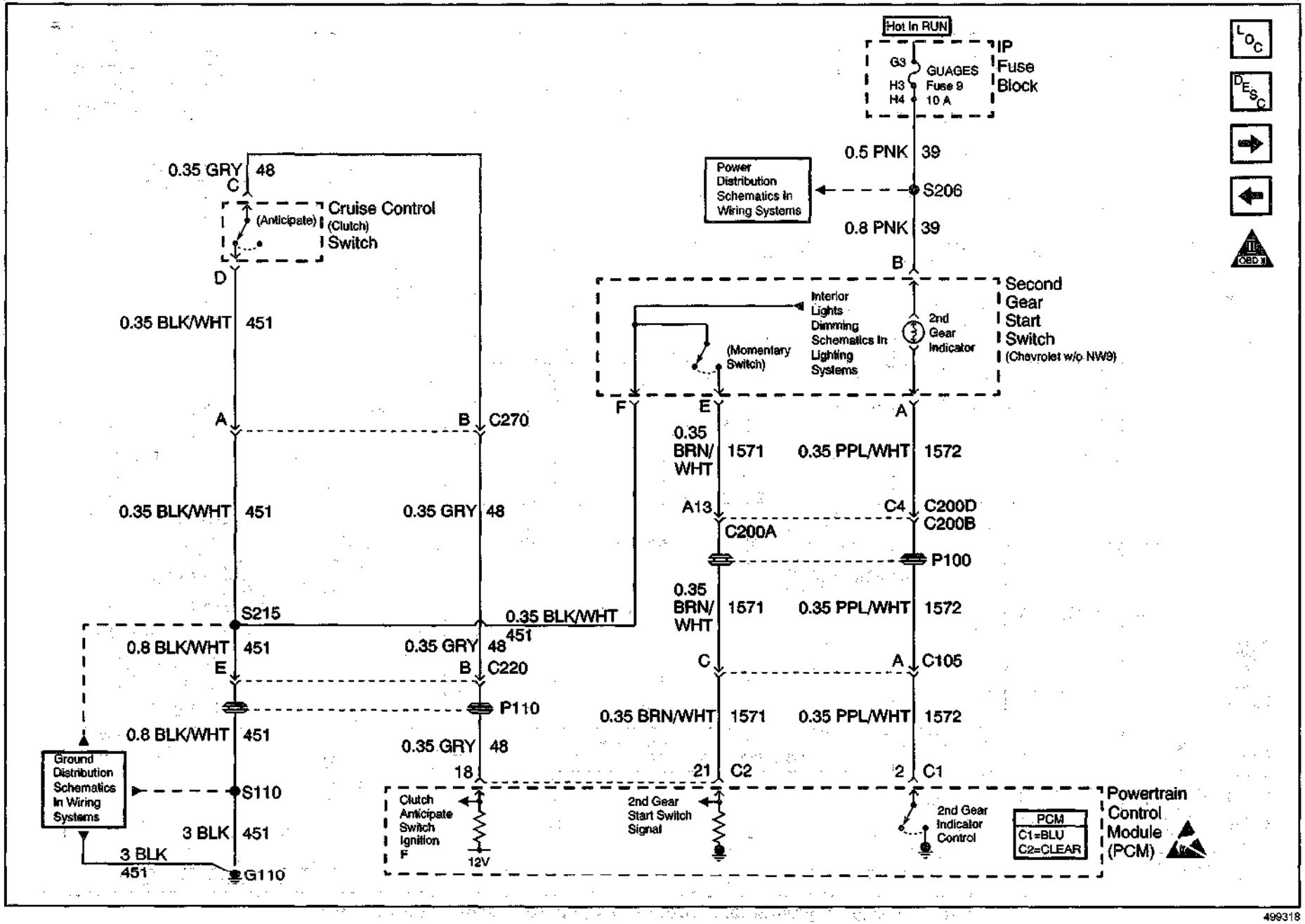
## Engine Controls Schematics (TAC Module, TAC)






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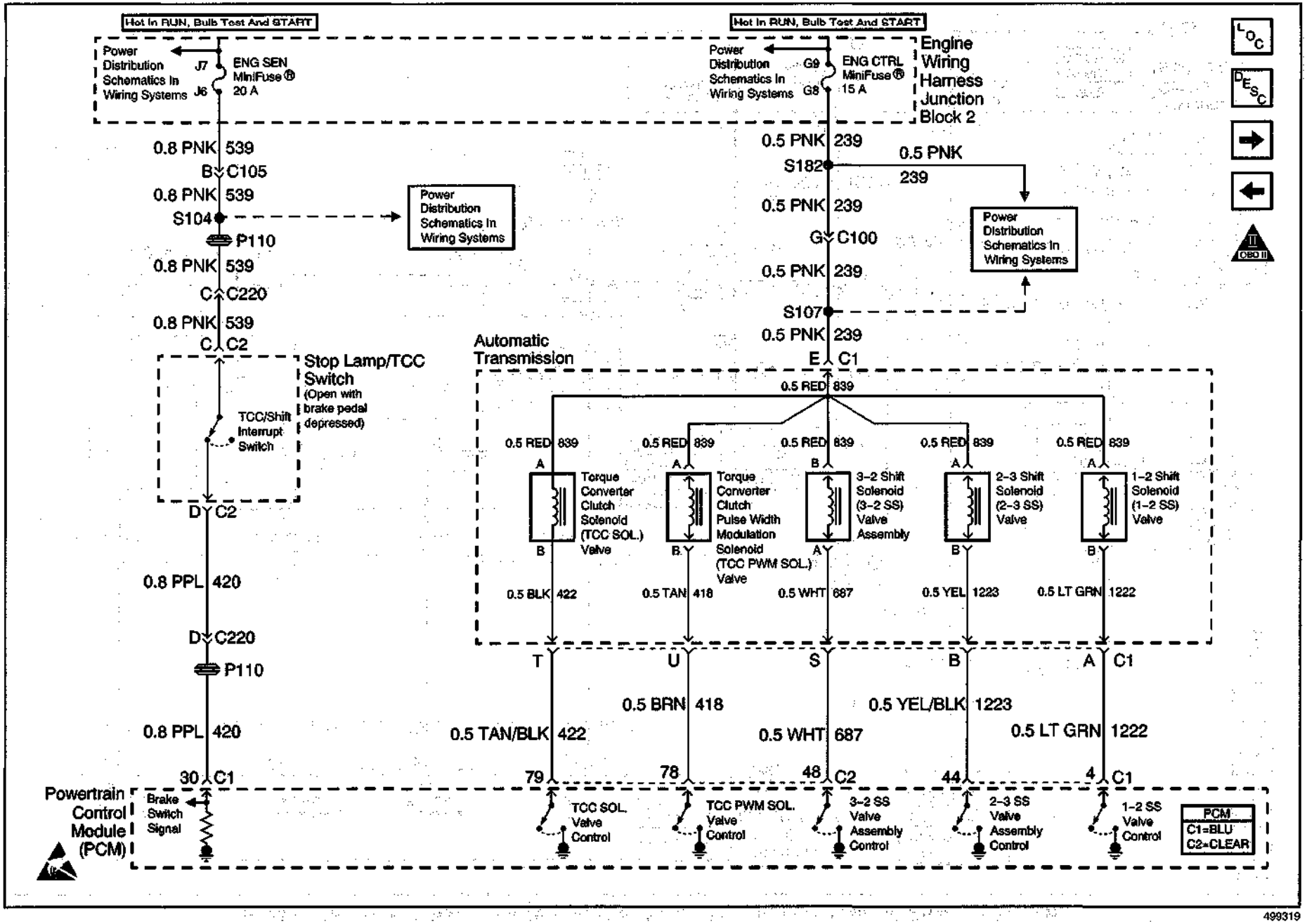
# Engine Controls Schematics (Second Gear Start, Cruise Control Switches)





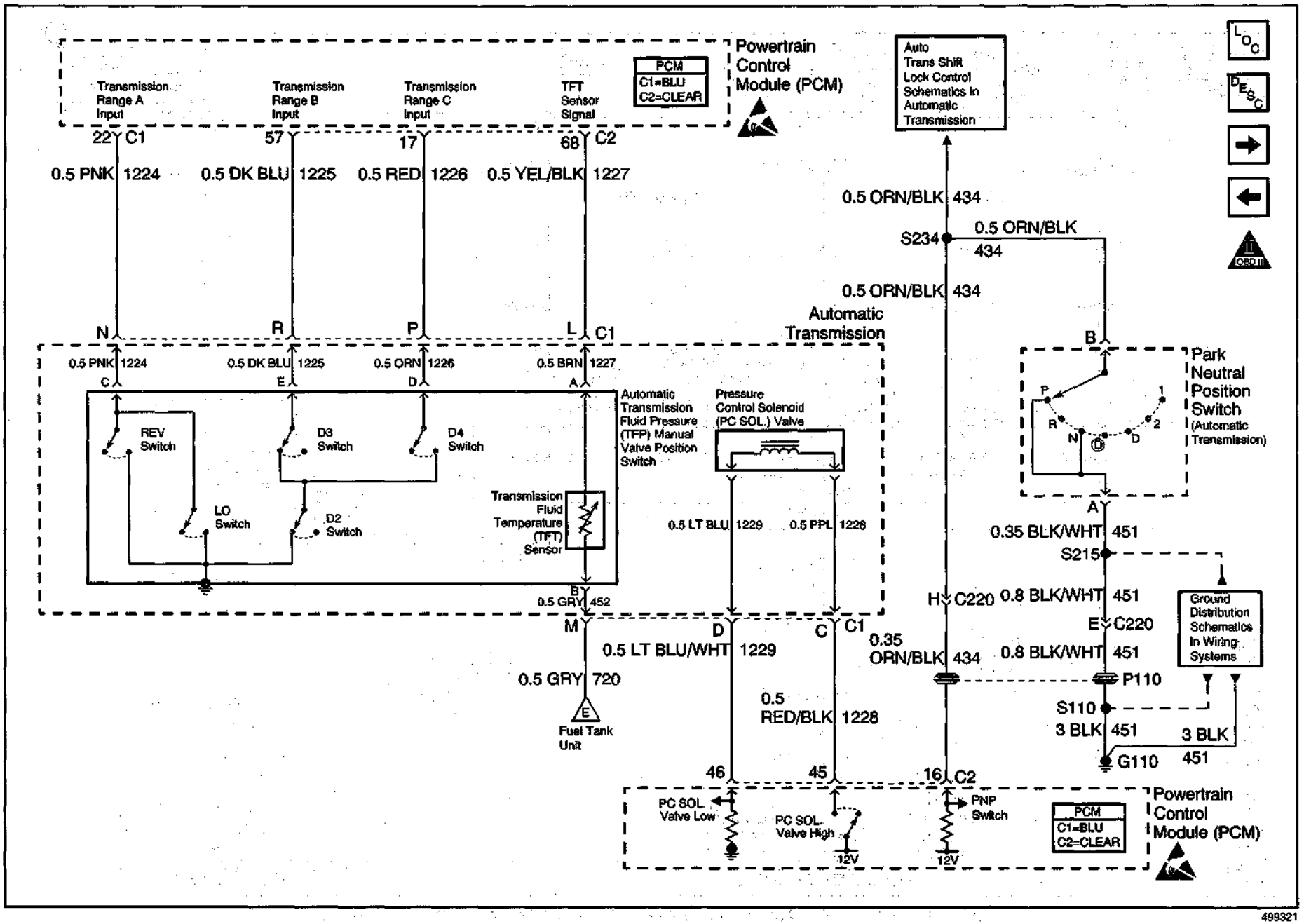

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## Engine Controls Schematics (Automatic Transmission, Brake Switch)




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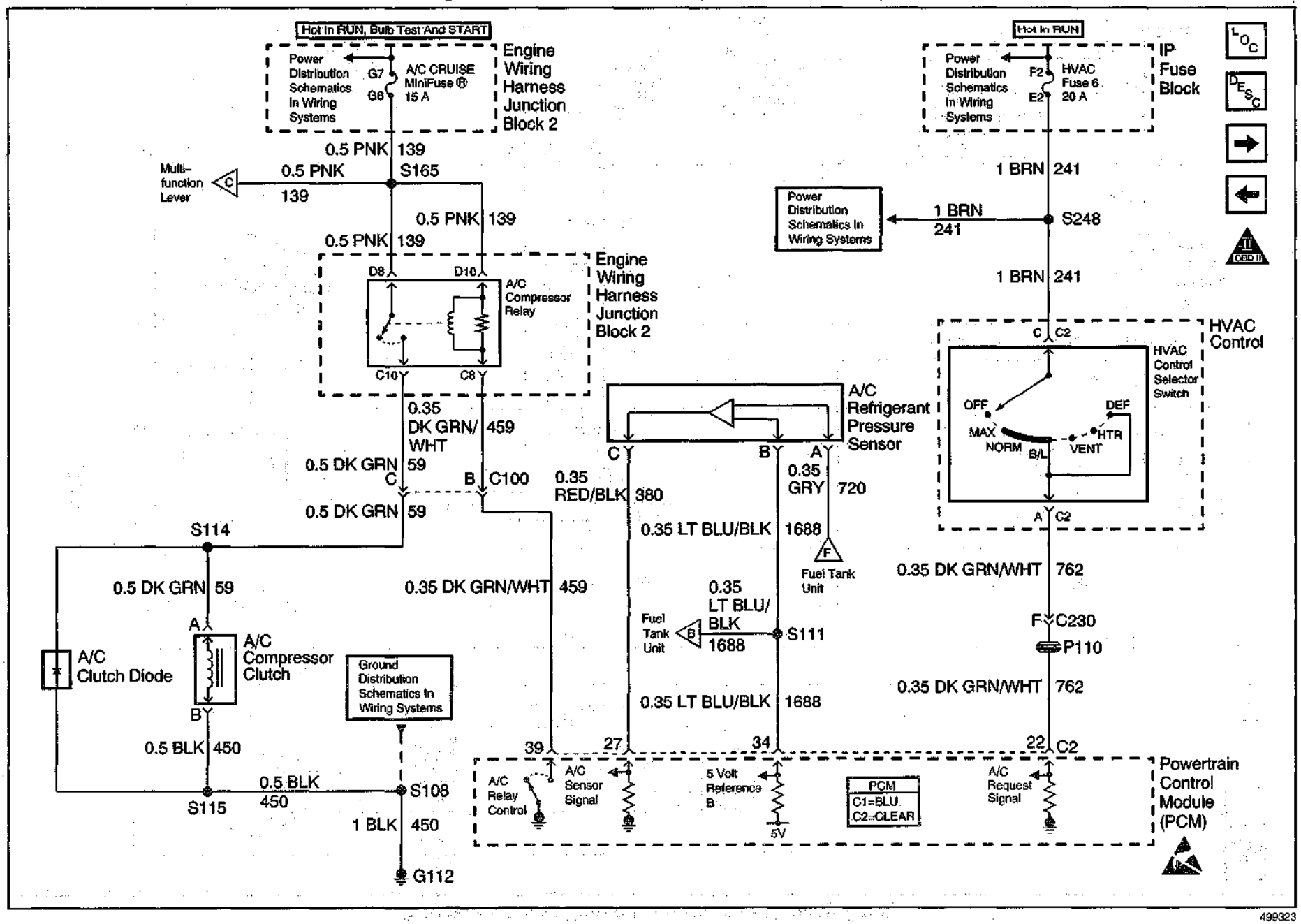
## Engine Controls Schematics (Automatic Transmission, Park Neutral Position Switch)




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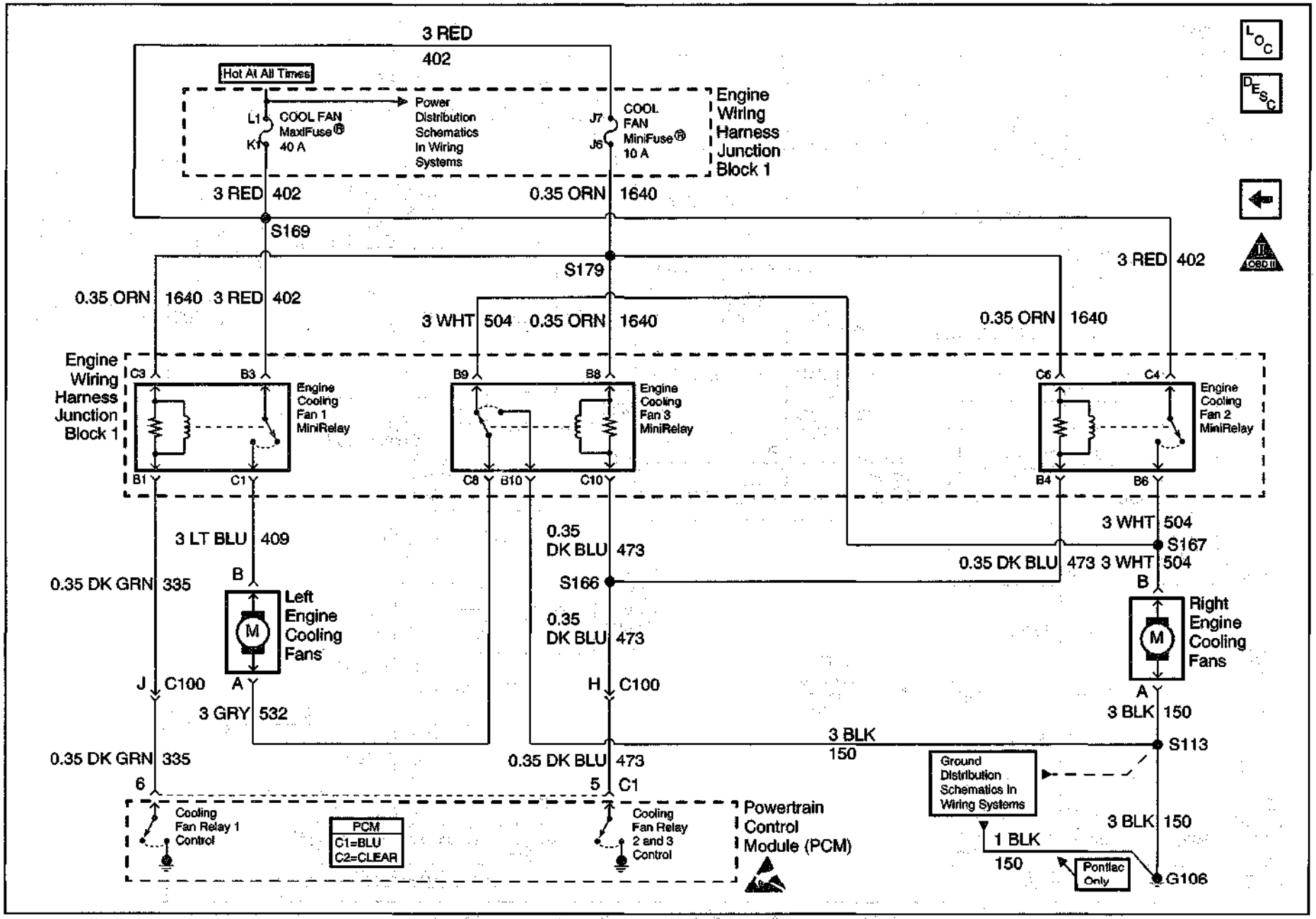
# Engine Controls Schematics (A/C HVAC Control)






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# Engine Controls Schematics (Engine Cooling Fans)






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## Component Locator

### Engine Controls Components

| Name | Location | Locator View | Connector End View |
|---|---|---|---|
| A/C Clutch Diode | Sealed in a harness, approximately 3 cm (1.2 in) from the injector 2 breakout | — | — |
| A/C Compressor Clutch | In the front of the engine, on the lower right side | *HVAC Component Views* in HVAC with A/C Manual | *Engine Controls Connector End Views* |
| A/C Refrigerant Pressure Sensor | Above the right front wheelhouse, attached to the refrigerant line | *HVAC Component Views* in HVAC with A/C Manual | *Engine Controls Connector End Views* |
| Automatic Transmission | Behind the engine | *ABS Component Views* in ABS Traction Control | *Automatic Transmission Inline Harness Connector End View* in Automatic Transmission |
| Body Control Module (BCM) | Under the right side of the IP near the blower motor | *Body Control Module Component Views* in Body Control Systems | *Body Control Module Connector End Views* in Body Control Systems |
| Camshaft Position (CMP) Sensor | Mounted in the top rear center of the engine | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| Crankshaft Position (CKP) Sensor | In the lower front of the engine | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| Cruise Control (Clutch) Switch | Mounted in the clutch pedal bracket | *Cruise Control Component Views* in Cruise Control | *Cruise Control Connector End Views* in Cruise Control |
| Cruise Control Module | Mounted to the left frame rail, forward of the wheelhouse | *Cruise Control Component Views* in Cruise Control | *Cruise Control Connector End Views* in Cruise Control |
| Cruise Control Release (Brake) Switch | Mounted in the upper hole of the brake pedal bracket | *Cruise Control Component Views* in Cruise Control | *Cruise Control Connector End Views* in Cruise Control |
| Data Link Connector (DLC) | Under the IP, right of the steering column | *Data Link Communications Component Views* in Data Link Communications | *Data Link Communications Connector End Views* in Data Link Communications |
| Electronic Brake Control Module (EBCM) | Mounted with brake pressure modulator valve on the top of the left front frame rail | *ABS Component Views* in ABS Traction Control | *ABS Connector End Views* in Antilock Brake System |
| Electronic Ignition Control Module (ICM) | On the top front left side of the engine | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| Engine Coolant Temperature (ECT) Sensor | Under the throttle body, on the front side of the engine | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| Engine Cooling Fans | Behind the radiator | *Cooling System Component Views* in Engine Cooling | *Cooling System Connector End Views* in Engine Cooling |
| Engine Oil Level Switch | On the lower left side of the engine, in the oil pan | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| Engine Wiring Harness Junction Block 1 | In the left front corner of the engine compartment | *Power and Grounding Component Views* in Wiring Systems | — |
| Engine Wiring Harness Junction Block 2 | In the left front corner of the engine compartment | *Power and Grounding Component Views* in Wiring Systems | — |
| Evaporative Emission (EVAP) Canister Purge Solenoid Valve | On the right side of the engine next to injector 2 | — | *Engine Controls Connector End Views* |

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## Engine Controls Components (cont'd)

| Name | Location | Locator View | Connector End View |
|---|---|---|---|
| Evaporative Emission (EVAP) Canister Vent Solenoid Valve | On the top right side of the engine, part of the EVAP canister | — | *Engine Controls Connector End Views* |
| Exhaust Gas Recirculation (EGR) Valve | On the front left side of the engine, in front of the ignition control module | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| Fuel Injectors | Mounted on the intake manifold, part of the fuel rail | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| Fuel Tank Unit | Under the rear of the vehicle | — | *Engine Controls Connector End Views* |
| Fusible Links | Forward of the left front wheelhouse, behind the underhood electrical center 2 | — | — |
| Generator | On the front right side of the engine | *Engine Electrical Component Views* in Engine Electrical | *Engine Electrical Connector End Views* in Engine Electrical |
| Heated Oxygen Sensor Bank 1, Sensor 1 | Mounted in the left exhaust manifold | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| Heated Oxygen Sensor Bank 1, Sensor 2 | At the rear of the catalytic converter | — | *Engine Controls Connector End Views* |
| Heated Oxygen Sensor Bank 2, Sensor 1 | Mounted in the right exhaust manifold | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| HVAC Control | In the center of the IP, above the radio | *HVAC Component Views* in HVAC with A/C Manual | *HVAC Connector End Views* in HVAC with A/C Manual |
| Instrument Cluster | On the left side of the IP | *Instrument Panel, Gauges, and Console Component Views* in Instrument Panel, Gauges and Console | *Instrument Panel, Gauges, and Console Connector End Views* in Instrument Panel, Gauges and Console |
| Intake Air Temperature (IAT) Sensor | Mounted on the air duct, in front of the intake manifold | — | *Engine Controls Connector End Views* |
| IP Fuse Block | On the left end of the IP carrier | *Instrument Panel, Gauges, and Console Component Views* in Instrument Panel, Gauges and Console | — |
| Knock Sensor, Left | In the bottom left side of the engine block | — | — |
| Knock Sensor, Right | In the bottom right side of the engine block | — | — |
| Manifold Absolute Pressure (MAP) Sensor | Mounted to the right side of the intake manifold | *Engine Controls Component Views* | *Engine Controls Connector End Views* |
| Mass Air Flow (MAF) Sensor | Mounted on the air duct, in front of the intake manifold | — | *Engine Controls Connector End Views* |
| Multi-function Lever | On the left side of the steering column | *Cruise Control Component Views* in Cruise Control | *Wiper/Washer System Connector End Views* in Wipers/Washer System |
| Park/Neutral Position Switch | Under the center console, on the base of the shift control lever | *Automatic Transmission Shift Lock Control Component Views* in Automatic Transmission | *Engine Controls Connector End Views* |
| Powertrain Control Module (PCM) | On the right side of the engine compartment, rear of the wheelhouse | *Power and Grounding Component Views* in Wiring Systems | *PCM Connector End Views* |
| Second Gear Start Switch (Chevrolet w/o NW9) | In the center of the IP, above the HVAC control | *ABS Component Views* in ABS Traction Control | *Engine Controls Connector End Views* |

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## Engine Controls Components (cont'd)

| Name | Location | Locator View | Connector End View |
|---|---|---|---|
| Stop Lamp/TCC Switch (Automatic) | Mounted on the brake pedal bracket | *Cruise Control Component Views* in Cruise Control | *Lighting Systems Connector End Views* in Lighting Systems |
| Throttle Actuator Control | On the plenum, with throttle body | — | *Engine Controls Connector End Views* |
| Throttle Actuator Control (TAC) Module | Mounted on the accelerator pedal bracket | — | *Engine Controls Connector End Views* |
| Vehicle Speed Sensor (Automatic) | On the rear right side of the transmission | *Instrument Panel, Gauges, and Console Component Views* in Instrument Panel, Gauges and Console | *Engine Controls Connector End Views* |
| Vehicle Speed Sensor (Manual) | On the rear left side of the transmission | *Instrument Panel, Gauges, and Console Component Views* in Instrument Panel, Gauges and Console | *Engine Controls Connector End Views* |
| Splice Pack SP200 | Under the left side of the IP, near the DLC | *Lighting Systems Component Views* in Lighting Systems | *Data Link Communications Connector End Views* in Data Link Communications |
| C100 (10 cavities) | Engine to forward lamp harness, in the engine compartment, above the right wheelhouse | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C101 (10 cavities) | Engine to forward lamp harness, in the engine compartment, above the right wheelhouse | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C105 (8 cavities) | Engine to forward lamp harness, in the engine compartment, above the right wheelhouse | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C200A (17 cavities) | Forward lamp to IP harness, between the left kick panel and the steering column | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C200B (18 cavities) | Forward lamp to IP harness, between the left kick panel and the steering column | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C200D (48 cavities) | Part of the IP harness, between the left kick panel and the steering column | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C220 (10 cavities) | IP to engine harness, under the right side of the IP, behind the knee bolster | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C230 (10 cavities) | IP to engine harness, under the right side of the IP, behind the knee bolster | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C250 (2 cavities) | Forward lamp harness of the cruise control harness, near the brake/clutch pedal bracket | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C270 (2 cavities) | IP harness of the cruise control harness, near the brake/clutch pedal bracket | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C405A (7 cavities) | Fuel tank harness to the IP harness pass through connector, forward of the rear axle | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| C405B (16 cavities) | IP harness pass through connector, forward of the rear axle | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |

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## Engine Controls Components (cont'd)

| Name | Location | Locator View | Connector End View |
|---|---|---|---|
| C405D (4 cavities) | Fuel tank harness to the IP harness pass through connector, forward of the rear axle | *Harness Routing Views* in Wiring Systems | *Inline Harness Connector End Views* in Wiring Systems |
| G106 | Attached to the top left side of the radiator support | *Harness Routing Views* in Wiring Systems | — |
| G110 (V6 VIN K) | In the front of the engine, bolted to the pulley above the A/C clutch connector | *Harness Routing Views* in Wiring Systems | — |
| G112 | Attached to the rear of the left cylinder head | *Harness Routing Views* in Wiring Systems | — |
| G200 | Near the left A-pillar, bolted to the IP mounting stud behind the kick panel | *Harness Routing Views* in Wiring Systems | — |
| G305 | Bolted to the left rocker panel at the floor pan bar | *Harness Routing Views* in Wiring Systems | — |
| P100 | Left side in the dash panel, engine to the passenger compartment | *Harness Routing Views* in Wiring Systems | — |
| P110 | Right side in the dash panel, engine to the passenger compartment | *Harness Routing Views* in Wiring Systems | — |
| S101 | In the engine harness main branch, approximately 15 cm (6 in) from the powertrain control module (PCM) breakout | — | — |
| S102 | In the engine harness, approximately 21 cm (8.3 in) from G211 breakout | — | — |
| S104 | In the engine harness, approximately 7 cm (2.3 in) from the right knock sensor breakout | — | — |
| S107 | In the engine harness, main branch, approximately 21 cm (8.3 in) from the powertrain control module (PCM) breakout | — | — |
| S108 | In the engine harness, main branch, approximately 15 cm (6 in) from G112 breakout | — | — |
| S110 | In the engine harness, approximately 4 cm (1.6 in) from the powertrain control module (PCM) breakout | — | — |
| S111 | In the forward lamp harness, approximately 14 cm (5.5 in) from the powertrain control module (PCM) breakout | — | — |
| S113 | In the forward lamp harness approximately 7 cm (2.8 in) from the electronic throttle control (ETC) module/cruise control module breakout | — | — |
| S114 | In the engine harness, approximately 3 cm (1.2 in) from the generator breakout | — | — |
| S115 | In the engine harness at the generator breakout | — | — |
| S117 | In the engine harness, approximately 3 cm (1.2 in) from fuel injector 5 breakout | — | — |
| S121 | In the engine harness, main branch, approximately 8 cm (3.1 in) from the powertrain control module (PCM) breakout | — | — |
| S144 | In the engine harness, approximately 2 cm (0.8 in) from fuel injector 3 breakout | — | — |
| S145 | In the engine harness, approximately 4 cm (1.6 in) from fuel injector 3 breakout | — | — |
| S154 (Chevrolet) | In the forward lamp harness, approximately 7 cm (2.8 in) from the C120 (left front wheel speed sensor) breakout | — | — |

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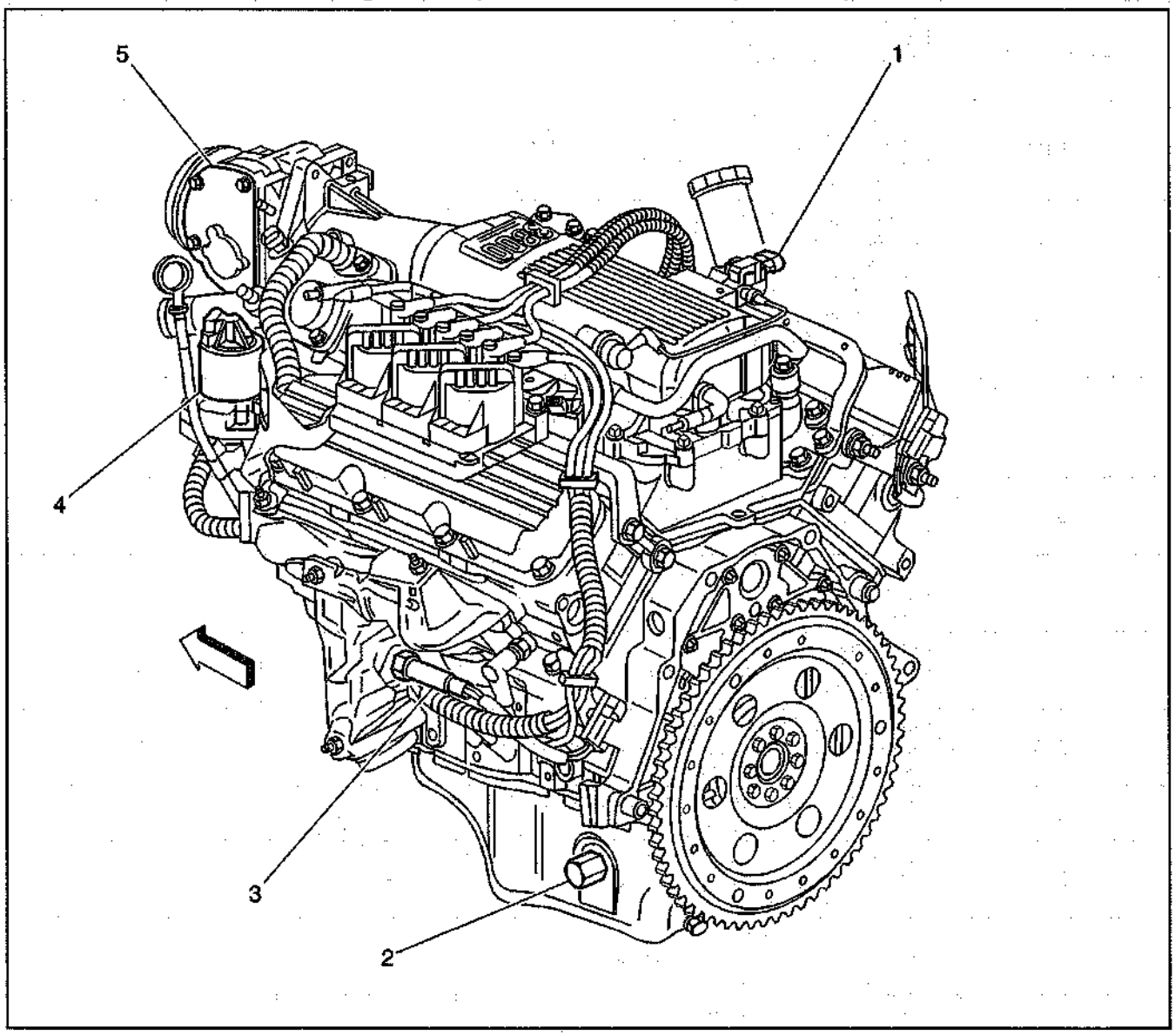
## Engine Controls Components (cont'd)

| Name | Location | Locator View | Connector End View |
|---|---|---|---|
| S154 (Pontiac) | In the forward lamp harness, approximately 13 cm (5.1 in) from the C120 (left front wheel speed sensor) breakout | — | — |
| S165 | In the forward lamp harness, approximately 7 cm (2.8 in) from the main branch into the engine wiring harness junction block 2 breakout | — | — |
| S166 | In the forward lamp harness, approximately 14 cm (5.5 in) from G105 breakout | — | — |
| S167 | In the forward lamp harness, approximately 7 cm (2.8 in) from the electronic brake control module (EBCM) breakout | — | — |
| S169 | In the forward lamp harness, approximately 6 cm (2.4 in) from the main branch into the engine wiring harness junction block 1 breakout | — | — |
| S170 | In the forward lamp harness, approximately 13 cm (5.1 in) from G106 breakout | — | — |
| S171 | In the forward lamp harness, approximately 10 cm (4 in) from G102 breakout | — | — |
| S179 | In the forward lam harness, approximately 25 cm (9.8 in) from the engine wiring harness junction block 1 breakout | — | — |
| S182 | In the forward lamp harness, approximately 15 cm (6 in) from the engine wiring harness junction block 1 breakout | — | — |
| S206 | In the IP harness, at the rear compartment lid release relay breakout | — | — |
| S215 | In the IP harness, main branch, approximately 11 cm (4 in) from the antenna cable breakout | — | — |
| S216 | In the IP harness, main branch, approximately 10 cm (4 in) from the instrument cluster breakout | — | — |
| S217 | In the IP harness, main branch, approximately 18 cm (6.8 in) from the body control module (BCM) breakout | — | — |
| S234 (Automatic) | In the IP harness, main branch, approximately 5 cm (2 in) from the body control module (BCM) breakout | — | — |
| S240 | In the IP harness, main branch, approximately 17 cm (6.7 in) from the antenna cable breakout | — | — |
| S242 | In the IP harness, approximately 4 cm (1.6 in) from the data link connector (DLC) breakout | — | — |
| S243 | In the IP harness, approximately 9 cm (3.5 in) from G200 breakout | — | — |
| S244 (Convertible) | In the IP harness, approximately 46 cm (18 in) from C405 | — | — |
| S244 (Coupe) | In the IP harness, approximately 40 cm (15.8 in) back from C405 | — | — |
| S248 | In the IP harness, approximately 2 cm (0.8 in) from DRL module breakout | — | — |

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## Engine Controls Component Views

### Engine Component Locator View (Left Side)



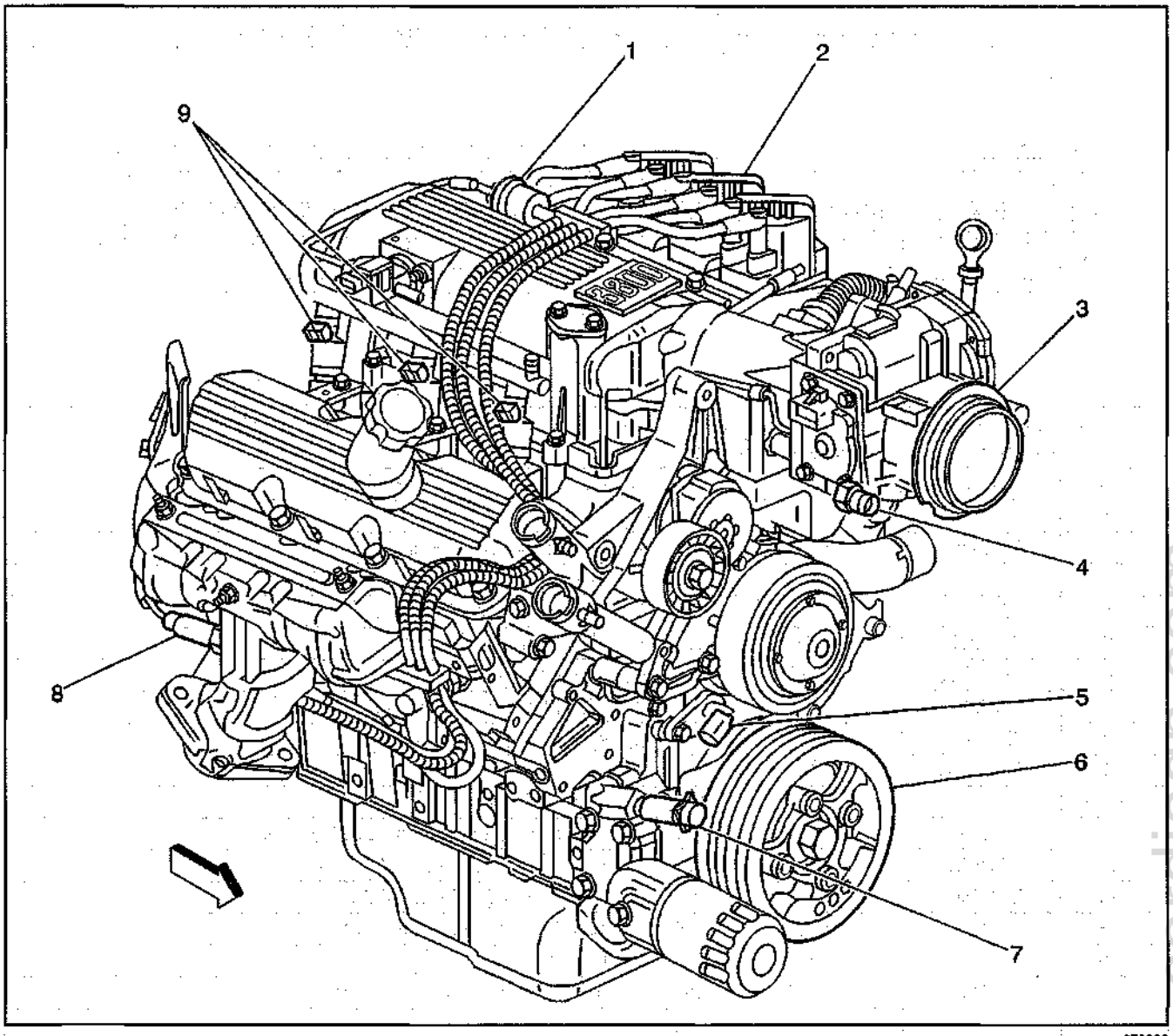

370231

**Legend**

(1) MAP Sensor
(2) Oil Level Sensor
(3) HO2S Sensor
(4) EGR Valve
(5) Throttle Body

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**Engine Component Locator View (Right Side)**



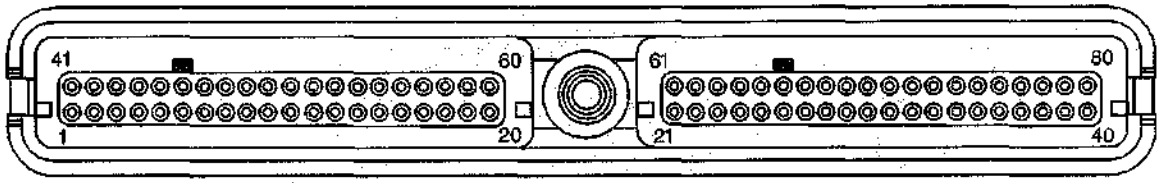

**Legend**

(1) Fuel Pressure Regulator
(2) Ignition Coils/Module
(3) Throttle Body
(4) Engine Coolant Temperature (ECT) Sensor
(5) CAM Sensor
(6) Crank Position (CKP) Sensor
(7) Oil Pressure Sensor
(8) HO2S Sensor
(9) Fuel Injectors

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## PCM Connector End Views

### Powertrain Control Module Connector C1 (BLU) End View

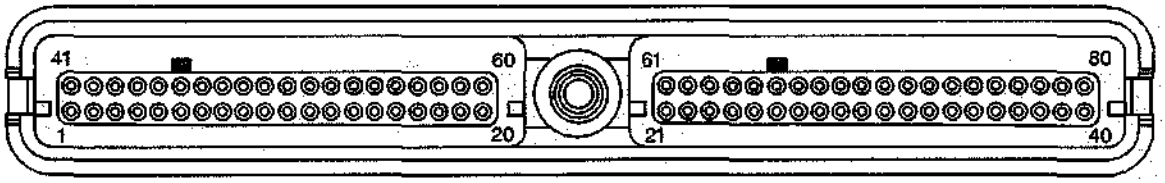



15026

| Connector Part Information | | • BLU PCM Connector C1<br>• 80 Pin Connector | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| 1 | — | — | Not Used |
| 2 | PPL/WHT | 1572 | 2nd Gear Start Indicator (4L60E only) |
| 3 | — | — | Not Used |
| 4 | LT GRN | 1222 | 1 - 2 Shift Solenoid Control (4L60E only) |
| 5 | DK BLU | 473 | Cooling Fan 2 and 3 Relay Control |
| 6 | DK GRN | 335 | Cooling Fan Relay 1 Control |
| 7 | BLK | 630 | Camshaft Position Sensor (CMP) Signal |
| 8 | PPL/WHT | 430 | 3X Reference |
| 9 | LT BLU/BLK | 647 | 18X Reference |
| 10-11 | — | — | Not Used |
| 12 | BRN | 718 | Engine Coolant Temperature Sensor (ECT) Ground |
| 13 | ORN/BLK | 469 | Manifold Air Pressure Sensor (MAP) Ground |
| 14 | ORN/BLK | 1061 | Throttle Actuator Control (TAC) Serial Data |
| 15 | TAN | 800 | Throttle Actuator Control (TAC) Serial Data |
| 16 | BLK/WHT | 451 | PCM Ground |
| 17 | PPL | 719 | Idlke Air Temperature Sensor (IAT) Ground |
| 18 | — | — | Not Used |
| 19 | PNK | 439 | PCM Ignition Feed |
| 20 | ORN | 340 | PCM Battery Feed |
| 21 | — | — | Not Used |
| 22 | PNK | 1224 | Transmission Range A input (4L60E only) |
| 23-26 | — | — | Not Used |
| 27 | TAN/WHT | 1653 | Bank 1 HO2S 1 Low |
| 28 | GRY | 1981 | Bank 1 HO2S 2 Low |
| 29 | TAN | 1667 | Bank 2 HO2S 1 Low |
| 30 | PPL | 420 | Brake Switch 2 Signal |
| 31 | BLK | 552 | Exhaust Gas Recirculation Sensor (EGR) Ground |
| 32 | GRY | 435 | EGR Valve Ground |
| 33 | DK/BLU | 496 | Bank 1 Knock Sensor Signal |
| 34 | LT/BLU | 1876 | Bank 2 Knock Sensor Signal |
| 35-42 | — | — | Not Used |
| 43 | YEL/BLK | 846 | Injector Control Cylinder #6 |
| 44 | YEL/BLK | 1223 | 2 - 3 Shift Solenoid Control (4L60E only) |

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## Powertrain Control Module Connector C1 (BLU) End View (cont'd)

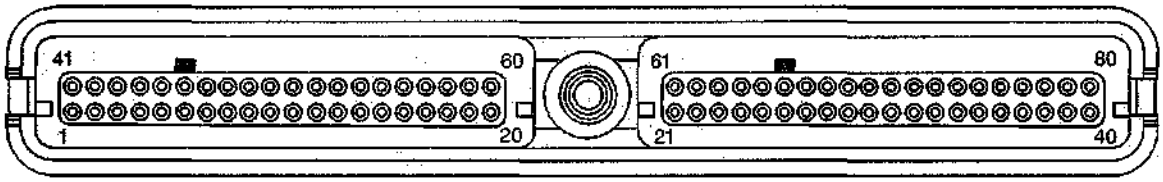



15026

| Connector Part Information | | • BLU PCM Connector C1<br>• 80 Pin Connector | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| 45 | — | — | Not Used |
| 46 | LT BLU/BLK | 844 | Injector Control Cylinder #4 |
| 47 | BLK/WHT | 845 | Injector Control Cylinder #5 |
| 48 | RED/BLK | 453 | Reference Low |
| 49-52 | — | — | Not Used |
| 53 | TAN/BLK | 424 | Bypass Control |
| 54 | WHT | 423 | Ignition Control (IC) |
| 55 | DK GRN/WHT | 817 | Vehicle Speed Sensor (VSS) Output |
| 56 | BLK/WHT | 451 | PCM Ground |
| 57 | BLK/WHT | 451 | PCM Ground |
| 58 | — | — | Not Used |
| 59 | DK GRN | 1049 | Class 2 Serial Data |
| 60 | BLK/WHT | 451 | PCM Ground |
| 61-63 | — | — | Not Used |
| 64 | YEL | 400 | VSS High |
| 65 | PPL | 401 | VSS Low |
| 66-68 | — | — | Not Used |
| 69 | YEL | 492 | Mass Air Flow Signal |
| 70 | DK BLU | 229 | Theft Deterrent Fuel Enable |
| 71 | ORN/BLK | 463 | Requested Torque Input |
| 72 | — | — | Not Used |
| 73 | LT GRN/BLK | 1745 | Injector Control Cylinder #2 |
| 74-75 | — | — | Not Used |
| 76 | DK GRN/WHT | 428 | EVAP Canister Purge Control |
| 77-78 | — | — | Not Used |
| 79 | BLK | 1744 | Injector Control Cylinder #1 |
| 80 | — | — | Not Used |

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## Powertrain Control Module Connector C2 (CLR) End View

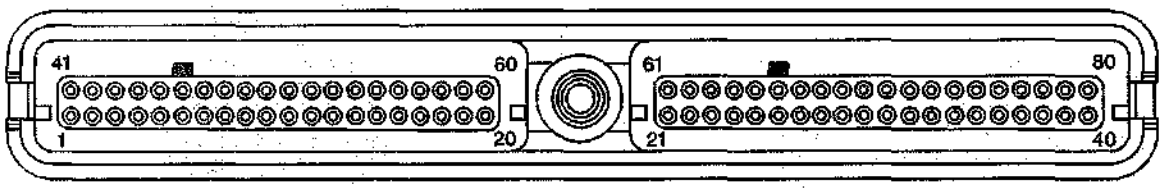



15026

| Connector Part Information | | • CLR PCM Connector C2<br>• 80 Pin Connector | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| 1 | — | — | Not Used |
| 2 | WHT | 1310 | EVAP Canister Vent Valve Control |
| 3 | DK GRN/WHT | 465 | Fuel Pump Relay Control |
| 4 | LT BLU | 697 | EGR Valve Control |
| 5 | BRN/WHT | 419 | MIL Control |
| 6-7 | — | — | Not Used |
| 8 | WHT | 121 | Engine Speed Output |
| 9 | TAN/BLK | 464 | Delivered Torque Output |
| 10 | PPL | 1666 | Bank 2 HO2S 1 Signal |
| 11 | DK BLU | 1980 | Bank 1 HO2S 2 Signal |
| 12 | PPL/WHT | 1665 | Bank 1 HO2S 1 Signal |
| 13-15 | — | — | Not Used |
| 16 | ORN/BLK | 434 | PNP Switch Signal |
| 17 | RED | 1226 | Transmission Range C Input (4L60E only) |
| 18 | GRY | 48 | Clutch Anticipate Switch |
| 19-20 | — | — | Not Used |
| 21 | BRN/WHT | 1571 | 2nd Gear Start Signal |
| 22 | DK GRN/WHT | 762 | A/C Request Signal |
| 23 | PPL/WHT | 1035 | Crank Signal |
| 24 | BRN | 86 | Cruise Control Release Signal |
| 25 | LT GRN | 432 | MAP Sensor Signal |
| 26 | YEL | 410 | ECT Sensor Signal |
| 27 | RED/BLK | 380 | A/C Refrigerant Pressure Sensor Signal |
| 28 | BRN | 1456 | EGR Pintle Position Signal |
| 29-32 | — | — | Not Used |
| 33 | GRY | 598 | 5 Volt Reference A |
| 34 | LT BLU/BLK | 1688 | 5 Volt Reference B |
| 35 | GRY | 720 | Sensor Ground |
| 36-38 | — | — | Not Used |
| 39 | DK GRN/WHT | 459 | A/C Compressor Clutch Relay Control |
| 40-41 | — | — | Not Used |
| 42 | PNK/BLK | 1746 | Injector Control Cylinder #3 |
| 43-44 | — | — | Not Used |
| 45 | RED/BLK | 1228 | Pressure Control Solenoid High (4L60E only) |
| 46 | LT BLU/WHT | 1229 | Pressure Control Solenoid Low (4L60E only) |

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## Powertrain Control Module Connector C2 (CLR) End View (cont'd)



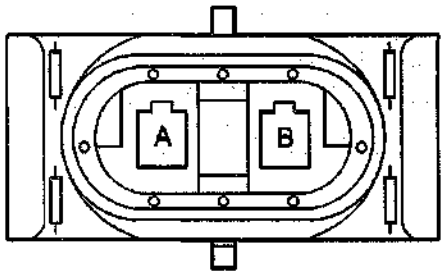

15026

| Connector Part Information | | • CLR PCM Connector C2<br>• 80 Pin Connector | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| 47 | — | — | Not Used |
| 48 | WHT | 687 | 3-2 Shift Solenoid Control (4L60E only) |
| 49 | — | — | Not Used |
| 50 | TAN | 472 | Intake Air Temperature Sensor Signal |
| 51-54 | — | — | Not Used |
| 55 | DK GRN | 890 | Fuel Tank Pressure Sensor Signal |
| 56 | — | — | Not Used |
| 57 | DK BLU | 1225 | Transmission Range B Input (4L60E only) |
| 58 | BRN | 1174 | Engine Oil Level Switch Signal |
| 59-60 | — | — | Not Used |
| 61 | RED | 225 | Generator Control |
| 62-67 | — | — | Not Used |
| 68 | YEL/BLK | 1227 | Transaxle Fluid Temperature Sensor (4L60E only) |
| 69 | PPL | 1589 | Fuel Level Signal |
| 70-75 | — | — | Not Used |
| 76 | DK GRN | 220 | Starter Enable (If Equipped) |
| 77 | — | — | Not Used |
| 78 | BRN | 418 | TCC PWM Solenoid Control (4L60E only) |
| 79 | TAN/BLK | 422 | TCC Enable Solenoid Control (4L60E only) |
| 80 | — | — | Not Used |

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## Engine Controls Connector End Views

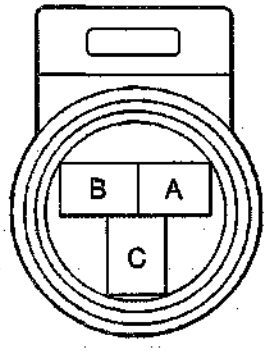
### A/C Compressor Clutch




62440

| Connector Part Information | • 1216-2017<br>• 2-Way F Metri-pack 150 Series (GRY) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | DK GRN | 59 | A/C Compressor Relay Fuse Feed Input |
| B | BLK | 450 | Ground |

### A/C Refrigerant Pressure Sensor




258299

| Connector Part Information | • 1211-0192<br>• 3-Way F Metri-pack 150 Series Pull To Seat Sealed (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | GRY | 720 | Fuel Tank Unit Feed Input |
| B | LT BLU/ BLK | 1688 | 5V Reference Input |
| C | RED/BLK | 380 | A/C Sensor Signal |

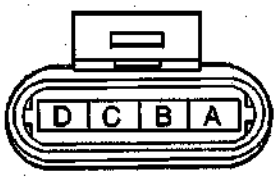
### Camshaft Position (CMP) Sensor




73223

| Connector Part Information | • 1216-2279<br>• 3-Way F Metri-pack 150 Series (GRY) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | BRN/WHT | 633 | Camshaft Position (CMP) Sensor Signal |
| B | RED/BLK | 645 | CMP/CKP Sensor Ground |
| C | WHT/BLK | 644 | CMP/CKP Sensor Ignition 12V Reference |

### Crankshaft Position (CKP) Sensor

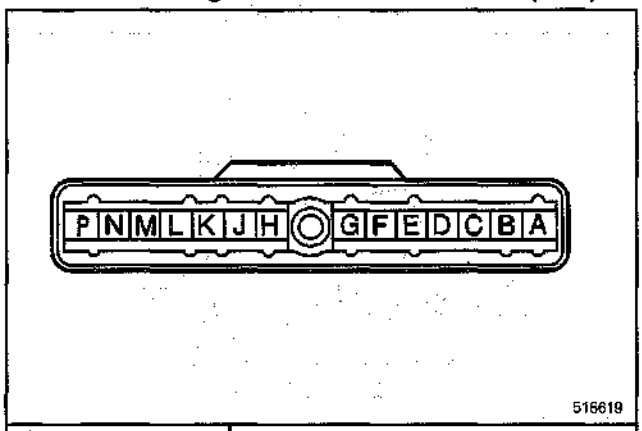



280765

| Connector Part Information | • 1216-2834<br>• 4-Way F Metri-pack 150 Series (GRY) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | LT BLU/ WHT | 1800 | Crankshaft Position (CKP) Sync Signal |
| B | YEL | 573 | CKP 18x Signal |
| C | RED/BLK | 645 | CMP/CKP Sensor Ground |
| D | WHT/BLK | 644 | CMP/CKP Sensor Ignition 12V Reference |

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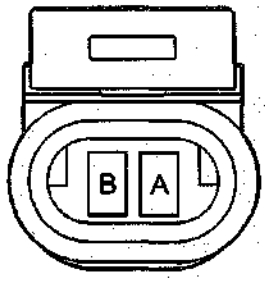
## Electronic Ignition Control Module (ICM)




516619

| Connector Part Information | • 1212-4379<br>• 14-Way F Metri-pack 150 Series Sealed P2S (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | WHT | 423 | Ignition Control |
| B | TAN/BLK | 424 | Bypass Control |
| C | LT BLU/ BLK | 647 | 18x Reference Signal |
| D | PPL/WHT | 430 | 3x Reference Signal |
| E | — | — | Not Used |
| F | BLK | 630 | Camshaft Position Sensor Signal |
| G | YEL | 573 | CKP 18x Signal |
| H | LT BLU/ WHT | 1800 | CKP Sync Signal |
| J | BRN/WHT | 633 | CMP Signal Sensor |
| K | BLK | 450 | Ground |
| L | RED/BLK | 453 | Reference Low |
| M | RED/BLK | 645 | CMP/CKP Sensor Ground |
| N | WHT/BLK | 644 | CMP/CKP Sensor Ignition 12V Reference |
| P | PNK | 239 | Fused Input Feed |

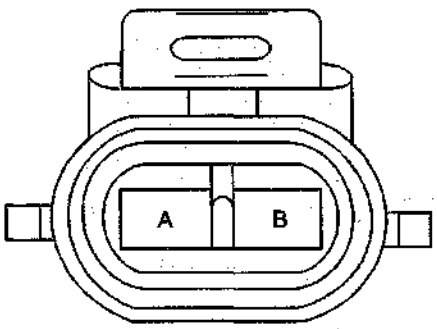
## Engine Coolant Temperature (ECT) Sensor




516983

| Connector Part Information | • 1216-2194<br>• 2-Way F Metri-pack 150 Series Sealed P2S (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | BRN | 718 | Engine Coolant Tenperature (ECT) Sensor Ground |
| B | YEL | 410 | Engine Coolant Temperature (ECT) Sensor Signal 5V Reference |

## Engine Oil Level Switch

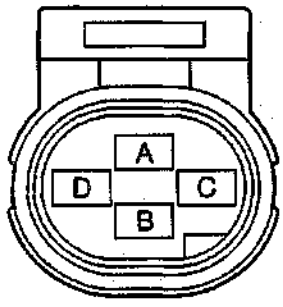



35437

| Connector Part Information | • 1205-2641<br>• 2 Way F Metri-pack 150 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | BLK/WHT | 451 | Ground |
| B | BRN | 1174 | Oil Level Switch Signal 5V Reference |

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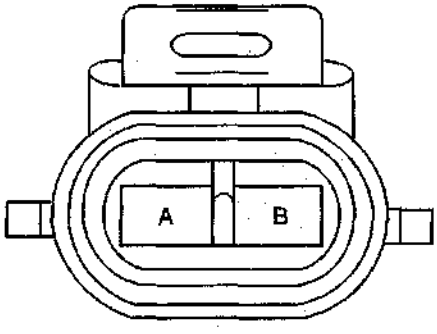
## Engine Oil Pressure Sensor




516616

| Connector Part Information | • 1206-5400<br>• 4-Way F Metri-pack 150 Series (GRN) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | TAN | 31 | Oil Pressure Indicator Lamp Output |
| B | BLK/WHT | 451 | Ground |
| C-D | — | — | Not Used |

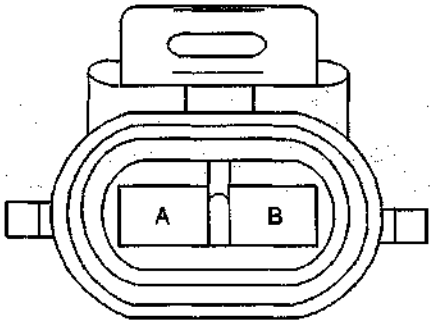
## Evaporative Emission (EVAP) Canister Purge Solenoid Valve




35437

| Connector Part Information | • 1205-2643<br>• 2-Way F Metri-pack 150 Series Sealed (RED) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PNK | 239 | Fused Input Feed |
| B | DK GRN/WHT | 428 | EVAP Canister Purge Valve Driver Ground |

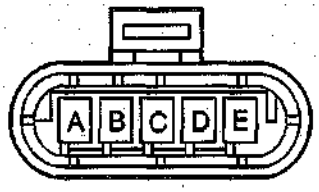
## Evaporative Emission (EVAP) Canister Vent Solenoid Valve




35437

| Connector Part Information | • 1205-2643<br>• 2 Way F Metri-pack 150 Series (RED) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PNK | 239 | Fused Input Feed |
| B | WHT | 1310 | EVAP Canister Vent Valve Driver Ground |

## Exhaust Gas Recirculation (EGR) Valve

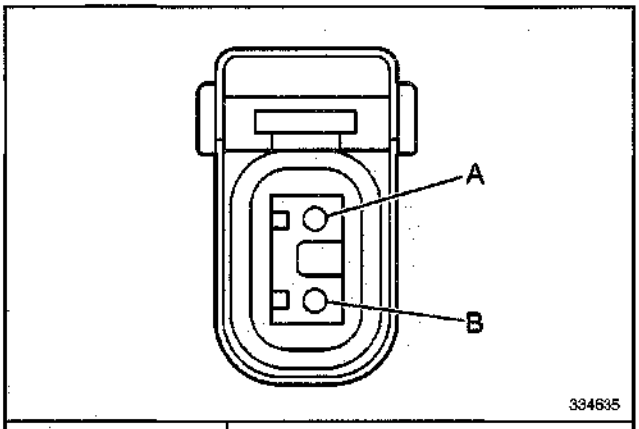



68773

| Connector Part Information | • 1218-6056<br>• 5 Way F Metri-pack 150 Series Pull to Seat Sealed (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | GRY | 435 | Exhaust Gas Recirculation (EGR) Valve Control Ground |
| B | BLK | 552 | Sensor Ground |
| C | BRN | 1456 | Exhaust Gas Recirculation (EGR) Pintle Position Signal |
| D | GRY | 598 | MAP Sensor Input |
| E | LT BLU | 697 | Exhaust Gas Recirculation (EGR) Valve 12V Reference |

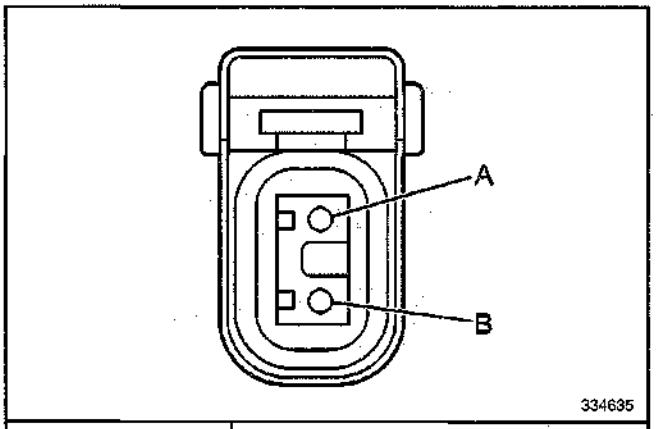
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### Fuel Injector #1



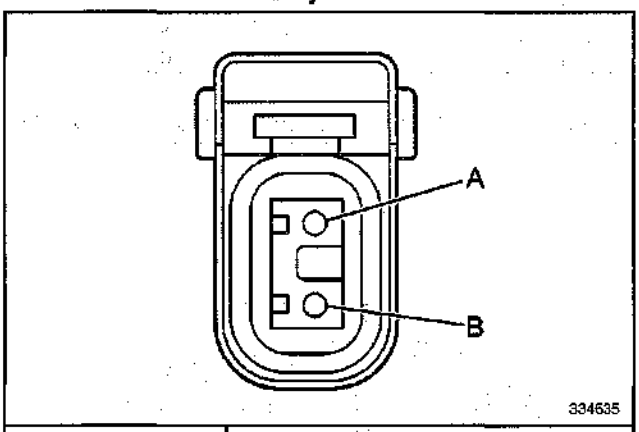

| Connector Part Information | • 1532-6181<br>• 2-Way F Micro-pack 64 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PNK | 639 | Fused Input Feed |
| B | BLK | 1744 | Fuel Injector #1 Driver Ground |

### Fuel Injector #3



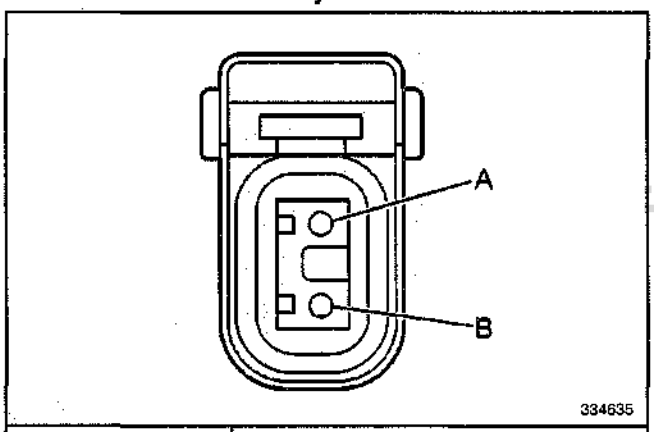

| Connector Part Information | • 1532-6181<br>• 2-Way F Micro-pack 64 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PNK | 639 | Fused Input Feed |
| B | PNK/BLK | 1746 | Fuel Injector #3 Driver Ground |

### Fuel Injector #2




| Connector Part Information | • 1532-6181<br>• 2-Way F Micro-pack 64 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PNK | 639 | Fused Input Feed |
| B | LT GRN/ BLK | 1745 | Fuel Injector #2 Driver Ground |

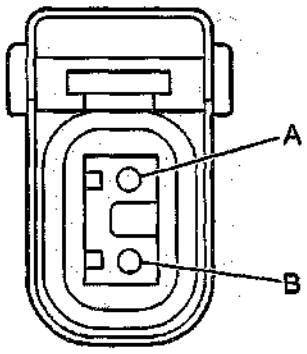
### Fuel Injector #4




| Connector Part Information | • 1532-6181<br>• 2-Way F Micro-pack 64 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PNK | 639 | Fused Input Feed |
| B | LT BLU/ BLK | 844 | Fuel Injector #4 Driver Ground |

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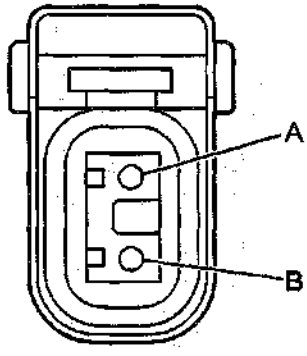
### Fuel Injector #5



334635

| Connector Part Information | • 1532-6181<br>• 2-Way F Micro-pack 64 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PNK | 639 | Fused Input Feed |
| B | BLK/WHT | 845 | Fuel Injector #5 Driver Ground |

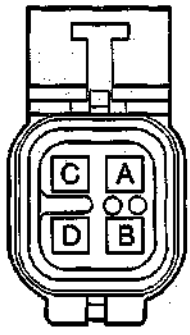
### Fuel Injector #6



334635

| Connector Part Information | • 1532-6181<br>• 2-Way F Micro-pack 64 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PNK | 639 | Fused Input Feed |
| B | YEL/BLK | 846 | Fuel Injector #6 Driver Ground |

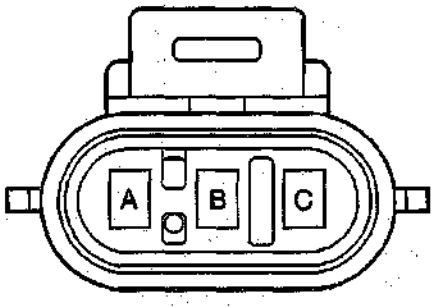
### Fuel Tank Unit (Fuel Pump Motor and Fuel Level Sensor)



518981

| Connector Part Information | • 1216-0482<br>• 4-Way F Metri-pack 150 Series Sealed (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PPL | 30 | PCM Fuel Level Signal Input |
| B | GRY | 120 | Fuel Pump Relay Fuse Feed Input |
| C | BLK | 150 | Ground |
| D | BLK/WHT | 651 | PCM Sensor Ground Input |

### Fuel Tank Unit (Fuel Tank Pressure Sensor)

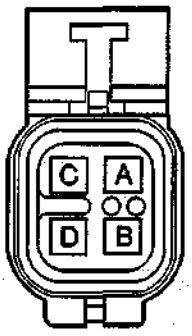


516611

| Connector Part Information | • 1205-9595<br>• 3-Way F Metri-pack 150 Series Sealed (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | ORN/BLK | 469 | PCM Sensor Ground Input |
| B | DK GRN | 890 | Fuel Tank Pressure Signal Input |
| C | GRY/BLK | 416 | A/C Refrigerant Pressure Sensor Output |

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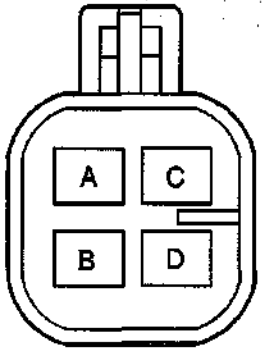
### Heated Oxygen Sensor Bank 1, Sensor 1



518981

| Connector Part Information | • 1216-0482<br>• 4-Way F Metri-pack 150 Series Sealed (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | TAN/WHT | 1653 | Left Front Heated Oxygen Sensor (HO2S) - Low |
| B | PPL/WHT | 1665 | Left Front Heated Oxygen Sensor (HO2S) - High |
| C | BLK | 450 | Ground |
| D | PNK | 539 | Fused Input Feed |

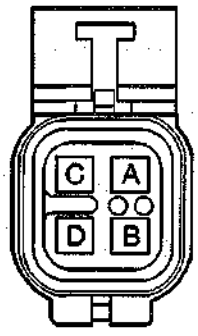
### Heated Oxygen Sensor Bank 1, Sensor 2



280761

| Connector Part Information | • 1216-0825<br>• 4 Way M Metri-pack 150 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | GRY | 1981 | Heated Oxygen Sensor (HO2S) - Low |
| B | DK BLU | 1980 | Heated Oxygen Sensor (HO2S) - High |
| C | BLK | 450 | Ground |
| D | PNK | 539 | Fused Input Feed |

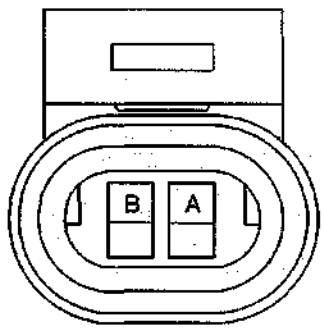
### Heated Oxygen Sensor Bank 2, Sensor 1



518981

| Connector Part Information | • 1216-0482<br>• 4-Way Metri-pack 150 Series Sealed (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | TAN | 1667 | Right Front Heated Oxygen Sensor (HO2S) - Low |
| B | PPL | 1666 | Right Front Heated Oxygen Sensor (HO2S) - High |
| C | BLK | 450 | Ground |
| D | PNK | 539 | Fused Input Feed |

### Intake Air Temperature (IAT) Sensor

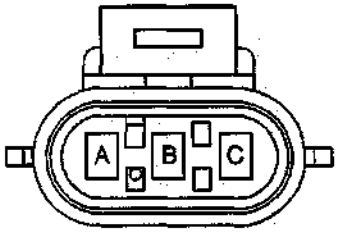


68719

| Connector Part Information | • 1216-2199<br>• 2-Way F Metri pack 150.2 Series Sealed (GRY) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PPL | 719 | Intake Air Temperature (IAT) Sensor Ground |
| B | TAN | 472 | Intake Air Temperature (IAT) Sensor Signal 5V Reference |

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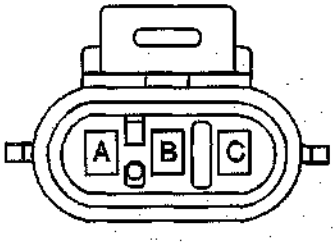
### Manifold Absolute Pressure (MAP) Sensor




68740

| Connector Part Information | • 1212-9946<br>• 3-Way F Metri pack 150 Series (GRY) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | ORN/BLK | 469 | Manifold Absolute Pressure (MAP) Sensor Ground |
| B | LT GRN | 432 | Manifold Absolute Pressure (MAP) Sensor Signal |
| C | GRY | 598 | Manifold Absolute Pressure (MAP) Sensor 5V Reference |

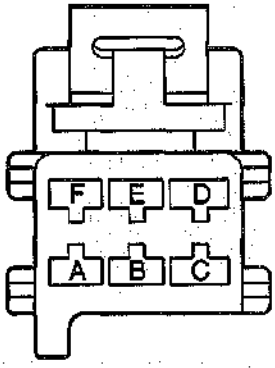
### Mass Air Flow (MAF) Sensor




62453

| Connector Part Information | • 1205-9595<br>• 3-Way F Metri-pack 150 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | YEL | 492 | Mass Air Flow (MAF) Sensor Signal |
| B | BLK/WHT | 451 | Ground |
| C | PNK | 539 | Fused Input Feed |

### Second Gear Start Switch (Chevrolet w/o NW9)

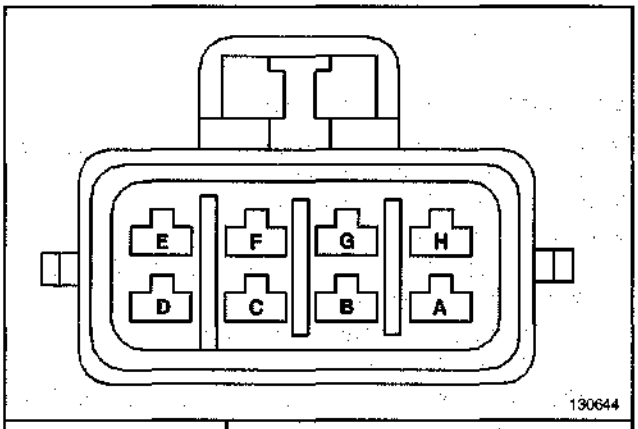



304345

| Connector Part Information | • 1217-7195<br>• 6-Way F Metri-pack 150 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PPL/WHT | 1572 | Second Gear Indicator Control Ground |
| B | PNK | 39 | Fused Input Feed |
| C | GRY | 8 | Interior Lights Dimming Ground Output |
| D | — | — | Not Used |
| E | BRN/WHT | 1571 | Second Gear Start Switch Signal Ground |
| F | BLK/WHT | 451 | Ground |

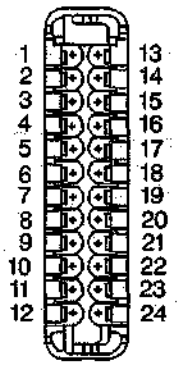
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## Throttle Actuator Control




| Connector Part Information | • 1204-7937<br>• 8-Way F Metri-pack 150 Series (BLK) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | BLK | 476 | TP Sensor 2 Ground |
| B | PPL | 486 | TP Sensor 2 Signal |
| C | GRY | 597 | TP Sensor 2 5V Reference |
| D | BRN | 582 | Not Used |
| E | YEL | 581 | Motor Driver-High |
| F | GRY/BLK | 1687 | TP Sensor 1 5V Reference |
| G | DK GRN | 485 | TP Sensor 1 Ground |
| H | BLK | 470 | TP Sensor 1 Ground |

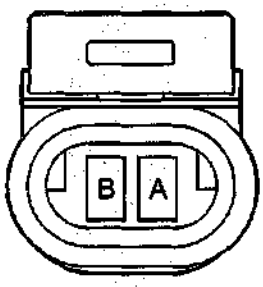
## Throttle Actuator Control Module




| Connector Part Information | • 1212-9225<br>• 24-Way F Micro-pack 100 Series (NAT) | | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| 1 | YEL | 581 | Motor Driver-High |
| 2 | — | — | Not Used |
| 3 | ORN | 1540 | Fused Input Feed |
| 4 | — | — | Not Used |
| 5 | BLK/WHT | 451 | Ground |
| 6 | — | — | Not Used |
| 7 | PNK | 339 | Fused Input Feed |
| 8 | DK BLU | 84 | Cruise Set/Coast Signal |
| 9 | LT BLU | 20 | Brake Switch Signal |
| 10 | DK GRN | 485 | TP Sensor 1 Ground |
| 11 | GRY/BLK | 1687 | TP Sensor 1 5V Reference |
| 12 | BLK | 470 | TP Sensor 1 Ground |
| 13 | BRN | 582 | Motor Driver-Low |
| 14-15 | — | — | Not Used |
| 16 | ORN/BLK | 1061 | TAC Serial Data |
| 17 | BLK/WHT | 451 | Ground |
| 18 | TAN | 800 | TAC Serial Data |
| 19 | — | — | Not Used |
| 20 | GRY | 397 | Cruise On/Off Signal |
| 21 | GRY/BLK | 87 | Cruise Resume/Accel Signal |
| 22 | PPL | 486 | TP Sensor 2 Signal |
| 23 | GRY | 597 | 5V Reference |
| 24 | BLK | 476 | TP Sensor 2 Ground |

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**Vehicle Speed Sensor Connector C2**




518983

| Connector Part Information | | • 1216-2195<br>• 2 Way F Metri-pack 150.2 Series Sealed P2S (BLK) | |
|---|---|---|---|
| **Pin** | **Wire Color** | **Circuit No.** | **Function** |
| A | PPL | 401 | Vehicle Speed Sensor (VSS) Signal - Low |
| B | YEL | 400 | Vehicle Speed Sensor (VSS) Signal - High 5V Reference |

# Diagnostic Information and Procedures

## A Diagnostic Starting Point

Begin the system diagnosis with the *A Powertrain On Board Diagnostic (OBD) System Check*. The Powertrain OBD System Check will provide the following information:

- The identification of the control module(s) which command the system.
- The ability of the control module(s) to communicate through the serial data circuit.
- The identification of any stored diagnostic trouble codes (DTCs) and their status.

The use of the Powertrain OBD System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

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## A Powertrain On Board Diagnostic (OBD) System Check

Refer to *Engine Controls Schematics*.

### Circuit Description

The Powertrain On-Board Diagnostic System Check must be the starting point for any driveability complaint diagnosis. Before using this procedure, you should perform a careful visual/physical inspection of the PCM and engine grounds for clean and secure connections. The Powertrain On-Board Diagnostic System Check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

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

1. The MIL should be ON steady with the key ON, engine OFF. If not, the No Malfunction Indicator Lamp table should be used to isolate the malfunction.
2. This test ensures that the PCM is capable of transmitting Class 2 serial data to the DLC and that the Class 2 data circuit is not open or shorted. If a problem is encountered and a malfunctioning scan tool is suspected, try the scan tool on another vehicle to verify operation. If a DLC problem exists, the DLC Diagnosis table should be used to diagnose the condition.
3. If the engine will not start, the Engine Cranks But Will Not Run table should be used to diagnose the condition.
4. The scan tool may display DTCs which are diagnosed in Automatic Transmission/Transaxle Diagnosis. If multiple DTCs are stored, diagnose each DTC according to the following priority:
   - PCM Error DTCs.
   - System Voltage DTCs.
   - Component Level DTCs (Switches, sensor range/performance, sensor high voltage, sensor low voltage, ODMs, etc.).
   - System level DTCs (Fuel trim, Misfire, EGR flow, TWC System, Idle Control System, HO2S Response or HO2S Transition Time Ratio).
5. A scan tool parameter which is not within the typical range may help to isolate the area which is causing the problem.

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**A Powertrain On Board Diagnostic (OBD) System Check**

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **Important:**<br>• Check for applicable service bulletins before proceeding with the diagnosis.<br>• Do not turn OFF the ignition when performing this diagnostic table.<br>• Do not perform this test if no drivability condition exists.<br>• Unless instructed, do not clear any DTCs.<br>1. Turn ON the ignition, with the engine OFF.<br>2. Observe the Malfunction Indicator Lamp (MIL).<br>Is the MIL illuminated? | — | *Go to Step 2* | Go to *Malfunction Indicator Lamp (MIL) Inoperative* |
| 2 | 1. Install a scan tool.<br>2. With a scan tool, attempt to display PCM data.<br>Does the scan tool display PCM data? | — | *Go to Step 3* | Go to *Data Link Connector Diagnosis* |
| 3 | Attempt to start the engine.<br>Does the engine start and continue to run? | — | *Go to Step 4* | Go to *Engine Cranks but Does Not Run* |
| 4 | **Important:** If the scan tool indicates any DTCs set, record Freeze Frame/Failure Records.<br>Use the scan tool in order to display Diagnostic Trouble Codes (DTCs).<br>Does the scan tool indicate any DTCs set? | — | Go to the applicable DTC table | *Go to Step 5* |
| 5 | With a scan tool, compare the PCM data to the *Scan Tool Data List*.<br>Does the scan tool indicate PCM values equal or within the typical values? | — | System OK | Go to Component System Checks |

## Scan Tool Data List

The Engine Scan Tool Data List contains all engine related parameters that are available on the scan tool. The list is arranged in alphabetical order. A given parameter may appear in any one of the data lists, and in some cases may appear more than once, or in more than one data list in order to group certain related parameters together.

Use the Engine Scan Tool Data List only after the following is determined:

- Powertrain On-Board Diagnostic System Check is completed.
- No Diagnostic Trouble Codes (DTCs) are active.
- On-board diagnostics are functioning properly.

Scan tool values from a properly running engine may be used for comparison with the engine you are diagnosing. The Engine Scan Tool Data List represents values that would be seen on a normally running engine.

**Important:** A scan tool that displays faulty data should not be used. The scan tool concern should be reported to the manufacturer. Use of a faulty scan tool can result in misdiagnosis and unnecessary parts replacement.

Only the parameters listed below are referenced in this service manual for use in diagnosis. If all values are within the typical range described below, refer to *Symptoms* for diagnosis.

The column labeled Data List indicates where a parameter can be located on the scan tool. Refer to the scan tool operating manual for the exact locations of the data lists. The following is a description of each term listed:

**Eng 1:** Engine Data 1 List
**Eng 2:** Engine Data 2 List
**EGR:** Exhaust Recirculation Valve Data
**EVAP:** Evaporative Emissions Data
**Cat:** Exhaust Catalyst Data
**HO2S:** Heated Oxygen Sensor Data
**Misfire:** Cylinder Misfire Data
**Cruise:** Cruise Control Data
**TAC:** Throttle Actuator Control Data
**ODD:** Output Driver Data

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## Scan Tool Data List

| Scan Tool Parameter | Data List | Units Displayed | Typical Data Value |
|---|---|---|---|
| **Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed Loop/Accessories Off/Brake Pedal Released** | | | |
| 3X Crank Sensor | Misfire | RPM | Varies |
| 18X Crank Sensor | Misfire | RPM | Varies |
| 1-2 Sol. | ODD | OK/Fault/Invalid State | OK |
| 2-3 Sol. | ODD | OK/Fault/Invalid State | OK |
| 3-2 Downshift Sol. | ODD | OK/Fault/Invalid State | OK |
| A/C High Side Pressure | Eng 2 | Volts | Varies |
| A/C Press Out of Range | Eng 2 | Yes/No | No |
| A/C Relay | ODD | OK/Fault/Invalid State | OK |
| A/C Request | Eng 2, Cat, Misfire | Yes/No | No |
| Actual EGR Position | Eng 1, 2, EGR, Misfire | Percent | 0 |
| Air Fuel Ratio | Eng 1, Cat, HO2S | Ratio | 14.2:1 - 14.7:1 |
| APP Average | Eng 1, 2, EGR, Cat, HO2S, Cruise, TAC | Counts | Varies |
| APP Indicated Angle | Eng 1, 2, EGR, Cat, HO2S, Cruise, TAC | Percent | 0 |
| APP Sensor 1 | TAC | Volts | 0.8 - 1.0 |
| APP Sensor 2 | TAC | Volts | 0.8 - 1.0 |
| APP Sensor 3 | TAC | Volts | 0.8 - 1.0 |
| APP Sensor 1 Angle | TAC | Percent | 0 |
| APP Sensor 2 Angle | TAC | Percent | 0 |
| APP Sensor 3 Angle | TAC | Percent | 0 |
| APP Sen. 1 and 2 Disagree | TAC | Yes/No | No |
| APP Sen. 1 and 3 Disagree | TAC | Yes/No | No |
| APP Sen. 2 and 3 Disagree | TAC | Yes/No | No |
| APP Sen. 1 Out of Range | TAC | Yes/No | No |
| APP Sen. 2 Out of Range | TAC | Yes/No | No |
| APP Sen. 3 Out of Range | TAC | Yes/No | No |
| BARO | Eng 1, 2, EGR, EVAP, Cat | kPa/Volts | 65-110 kPa / 3.5-4.5 Volts |
| Brake Switch | Cruise, TAC | Applied/Released | Released |
| Cam Signal Present | Misfire | Yes/No | Yes |
| Clutch Anticipate Switch | Cruise (w/ Manual Transmission) | Applied/Released | Released |
| Commanded A/C | Eng 2, Cat, Misfire | On/Off | Off |
| Commanded Gen | Eng 1 | On/Off | On |
| Cruise | Cruise, TAC | Engaged/Disengaged | Disengaged |
| Cruise Disengage Hist.1-6 | Cruise | *Cruise Control Diagnosis* | Varies |
| Cruise Release Sw. | Cruise, TAC | Applied/Released | Released |
| Cruise Resume/Accel | Cruise, TAC | On/Off | Off |
| Cruise Set/Coast | Cruise, TAC | On/Off | Off |
| Cruise Switch | Cruise, TAC | On/Off | Off |
| Current Gear | Eng 1 | Transmission Gear Position | 1 |
| Cyl. 1-6 Ckt. History | ODD | OK/Stuck Low (open)/Stuck High/Fault | OK |
| Cyl. 1-6 Ckt. Status | ODD | OK/Stuck Low (open)/Stuck High | OK |
| Decel Fuel Mode | Eng 1, 2, Cat, HO2S, Misfire, Cruise, TAC | Active/Inactive | Inactive |

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## Scan Tool Data List (cont'd)

| Scan Tool Parameter | Data List | Units Displayed | Typical Data Value |
|---|---|---|---|
| **Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed Loop/Accessories Off/Brake Pedal Released** | | | |
| Desired EGR Position | Eng 1, 2, EGR, Misfire | Percent | 0 |
| Desired Idle Speed | Eng 1, 2, EVAP, Cruise, TAC | RPM | PCM Controlled (varies) |
| Driver Module 1 Status | ODD | Enabled/Off-High Volts/Off High Temp/Invalid State | Enabled |
| Driver Module 2 Status | ODD | Enabled/Off-High Volts/Off High Temp/Invalid State | Enabled |
| Driver Module 3 Status | ODD | Enabled/Off-High Volts/Off High Temp/Invalid State | Enabled |
| Driver Module 4 Status | ODD | Enabled/Off-High Volts/Off High Temp/Invalid State | Enabled |
| ECT | Eng 1, 2, EGR, EVAP, Cat, HO2S, Misfire | °C/°F | Varies |
| EGR Closed Val. Pintle | EGR | Volts | 0.14-1.0 |
| EGR Duty Cycle | EGR | Percent | 0 |
| EGR Feedback | EGR | Volts | 0.14-1.0 |
| EGR Flow Test Count | EGR | Counts | 0-10 |
| EGR Position Error | EGR | Percent | 0-100 |
| Engine Load | Eng 1, 2, Cat, Misfire, Cruise, TAC | Percent | 2-5 |
| Engine Run Time | Engine 1, 2, EVAP, Cat, Cruise, TAC | Hr: Min: Sec | Varies |
| Engine Speed | Eng 1, 2, EGR, EVAP, Cat, HO2S, Misfire, Cruise, TAC | RPM | Varies |
| EVAP Canister Purge | EVAP, HO2S | Percent | Low and Varying |
| EVAP Fault History | EVAP | No Fault/Excess Vacuum/Purge Valve Leak/Small Leak/Weak Vacuum | No Fault |
| EVAP Purge Sol. | ODD | OK/Fault/Invalid State | OK |
| EVAP Vent Sol. | EVAP | Open/Closed | Varies |
| EVAP Vent Sol. | ODD | OK/Fault/Invalid State | OK |
| Fans High Speed | Eng 2, Cat | On/Off | Off |
| Fans Low Speed | Eng 2, Cat | On/Off | Off |
| FC Relay 1 | ODD | OK/Fault/Invalid State | OK |
| FC Relay 2 and 3 | ODD | OK/Fault/Invalid State | OK |
| Fuel Level | EVAP | Percent | 0-100 |
| Fuel Pump | Eng 2 | On/Off | On |
| Fuel Pump Ckt. History | ODD | OK/Stuck Low (open)/Stuck High/Fault | OK |
| Fuel Pump Ckt. Status | ODD | OK/Stuck Low (open)/Stuck High/Fault | OK |
| Fuel Tank Pressure | EVAP | in H2O/Volts | Varies |
| Fuel Trim Cell | Eng 1, Misfire | 0-4 | 0 |
| Fuel Trim Learn | Eng 1, Cat | Enabled/Disabled | Varies |
| HO2S Bank 1 Sensor 1 | Eng 1, HO2S | Ready/Not Ready | Ready |
| HO2S Bank 2 Sensor 1 | Eng 1, HO2S | Ready/Not Ready | Ready |

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## Scan Tool Data List (cont'd)

| Scan Tool Parameter | Data List | Units Displayed | Typical Data Value |
|---|---|---|---|
| **Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed Loop/Accessories Off/Brake Pedal Released** | | | |
| HO2S Bank 1 Sensor 1 | Eng 1, Cat, HO2S | millivolts | 0-1000 and Varying |
| HO2S Bank 2 Sensor 1 | Eng 1, Cat, HO2S | millivolts | 0-1000 and Varying |
| HO2S Bank 1 Sensor 2 | Eng 1, Cat, HO2S | millivolts | 0-1000 and Varying |
| HO2S Warm-Up Bn1 Sen 1 | HO2S | Min: Sec | Varies (under 2 minutes) |
| HO2S Warm-Up Bn2 Sen 1 | HO2S | Min: Sec | Varies (under 2 minutes) |
| HO2S Warm-Up Bn1 Sen 2 | HO2S | Min: Sec | Varies (under 2 minutes) |
| HO2S XCounts Bank 1 | HO2S | Counts | Varies |
| HO2S XCounts Bank 2 | HO2S | Counts | Varies |
| IAT | Eng 1, 2, EVAP, Cat, HO2S | °C/°F | Varies |
| Ignition 1 | Eng 1, 2, EGR, HO2S, Cruise, TAC | Volts | Varies |
| Ignition Mode | Eng 2 | IC/Bypass | IC |
| Injector Pulse Width | Eng 1, Cat | milliseconds | Varies (1.5-3.5) |
| Knock Retard | Eng 2 | Degrees | 0 |
| Long Term FT Bank 1 | Eng 1, Misfire | Percent | -10-10 |
| Long Term FT Bank 2 | Eng 1, Misfire | Percent | -10-10 |
| Loop Status | Eng 1, Cat, HO2S, Misfire | Open/Closed | Closed |
| MAF | Eng 1, 2, Cat, HO2S, TAC | Grams per Second | 3-6 (depends on altitude) |
| MAF Frequency | Eng 1 | Hz | 1200-3000 (depends on altitude) |
| MAP | Eng 1, 2, EGR, EVAP, TAC | kPa/Volts | 20-48 kPa/0.75-2 Volts (depends on altitude) |
| MIL | Eng 2 | On/Off | Off |
| MIL | ODD | OK/Fault/Invalid State | OK |
| Misfire Current Cyl. 1-6 | Misfire | Counts | 0 |
| Misfire History Cyl. 1-6 | Misfire | Counts | 0 |
| Misfiring Cylinder Prim. | Misfire | 0-6 | 0 |
| Misfiring Cylinder Sec. | Misfire | 0-6 | 0 |
| Power Enrichment | Eng 1, 2, Cat, HO2S, Misfire, Cruise, TAC | Active/Inactive | Inactive |
| Reduced Engine Power | Eng 1, 2, EGR, Cat, HO2S, Misfire, Cruise, TAC | Active/Inactive | Inactive |
| Rich/Lean Bank 1 | Eng 1 | Rich/Lean | Constantly Varying |
| Rich/Lean Bank 2 | Eng 1 | Rich/Lean | Constantly Varying |
| Short Term FT Bank 1 | Eng 1, Cat, Misfire | Percent | -10-10 |
| Short Term FT Bank 2 | Eng 1, Cat, Misfire | Percent | -10-10 |
| Spark | Eng 2 | Degrees | 20 (varies) |
| Starter Enable Relay | ODD | OK/Fault/Invalid State | OK |
| Starter Inhibit | Eng 2 | Active/Inactive | Inactive |
| Start Up ECT | EVAP, HO2S | °C/°F | Varies |
| Start Up IAT | EVAP, HO2S | °C/°F | Varies |
| TAC Brake Switch | Cruise, TAC | Applied/Released | Released |
| TAC/PCM Communication | Eng 1, 2, EGR, Cat, HO2S, Cruise, TAC | OK/Fault | OK |

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**Scan Tool Data List (cont'd)**

| Scan Tool Parameter | Data List | Units Displayed | Typical Data Value |
|---|---|---|---|
| **Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed Loop/Accessories Off/Brake Pedal Released** | | | |
| TCC Enable Sol. | ODD | OK/Fault/Invalid State | OK |
| TCC Sol. | ODD | OK/Fault/Invalid State | OK |
| Total Misfire Current Count | Misfire | Counts | 0 |
| Total Misfire Failures Since First Fail | Misfire | Counts | 0 |
| Total Misfire Passes Since First Fail | Misfire | Counts | 0 |
| TP Desired Angle | Eng 1, 2, EGR, Cat, HO2S, Cruise, TAC | Percent | 1-4 |
| TP Indicated Angle | Eng 1, 2, EGR, Cat, HO2S, Misfire, Cruise, TAC | Percent | 1-4 |
| TP Sensor 1 | TAC | Volts | 0.5-1.2 |
| TP Sensor 2 | TAC | Volts | 0.5-1.2 |
| TP Sensor 1 Angle | TAC | Percent | 2-4 |
| TP Sensor 2 Angle | TAC | Percent | 2-4 |
| TP Sensors Disagree | TAC | Yes/No | No |
| TP Sensor 1 Out of Range | TAC | Yes/No | No |
| TP Sensor 2 Out of Range | TAC | Yes/No | No |
| Traction Control | Eng 2, Cruise | Active/Inactive | Inactive |
| Traction Control Desired Toque | Eng 2, Cruise | Percent | 100% |
| Traction Control Torque | Eng 2, Cruise | Percent | 65-80% |
| Transmission Range | Eng 2, Cruise (w/ automatic transmission) | Transmission Gear Position | Park |
| TR Switch A | Eng 2, Cruise (w/ automatic transmission) | Low/High | High |
| TR Switch B | Eng 2, Cruise (w/ automatic transmission) | Low/High | Low |
| TR Switch C | Eng 2, Cruise (w/ automatic transmission) | Low/High | High |
| TWC Protection | Eng 1, 2, Cat, HO2S, Misfire, Cruise, TAC | Active/Inactive | Inactive |
| Vehicle Speed | Eng 1, 2, EGR, Cat, Misfire, Cruise, TAC | MPH/Km/h | 0 |
| VTD Fuel Disable | Eng 2 | Active/Inactive | Inactive |

## Scan Tool Data Definitions

The Engine Scan Tool Data Definitions contain a brief description of all engine related parameters available on the scan tool. The list is in alphabetical order. A given parameter may appear in any one of the data lists. In some cases, the parameter more than once or in more than one data list in order to group certain related parameters together.

**3X Crank Sensor:** Scan tool displays 1200 to 10,000 RPM. This signal is calculated from the 18X pulses and is fed to the PCM by the ignition control module. This is used by the PCM to calculate RPM at engine speeds above 1200 RPM and to initiates injector pulses.

**18X Crank Sensor:** Scan tool displays 0 to 1200 RPM. This signal is produced by the ignition control module and is fed to the PCM to calculate engine RPM below 1200 RPM.

**1-2 Sol.:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**2-3 Sol.:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**3-2 Downshift Sol.:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**A/C High Side Pressure:** Scan tool displays 0.00 to 5.00 volts. Represents the A/C refrigerant pressure sensor signal. The amount of pressure indicates the amount of load that the A/C compressor is placing on the engine. The PCM uses this information to adjust idle and to control the cooling fans.

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**A/C Pressure Out Of Range:** Scan tool displays YES or NO. YES displayed indicated that the PCM is monitoring an A/C refrigerant pressure signal voltage which is too high or too low to allow the A/C compressor clutch to engage.

**A/C Relay:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**A/C Request:** Scan tool displays YES or NO. Indicates the state of the A/C request input circuit from the HVAC controls. The PCM uses the A/C request signal to determine whether A/C compressor operation is being requested.

**Actual EGR Position:** Scan tool displays 0 percent to 100 percent. Represents the actual position of the EGR pintle in percent. 0 percent displayed indicates a fully extended pintle (EGR valve closed).

**Air/Fuel Ratio:** Scan tool displays 0.0 to 25.5. Air Fuel Ratio indicates the PCM commanded value. In closed loop, Air Fuel Ratio should normally be around 14.2–14.7. A lower Air Fuel Ratio indicates a richer commanded mixture, which may be seen during Power Enrichment or TWC Protection modes. A higher Air Fuel Ratio indicates a leaner commanded mixture. This can be seen during Decel Fuel Mode.

**APP Average:** Scan tool displays 0–150 counts. When the accelerator pedal is fully depressed the scan tool will display approximately 122 counts. The TAC module takes the voltages from the 3 APP sensors, averages the readings and converts the readings into counts. The scan tool displays the average. The average is different on every vehicle.

**APP Indicated Angle:** Scan tool displays 0–100 percent. The scan tool displays the Accelerator Pedal Position in percentage. When the APP is at rest, the display shows 0 percent. When the APP is fully depressed, the display shows 100 percent.

**APP Sensor 1 / 2 / 3:** Scan tool displays 0–5.0 volts. When the accelerator pedal is at 0 percent (pedal at rest), the display shows approximately 1 Volt. When the accelerator pedal is at 100 percent (pedal fully depressed), the display shows approximately 3.6 volts.

**APP Sensor 1 / 2 / 3 Angle:** Scan tool displays 0–100 percent. When the accelerator pedal is at rest, display shows 0 percent. When the accelerator pedal is fully depressed, display shows 100 percent. This percentage indicates to the TAC module the actual pedal position.

**APP Sen. 1 and APP Sen. 2 Disagree:** Scan tool displays YES or NO. When the TAC module receives a signal voltage from APP sensor 1 not in proper relationship to APP sensor 2, the scan tool displays YES. The scan tool displays NO under the normal operating conditions.

**APP Sen. 1 and APP Sen. 3 Disagree:** Scan tool displays YES or NO. When the TAC module receives a signal voltage from APP sensor 1 not in proper relationship to APP sensor 3, the scan tool displays YES. The scan tool displays NO under the normal operating conditions.

**APP Sen. 2 and APP Sen. 3 Disagree:** Scan tool displays YES or NO. When the TAC module receives a signal voltage from APP sensor 2 not in proper relationship to APP sensor 3, the scan tool displays YES. The scan tool displays NO under the normal operating conditions.

**APP Sensor 1 / 2 / 3 Out of Range:** Scan tool displays YES or NO. If the APP sensor voltage is not within the specifications, the scan tool displays YES. If the APP sensor voltage is within the specifications, the scan tool displays No.

**BARO:** Scan tool displays 10 to 105 kPa / 0.00 to 5.00 volts. The barometric pressure reading is determined from the MAP sensor signal monitored during key up and wide-open throttle (WOT) conditions. Barometric pressure is used to adjust fuel delivery and spark advance to compensate for altitude changes.

**Brake Switch:** Scan tool displays APPLIED or RELEASED. Indicates the brake pedal position. When the brake pedal is depressed a signal voltage is sent to the PCM. If a fault occurs on this circuit known as the cruise control brake switch 2 Circuit, a P1586 will set and cruise will not function.

**Cam Signal Present:** Scan tool displays YES or NO. If the PCM does not receive a cam signal from the ignition control module the scan tool displays NO.

**Clutch Anticipate Switch:** Scan Tool Displays APPLIED or RELEASED. The PCM monitors the clutch pedal switch input; if a low voltage is monitored, the PCM considers the clutch anticipate switch closed to ground (clutch pedal released). This is done to avoid a possible RPM flare caused by the sudden change in engine load.

**Commanded A/C:** Scan tool displays ON or OFF. Represents the PCM commanded state of the A/C compressor clutch relay driver circuit. The A/C compressor clutch should be engaged when Commanded A/C displays ON.

**Commanded Gen:** Scan tool displays ON or OFF. OFF displayed indicates that the PCM has commanded the generator control circuit OFF.

**Cruise:** Scan tool displays ENGAGED or DISENGAGED. Represents the state of the Cruise Status Input from the PCM module. Cruise should not display DISENGAGED unless the vehicle is operating in cruise control.

**Cruise Disengage History 1-6:** Scan tool displays the last 6 cruise control disengages in order from 1 to 6. There are 30 possible causes for the cruise control to disengage.

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**Cruise Release Switch:** Scan tool displays RELEASED or APPLIED. This circuit has the cruise brake switch and the cruise clutch switch wired in series on manual transmission vehicles. Represents the position of the brake pedal and clutch as seen by the PCM. If the brake or clutch pedal is applied the PCM will not allow the cruise to engage. If a fault occurs on this circuit known as the cruise control brake switch Circuit, a P0571 will set and cruise will not function.

**Cruise Resume/Accel:** Scan tool displays ON or OFF. When the Cruise control switch is in the on position and the Resume/Accel switch is activated, the scan tool displays ON. The switch, when in the ON position, sends a signal voltage to the TAC module, that signal is then sent to the PCM across serial data. When the Resume/Accel switch is released the scan tool displays OFF.

**Cruise Set/Coast:** Scan tool displays ON or OFF. When the Cruise control switch is in the on position and the Set/Coast switch is activated, the scan tool displays ON. The switch, when in the ON position, sends a signal voltage to the TAC module, that signal is then sent to the PCM across serial data. When the Set/Coast switch is released the scan tool displays OFF.

**Cruise Switch:** Scan tool displays ON or OFF. When you activate the cruise control switch, the scan tool displays ON. The switch, when in the ON position, sends a signal voltage to the TAC module, that signal is then sent to the PCM across serial data. This allows all other functions of the Cruise Control. When you turn off the cruise control switch, the scan tool displays OFF.

**Current Gear:** Scan tool displays 0–4. The scan tool display the gear that the transmission is in. An illegal transmission position displays 9.

**Cyl. 1-6 Ckt. History:** Scan tool displays OK, Stuck Low (open) or Stuck High. These Parameters describe the condition of each injector control circuit. If a fault is detected the scan tool will list which the fault type with the corresponding cylinder.

**Cyl. 1-6 Ckt. Status:** Scan tool displays OK, Stuck Low (open) or Stuck High. These Parameters describe the condition of each injector control circuit.

**Decel Fuel Mode:** Scan tool displays ACTIVE or INACTIVE. ACTIVE is displayed if the PCM has detected conditions appropriate to operate in Deceleration Fuel Mode. The PCM will command deceleration fuel mode when a sudden decrease in throttle position has been detected while the vehicle is traveling over 25 mph. While in Deceleration Fuel mode, the PCM will decrease the amount of fuel delivered by entering Open Loop and decreasing the injector pulse width.

**Desired EGR Position:** Scan tool displays 0 percent to 100 percent. Represents the EGR pintle position that the PCM is commanding. Desired EGR Position should stay close to Actual EGR Position.

**Desired Idle Speed:** Scan tool displays 0 to 3187 RPM. Represents the idle speed that is commanded by the PCM. The PCM will compensate for various engine loads based on engine coolant temperature to keep the engine at the desired idle speed.

**Driver Module 1 / 2 / 3 / 4 Status:** Scan tool displays Enabled, Off-High volts, Off High Temp or Invalid state. This parameter describes the internal PCM driver module condition. This module controls all the relays/solenoids listed below the Driver Module parameter in the scan tool Output Driver Data List up to the next driver module.

**ECT:** Scan tool displays -40°C to 151°C, -40°F to 304°F. The engine coolant temperature (ECT) sensor is mounted in the coolant stream. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (internal resistance high), the PCM monitors a high signal voltage and interprets it as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal decreases and the PCM interprets the lower voltage as a warm engine.

**EGR Closed Valve Pintle Position:** Scan tool displays 0.0 to 5.0 volts. Represents the learned voltage that the PCM uses to determine whether or not the EGR valve is fully closed (0 percent pintle position). If the Desired EGR Position is 0 percent and a difference of more than 0.4 volt between EGR Feedback and EGR Closed Valve Pintle Position is detected, DTC P1406 will set.

**EGR Duty Cycle:** Scan tool displays 0 percent to 100 percent. Represents the EGR valve driver PWM signal from the PCM. A duty cycle of 0 percent indicates that no EGR flow is being commanded; a 100 percent duty cycle indicates maximum EGR flow commanded.

**EGR Feedback:** Scan tool displays 0.00 to 5.00 volts. Indicates the EGR pintle position sensor signal voltage being monitored by the PCM. A low voltage indicates a fully extended pintle (closed valve); a voltage near 5 volts indicates a fully retracted pintle (open valve)

**EGR Flow Test Count:** Scan tool displays 0 to 255. Indicates the number of EGR flow test samples collected during the current ignition cycle. The maximum number of samples allowed is 1 during normal operation. If the PCM battery feed has been disconnected or a DTC P0401 has been cleared, several EGR flow test samples will be allowed during the next ignition cycle. This is to allow repair verification during a single ignition cycle.

**EGR Position Error:** Scan tool displays 0 percent to 100 percent. Indicates the difference between Desired EGR Position and Actual EGR Position currently being monitored by the PCM. If the EGR Position Error reaches an unacceptable level, DTC P1406 will set.

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**Engine Load:** Scan tool displays 0 percent to 100 percent. Engine load is calculated by the PCM from engine speed and MAF sensor readings. Engine load should increase with an increase in RPM or air flow.

**Engine Run Time:** Scan tool displays 00:00:00 to 99:99:99 Hrs:Min:Sec. Indicates the time elapsed since the engine was started. If the engine is stopped, ENGINE RUN TIME will be reset to 00:00:00.

**Engine Speed:** Scan tool displays 0 to 9999 RPM. Engine speed is computed by the PCM from the 3X reference input. It should remain close to desired idle under various engine loads with engine idling

**EVAP Canister Purge:** Scan tool displays 0 percent to 100 percent Represents the PCM commanded PWM duty cycle of the EVAP Purge valve. 0 percent displayed indicates no purge; 100 percent displayed indicates full purge.

**EVAP Fault History:** Scan tool displays NO FAULT, EXCESS VACUUM, PURGE VALVE LEAK, SMALL LEAK or WEAK VACUUM. The EVAP Fault History indicates the status of the EVAP system diagnostics performed by the PCM.

**EVAP Purge Sol.:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**EVAP Vent Sol.:** Listed in the EVAP Data List - Scan tool displays Open or Closed. The scan tool displays Open when the PCM commands the EVAP system to purge. The scan tool will show Closed when the system is not purging.

**Fans High Speed:** Scan tool displays ON or OFF. Represents the PCM commanded state of both fans.

**Fans Low Speed:** Scan tool displays ON or OFF. Represents the PCM commanded state of both fans.

**Fan Control Relay 1:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**Fan Control Relay 2 and 3:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**Fuel Level:** Scan tool displays 0–100 percent. The scan tool displays in percentage the amount of fuel in the fuel tank.

**Fuel Pump:** Scan tool displays ON or OFF. Indicates the PCM commanded state of the fuel pump relay control circuit.

**Fuel Pump Ckt. History:** Scan tool displays OK, Stuck Low (open) or Stuck High. These Parameters describe the condition of the fuel pump control circuit.

**Fuel Pump Ckt. Status:** Scan tool displays OK, Stuck Low (open) or Stuck High. These Parameters describe the condition of the fuel pump control circuit. If a fault is detected the scan tool will list which the fault type.

**Fuel Tank Pressure:** Scan tool displays in 0 to 5.00 volts or –32 to 32 (in/H2O). This parameter indicates the pressure/Vacuum inside of the fuel tank. A negative value indicates a vacuum. A positive value indicates a pressure.

**Fuel Trim Cell:** Scan tool displays 0 to 9 fuel trim cell is dependent upon engine speed and MAF sensor readings. A plot of RPM vs. MAF is divided into 10 cells. Fuel trim cell indicates which cell is currently active.

**Fuel Trim Learn:** Scan tool displays YES or NO. When conditions are appropriate for enabling long term fuel trim corrections, FUEL TRIM LEARN will display yes. This indicates that the long term fuel trim is responding to short term fuel trim. If the Fuel Trim Learn displays NO, long term fuel trim will not respond to changes in short term fuel trim.

**HO2S Bank 1 Sen. 1 / Bank 2 Sen. 1:** Scan tool displays READY or NOT READY. Indicates the status of the fuel control exhaust oxygen sensor. The scan tool will indicate that the exhaust oxygen sensors are ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensors are warmed up.

**HO2S Bank 1 Sen. 1 / Bank 2 Sen. 1 / Bank 1 Sen. 2:** Scan tool displays 0 to 1132 mV. Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in Closed Loop.

**HO2S Warm-Up Sensor Bank 1 Sen. 1 / Bank 2 Sen. 1 / Bank 1 Sen. 2:** Scan tool displays 00:00 to 99:99 MIN:SEC. Indicates time to warm-up for each HO2S. The HO2S warm up time is used for the HO2S heater test. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of startup) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since startup. If the PCM determines that too much time was required for the HO2S to become active, a DTC will set. If the engine was warm when started, HO2S Warm-Up will display the value that was stored last time the test ran. If info has been cleared, HO2S Warm-Up will display 00:00.

**HO2S XCounts Bank 1 / Bank 2:** Scan tool displays 0 to 255. Indicates the number of times the HO2S 1 signal has crossed the 450 mV bias voltage during a 1 second interval. A HO2S 1 signal that almost never crosses the bias voltage could indicate a fuel trim problem, a faulty HO2S 1 circuit, or a faulty HO2S 1.

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**IAT:** Scan tool displays -40°C to 151°C, -40°F to 304°F. The PCM converts the resistance of the intake air temperature sensor to degrees. The PCM uses Intake air temperature (IAT) to adjust fuel delivery and spark timing according to incoming air density. IAT is also compared to ECT at startup to identify cold starts for the HO2S heater and the EVAP diagnostics.

**Ignition 1:** Scan tool displays 0 to 25.5 volts. Represents the system voltage measured by the PCM at its ignition feed.

**Ignition Mode:** Scan tool displays BYPASS or IC. Indicates the commanded state of the Bypass signal output from the PCM. When BYPASS is displayed, the ignition control module is controlling the spark advance at a fixed 10 degrees BTDC (Bypass mode). IC displayed indicates that the PCM has requested control of the spark advance (IC mode). The ignition control module determines the correct operating mode based on the level of voltage that the PCM applies to the ignition control module bypass circuit. The PCM provides 5 volts to the ignition control module bypass circuit when conditions are appropriate for PCM control of spark timing (IC mode). If the PCM does not apply 5 volts to the bypass circuit, or if the ignition control module does not receive it, the module will control spark timing.

**Injector Pulse Width:** Scan tool displays 0 to 1000 msec. Indicates the amount of time the PCM is commanding each injector ON during each engine cycle. A longer injector pulse width will cause more fuel to be delivered. Injector Pulse Width should increase with increased engine load.

**Knock Retard:** Scan tool displays 0.0 degrees to 25.5 degrees. Indicates the amount of spark the PCM is removing from IC spark advance in response to the signal from the knock sensors. The Traction Control system Desired Torque signal from the EBTCM may cause knock retard to display a value greater than 0.0 degrees if Traction Control is active.

**Long Term Fuel Trim Bank 1 / Bank 2:** Scan tool displays -23 percent to 16 percent.Long Term Fuel Trim is derived from the Short Term Fuel Trim value and represents a long-term correction of fuel delivery. A value of 0 percent indicates that fuel delivery requires no compensation to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0 percent indicates that the fuel system is rich and fuel delivery is being reduced (decreased injector pulse width). A positive value significantly greater than 0 percent indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width). Because Long Term Fuel Trim tends to follow Short Term Fuel Trim; a value in the negative range due to canister purge at idle should not be considered unusual. The PCMs maximum authority to control long term fuel trim allows a range between -23 percent and +16 percent. Fuel trim values at or near maximum authority may indicate an excessively rich or lean system.

**Loop Status:** Scan tool displays OPEN or CLOSED. Closed Loop indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In Open Loop, the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on TP sensor, engine coolant, and MAF sensor inputs only.

**MAF:** Scan tool displays 0.0-512 g/s. Mass air flow (MAF) is the MAF Input Frequency converted to grams of air per second. This indicates the amount of air entering the engine.

**MAF Frequency:** Scan tool displays 0 to 32000 Hz. The mass air flow sensor input signal to the PCM is a frequency which varies from around 3000 Hz at idle to above 7000 Hz at wide-open throttle. The PCM converts this frequency signal to grams per second to be displayed on the scan tool as MAF.

**MAP:** Scan tool displays 10-105 kPa/0.00 to 4.97 volts. The manifold absolute pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, EGR flow, and speed changes. As intake manifold pressure increases, intake vacuum decreases resulting in a higher MAP sensor voltage and kPa reading. The MAP sensor signal is used to monitor intake manifold pressure changes during the EGR flow test, to update the BARO reading, and as an enabling factor for many of the diagnostics.

**MIL:** Listed in Eng 2 Data list - Scan tool displays ON or OFF. Indicates the PCM commanded state of the malfunction indicator lamp.

**MIL:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**Misfire Current Cyl 1-6:** Scan tool displays 0 to 198 Counts. The Misfire Current counters indicate the number of cylinder firing events detected as possible misfires on each cylinder during the last 200 crankshaft revolutions. The number that the counters display are twice the actual number of misfire events detected. The counters may normally display some activity, but the activity should be very low and nearly equal for all the cylinders.

**Misfire History Cyl 1-6:** Scan tool displays 0 to 65535 Counts. The Misfire History counters indicate the total level of misfire that has been detected on each cylinder. The number that the counters display are twice the actual number of misfire events detected. The Misfire History counters will not update or show any activity until a misfire DTC (P0300) has become active. The Misfire History counters will be updated every time a 200 crankshaft revolution misfire test failure is detected.

**Misfiring Cylinder (Primary) / Misfiring Cylinder (Secondary):** Scan tool displays 0 or Cylinder #. If a misfire is being detected, Misfiring Cylinder displays the misfiring cylinder numbers.

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**Power Enrichment:** Scan tool displays ACTIVE or INACTIVE. ACTIVE displayed indicates that the PCM has detected conditions appropriate to operate in Power Enrichment mode. The PCM will command Power Enrichment mode when a large increase in throttle position and load is detected. While in Power Enrichment, the PCM will increase the amount of fuel delivered by entering Open Loop and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

**Reduced Engine Power:** Scan tool displays ACTIVE or INACTIVE. The scan tool displays Active when the PCM has diagnosed a ETC problem or during drivetrain abuse protection. The PCM limits the engine power.

**Rich/Lean Bank 1 / Bank 2:** Scan tool displays RICH or LEAN. Indicates whether oxygen sensor voltage is greater than a 600 mV threshold voltage (rich) or less than a 300 mV threshold voltage (lean). Should change constantly while in closed loop, indicating that the PCM is controlling the air/fuel mixture properly.

**Short Term Fuel Trim Bank 1 / Bank 2:** Scan tool displays -11percent to 20 percent. Short Term Fuel Trim represents a short-term correction to fuel delivery by the PCM in response to the amount of time the fuel control oxygen sensor voltage spends above or below the 450 mV threshold. If the oxygen sensor voltage has mainly remained less than 450 mV, indicating a lean air/fuel mixture, short term fuel trim will increase into the positive range above 0 percent and the PCM will add fuel. If the oxygen sensor voltage stays mainly above the threshold, short term fuel trim will decrease below 0 percent into the negative range while the PCM reduces fuel delivery to compensate for the indicated rich condition. Under certain conditions such as extended idle and high ambient temperatures, canister purge may cause Short Term Fuel Trim to read in the negative range during normal operation. The PCMs maximum authority to control fuel trim allows a range between -11 percent and +20 percent. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

**Spark:** Scan tool displays -64 degrees to 64 degrees. Displays the spark timing being commanded by the PCM on the IC circuit. A negative (-) value indicates degrees Before Top Dead Center (BTDC) or spark advance; a positive value indicates degrees After Top Dead Center (ATDC) or spark retard. Because the ignition control module sets spark advance at a fixed value of 10° BTDC while operating in Bypass mode, the displayed Spark advance only reflects true spark timing when the PCM has commanded IC mode.

**Starter Enable Relay:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**Starter Inhibit:** Scan tool displays ACTIVE or INACTIVE. Indicates if the PCM has received the correct inputs for startup. If ACTIVE is displayed a fault exists in the Theft Deterrent System.

**Start-Up ECT:** Scan tool displays -40°C to 151°C, -40°F to 304°F. Indicates the engine coolant temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last startup was a cold start.

**Start-Up IAT:** Scan tool displays -40°C to 151°C, -40°F to 304°F. Indicates the intake air temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last startup was a cold start.

**TAC Brake Switch:** Scan tool displays APPLIED or RELEASED. Indicates the brake pedal position. When the brake pedal is depressed a signal voltage is sent to the TAC module, that signal is then sent to the PCM across serial data. If a fault occurs on this circuit known as the Stoplamp Switch CIrcuit, a P1574 will set.

**TAC/PCM Communication:** Scan tool displays OK or FAULT. If the communication between the TAC module and the PCM is interrupted the scan tool displays FAULT. The scan tool displays OK under the normal operating conditions.

**TCC Enable Sol.:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**TCC Sol.:** Scan tool displays OK, Fault or Invalid state. These parameters describe the condition of the control circuit.

**Total Misfire Current Count:** Scan tool displays 0 to 99. Indicates the total number of cylinder firing events that were detected as being misfires during the last 200 crankshaft revolution sample period.

**Total Misfire Failures Since First Fail:** Scan tool displays 0 to 65535 Counts. Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently high to report a failure.

**Total Misfire Passes Since First Fail:** Scan tool displays 0 to 65535 Counts. Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently low to report a pass.

**TP Desired Angle:** Scan tool displays 0–100 percent. The PCM indicates the desired throttle angle for conditions present at that time.

**TP Indicated Angle:** Scan tool displays 0–100 percent. The TP Indicated angle displays in percentage the amount of throttle opening.

**TP Sensor 1 / 2:** Scan tool displays 0-5 volts. The scan tool displays the amount of throttle opening in volts. Closed throttle displays approximately 1 volt and wide open throttle displays approximately 4 volts.

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**TP Sensor 1 / 2 Angle:** Scan tool displays 0–100 percent. The scan tool displays the amount of throttle opening in percentage. Closed throttle displays 0 percent and wide open throttle displays near 100 percent.

**TP Sensors Disagree:** Scan tool displays YES or NO. When the TAC module receives a signal voltage from one of the throttle position sensors not in proper relationship to the other, the scan tool displays YES. The scan tool displays NO under normal operating conditions.

**TP Sensor 1 Out of Range:** Scan tool displays YES or NO. If the TAC module detects that the voltage is below.37 volts at closed throttle or above 4.7 volts at wide open throttle, the scan tool displays YES. If the voltages are within specifications, the scan tool displays NO.

**TP Sensor 2 Out of Range:** Scan tool displays YES or NO. If the TAC module detects that the voltage is below.37 volts or at closed throttle or above 4.7 volts at wide open throttle, the scan tool displays YES. If the voltages are within specifications, the scan tool displays NO.

**Traction Control:** Scan tool displays ACTIVE or INACTIVE. Active will be displayed if a message is received from the EBTCM requesting torque reduction.

**Traction Control Desired Torque:** Scan tool range 0 percent to 100 percent. Represents the PWM signal from the electronic brake and traction control module. The EBTCM reduces the Traction Control Desired Torque signal pulse width when a drive wheel slippage situation is detected. The PCM monitors the Traction Control Desired Torque signal and reduces drive wheel slippage as necessary by retarding spark timing, or increasing air/fuel ratio. The PCM can also turn OFF up to three fuel injectors if the Traction Control Desired Torque signal indicates a large enough amount of drive wheel slippage. A problem with the Traction Control Desired Torque signal should cause a DTC to set.

**Traction Control Torque:** Scan tool range 0 percent to 100 percent. Represents the PWM signal which indicates the percent of available torque the engine is delivering to the drive wheels. The EBTCM monitors the Traction Control Torque signal to ensure that the PCM is responding properly to the Traction Control Desired Torque signal.

**Transmission Range:** Scan tool displays INVALID, PARK/NEUTRAL, REVERSE, DRIVE 4, DRIVE 3, DRIVE 2, or LOW. Transmission Range represents the decoded status of the four inputs from the Transaxle Range Switch Assembly. The combination of transaxle range inputs indicates the position of the transaxle manual valve.

**TR Switch A / B / C:** Scan tool displays HIGH or LOW. The TR switch A / B / C display represents the states of the four inputs from the transaxle range switch. HIGH displayed indicates a B+ voltage signal being monitored at the PCM, LOW displayed indicates a grounded input signal. The combination of transaxle range inputs indicates the position of the transaxle manual valve.

**TWC Protection:** Scan tool displays ACTIVE or INACTIVE. ACTIVE displayed indicates that the PCM has detected conditions appropriate to operate in TWC Protection mode. This is determined based on engine load and engine coolant temperature. While in TWC Protection, the PCM will decrease Air/Fuel Ratio to a value that depends on mass air flow (higher Mass Airflow = lower Air/Fuel Ratio).

**Vehicle Speed:** Scan tool displays 0-255 km/h, 0-155 mph. The vehicle speed sensor signal is converted into mph and km/h for display.

**VTD Fuel Disable:** Scan tool displays ACTIVE or INACTIVE. The Theft Deterrent Fuel Enable circuit is an input from the vehicle theft deterrent control module that signals the PCM to enable the injectors if the proper signal is received. The scan tool will normally display INACTIVE. If the vehicle theft deterrent control module does not sent the correct Theft Deterrent Fuel Enable signal to the PCM, the display will switch to ACTIVE and the fuel system may be disabled. Refer to DTCs P1626, P1629, or Vehicle Theft Deterrent diagnosis for further information.

## Diagnostic Trouble Code (DTC) Type Definitions

Diagnostic Trouble Codes (DTCs) are categorized into emissions and non-emissions related types. When a DTC is set, the MIL and Failure data are utilized by the control modules diagnostic executive according to the DTC type. Each DTC is set based upon the individual DTCs running and setting criteria. It is important to read the Action Taken When the DTC Sets and Conditions for Clearing the MIL/DTC in the supporting text for taking appropriate action to each DTC.

### Emissions Related DTCs

#### Type A

The following actions occur at the time of the first failure:

- Turns on the MIL
- Stores DTC in memory
- Stores Freeze Frame/Failure records data
- Updates the Failure Records after each ignition cycles first failure

Some Type A DTCs will not perform the above actions when the DTC first detects a failure. Two consecutive failures are required. This allows systems, such as EVAP, to accurately identify what failure exists before setting a DTC and requesting MIL illumination.

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### Type B

The following actions occur at one of the following times:

- First failure:
  - Does not turn on the MIL
  - Stores the DTC in memory as Failed Last Test
  - Stores Failure Records data
- Second consecutive drive cycle with a failure:
  - Turns on the MIL
  - Stores the DTC in memory as a history DTC
  - Stores Freeze Frame data
  - Updates Failure Records data
- Second non-consecutive drive cycle with a failure:
  - Does not turn on the MIL
  - Stores the DTC in memory as Failed Last Test
  - Updates Failure Records data

## Non-Emissions Related DTCs

### Type C

The following actions occur at the time of a failure:

- Does not turn on the MIL
- Stores the DTC in memory as a history DTC
- Stores Failure Records data
- Updates the Failure Records after each ignition cycles first failure
- Some Type C DTCs may also cause an auxiliary service lamp to be illuminated, and/or display a message to the vehicle operator.

### Type X

No actions occur. These DTCs are coded into the control modules software, but will not run because one of the following reasons:

- Associated hardware is not installed with the vehicles emission package
- The diagnostic is not required for the vehicles emission package

### Diagnostic Trouble Code (DTC) List/Type

| Description | Domestic RPO L36 | Export Unleaded Fuel | European Export Unleaded Fuel |
|---|---|---|---|
| *DTC P0101 Mass Air Flow (MAF) Sensor Performance* | B | B | B |
| *DTC P0102 Mass Air Flow (MAF) Sensor Circuit Low Frequency* | B | B | B |
| *DTC P0103 Mass Air Flow (MAF) Sensor Circuit High Frequency* | B | B | B |
| *DTC P0107 Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage* | B | B | B |
| *DTC P0108 Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage* | B | B | B |
| *DTC P0112 Intake Air Temperature (IAT) Sensor Circuit Low Voltage* | B | B | B |
| *DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Voltage* | B | B | B |
| *DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage* | B | B | B |
| *DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage* | B | B | B |
| *DTC P0125 Engine Coolant Temperature (ECT) Excessive Time to Closed Loop Fuel Control* | B | B | B |
| *DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1* | B | B | B |
| *DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1* | B | B | B |
| *DTC P0133 HO2S Slow Response Bank 1 Sensor 1* | B | B | B |
| *DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1* | B | B | B |
| *DTC P0135 HO2S Heater Performance Bank 1 Sensor 1* | B | B | B |
| *DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2* | B | B | B |
| *DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2* | B | B | B |
| *DTC P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2* | B | B | B |
| *DTC P0141 HO2S Heater Performance Bank 1 Sensor 2* | B | B | B |
| *DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1* | B | B | B |
| *DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1* | B | B | B |
| *DTC P0153 HO2S Slow Response Bank 2 Sensor 1* | B | B | B |
| *DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1* | B | B | B |
| *DTC P0155 HO2S Heater Performance Bank 2 Sensor 1* | B | B | B |
| *DTC P0171 Fuel Trim System Lean Bank 1* | B | B | B |

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## Diagnostic Trouble Code (DTC) List/Type (cont'd)

| Description | Domestic RPO L36 | Export Unleaded Fuel | European Export Unleaded Fuel |
|---|---|---|---|
| *DTC P0172 Fuel Trim System Rich Bank 1* | B | B | B |
| *DTC P0174 Fuel Trim System Lean Bank 2* | B | B | B |
| *DTC P0175 Fuel Trim System Rich Bank 2* | B | B | B |
| *DTC P0201 Injector 1 Control Circuit* | B | B | B |
| *DTC P0202 Injector 2 Control Circuit* | B | B | B |
| *DTC P0203 Injector 3 Control Circuit* | B | B | B |
| *DTC P0204 Injector 4 Control Circuit* | B | B | B |
| *DTC P0205 Injector 5 Control Circuit* | B | B | B |
| *DTC P0206 Injector 6 Control Circuit* | B | B | B |
| *DTC P0230 Fuel Pump Relay Control Circuit* | C | C | C |
| *DTC P0300 Engine Misfire Detected* | B | B | B |
| *DTC P0325 Knock Sensor (KS) Circuit* | B | B | B |
| *DTC P0327 Knock Sensor (KS) Circuit Bank 1* | B | B | B |
| *DTC P0332 Knock Sensor (KS) Circuit Bank 2* | B | B | B |
| *DTC P0336 Crankshaft Position (CKP) Sensor Circuit* | B | B | B |
| *DTC P0341 Camshaft Position (CMP) Sensor Performance* | B | B | B |
| *DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient* | A | A | A |
| *DTC P0403 Exhaust Gas Recirculation (EGR) Solenoid Control Circuit* | B | B | B |
| *DTC P0404 Exhaust Gas Recirculation (EGR) Open Position Performance* | B | B | B |
| *DTC P0405 Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage* | B | B | B |
| *DTC P0420 Catalyst System Low Efficiency* | A | A | A |
| *DTC P0440 Evaporative Emission (EVAP) System* | B | B | B |
| *DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected* | A | A | A |
| *DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit* | B | B | B |
| *DTC P0446 Evaporative Emission (EVAP) Vent System Performance* | B | B | B |
| *DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit* | B | B | B |
| *DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage* | B | B | B |
| *DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage* | B | B | B |
| *DTC P0462 Fuel Level Sensor Circuit Low Voltage* | C | C | C |
| *DTC P0463 Fuel Level Sensor Circuit High Voltage* | C | C | C |
| *DTC P0480 Cooling Fan Relay 1 Control Circuit* | B | B | B |
| *DTC P0481 Cooling Fan Relay 2 and 3 Control Circuit* | B | B | B |
| *DTC P0500 Vehicle Speed Sensor (VSS) Circuit* | B | B | B |
| *DTC P0502 Vehicle Speed Sensor (VSS) Circuit Low Input (3.8L)* | B | B | B |
| *DTC P0503 Vehicle Speed Sensor (VSS) Circuit Intermittent (3.8L)* | B | B | B |
| *DTC P0506 Idle Speed Low* | B | B | B |
| *DTC P0507 Idle Speed High* | A | A | A |
| *DTC P0530 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit* | C | C | C |
| *DTC P0560 System Voltage* | C | C | C |
| *DTC P0567 Cruise Control Resume Switch Circuit* | C | C | C |
| *DTC P0568 Cruise Control Set Switch Circuit* | C | C | C |
| *DTC P0571 Cruise Control Brake Switch Circuit* | C | C | C |
| *DTC P0601Control Module Read Only Memory (ROM)* | A | A | A |
| *DTC P0602 Control Module Not Programmed* | A | A | A |

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## Diagnostic Trouble Code (DTC) List/Type (cont'd)

| Description | Domestic RPO L36 | Export Unleaded Fuel | European Export Unleaded Fuel |
|---|---|---|---|
| *DTC P0604 Control Module Random Access Memory (RAM)* | A | A | A |
| *DTC P0606 Control Module Internal Performance* | A | A | A |
| *DTC P0620 Generator Performance* | C | C | C |
| *DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit* | B | B | B |
| *DTC P0704 Clutch Switch Circuit* | C | C | C |
| *DTC P0711 TFT Sensor Circuit Range/Performance (3.8L)* | C | C | C |
| *DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input (3.8L)* | C | C | C |
| *DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input (3.8L)* | C | C | C |
| *DTC P0719 Brake Switch Circuit Low Input (3.8L)* | C | C | C |
| *DTC P0724 Brake Switch Circuit High Input (3.8L)* | C | C | C |
| *DTC P0740 TCC Enable Solenoid Circuit Electrical (3.8L)* | B | B | B |
| *DTC P0742 TCC System Stuck On (3.8L)* | B | B | B |
| *DTC P0748 Pressure Control Solenoid Circuit Electrical (3.8L)* | C | C | C |
| *DTC P0751 1-2 Shift Solenoid Valve Performance - No First or Fourth Gear (3.8L)* | B | B | B |
| *DTC P0752 1-2 Shift Solenoid Valve Performance - No Second or Third Gear (3.8L)* | B | B | B |
| *DTC P0753 1-2 Shift Solenoid Circuit Electrical (3.8L)* | B | B | B |
| *DTC P0756 2-3 Shift Solenoid Valve Performance - No First or Second Gear (3.8L)* | A | A | A |
| *DTC P0757 2-3 Shift Solenoid Valve Performance - No Third or Fourth Gear (3.8L)* | A | A | A |
| *DTC P0758 2-3 Shift Solenoid Circuit Electrical (3.8L)* | A | A | A |
| *DTC P0785 3-2 Shift Solenoid Circuit Electrical (3.8L)* | B | B | B |
| *DTC P1106 Manifold Absolute Pressure (MAP) Sensor Circuit Intermittent High Voltage* | C | C | C |
| *DTC P1107 Manifold Absolute Pressure (MAP) Sensor Circuit Intermittent Low Voltage* | C | C | C |
| *DTC P1111 Intake Air Temperature (IAT) Sensor Circuit Intermittent High Voltage* | C | C | C |
| *DTC P1112 Intake Air Temperature (IAT) Sensor Circuit Intermittent Low Voltage* | C | C | C |
| *DTC P1114 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent Low Voltage* | C | C | C |
| *DTC P1115 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent High Voltage* | C | C | C |
| *DTC P1120 Throttle Position (TP) Sensor 1 Circuit* | A | A | A |
| *DTC P1125 Accelerator Pedal Position (APP) System* | A | A | A |
| *DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1* | B | B | B |
| *DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1* | B | B | B |
| *DTC P1153 HO2S Insufficient Switching Bank 2 Sensor 1* | B | B | B |
| *DTC P1154 HO2S Transition Time Ratio Bank 2 Sensor 1* | B | B | B |
| *DTC P1220 Throttle Position (TP) Sensor 2 Circuit* | A | A | A |
| *DTC P1221 Throttle Position (TP) Sensor 1- 2 Correlation* | A | A | A |
| *DTC P1271 Accelerator Pedal Position (APP) Sensor 1-2 Correlation* | C | C | C |
| *DTC P1272 Accelerator Pedal Position (APP) Sensor 2-3 Correlation* | C | C | C |
| *DTC P1273 Accelerator Pedal Position (APP) Sensor 1-3 Correlation* | C | C | C |
| *DTC P1275 Accelerator Pedal Position (APP) Sensor 1 Circuit* | C | C | C |

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## Diagnostic Trouble Code (DTC) List/Type (cont'd)

| Description | Domestic RPO L36 | Export Unleaded Fuel | European Export Unleaded Fuel |
|---|---|---|---|
| *DTC P1276 Accelerator Pedal Position (APP) Sensor 1 Performance* | C | C | C |
| *DTC P1280 Accelerator Pedal Position (APP) Sensor 2 Circuit* | C | C | C |
| *DTC P1281 Accelerator Pedal Position (APP) Sensor 2 Performance* | C | C | C |
| *DTC P1285 Accelerator Pedal Position (APP) Sensor 3 Circuit* | C | C | C |
| *DTC P1286 Accelerator Pedal Position (APP) Sensor 3 Performance* | C | C | C |
| *DTC P1336 Crankshaft Position (CKP) System Variation Not Learned* | A | A | A |
| *DTC P1351 Ignition Coil Control Circuit High Voltage* | B | B | B |
| *DTC P1352 Ignition Bypass Circuit High Voltage* | B | B | B |
| *DTC P1361 Ignition Control (IC) Circuit Low Voltage* | B | B | B |
| *DTC P1362 Ignition Bypass Circuit Low Voltage* | B | B | B |
| *DTC P1374 Crankshaft Position (CKP) High to Low Resolution Frequency Correlation* | B | B | B |
| *DTC P1380 Misfire Detected - Rough Road Data Not Available* | C | X | X |
| *DTC P1381 Misfire Detected - No Communication with Brake Control Module* | C | X | X |
| *DTC P1404 Exhaust Gas Recirculation (EGR) Closed Position Performance* | A | A | A |
| *DTC P1441 Evaporative Emission (EVAP) System Flow During Non-Purge* | B | B | B |
| *DTC P1514 Throttle Body Performance* | A | A | A |
| *DTC P1515 Control Module Throttle Actuator Position Performance* | A | A | A |
| *DTC P1516 Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance* | A | A | A |
| *DTC P1517 Throttle Actuator Control (TAC) Module Performance* | A | A | A |
| *DTC P1518 Throttle Actuator Control (TAC) Module Serial Data Circuit* | A | A | A |
| *DTC P1519 Throttle Actuator Control (TAC) Module Internal Circuit* | C | C | C |
| *DTC P1523 Throttle Closed Position Performance* | C | C | C |
| *DTC P1546 Air Conditioning (A/C) Clutch Relay Control Circuit* | C | C | C |
| *DTC P1571 Traction Control Torque Request Circuit* | C | C | C |
| *DTC P1574 Stoplamp Switch Circuit* | C | C | C |
| *DTC P1586 Cruise Control Brake Switch 2 Circuit* | C | C | C |
| *DTC P1626 Theft Deterrent Fuel Enable Signal Lost* | C | C | C |
| *DTC P1629 Theft Deterrent Fuel Enable Signal Not Received* | C | C | C |
| *DTC P1635 5 Volt Reference 1 Circuit* | B | B | B |
| *DTC P1639 5 Volt Reference 2 Circuit* | B | B | B |
| *DTC P1689 Traction Control Delivered Torque Output Circuit* | C | C | C |
| *DTC P1810 TFP Valve Position Switch Circuit (3.8L)* | B | B | B |
| *DTC P1860 TCC PWM Solenoid Circuit Electrical (3.8L)* | B | B | B |
| *DTC P1870 Transmission Component Slipping (3.8L)* | B | B | B |

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## Malfunction Indicator Lamp (MIL) Inoperative

Refer to *Engine Controls Schematics*.

### Circuit Description

There should be a steady MIL with the ignition ON and the engine not running. Ignition feed voltage is supplied directly to the MIL. The powertrain control module (PCM) turns the MIL ON by grounding the MIL control circuit. No MIL with the key ON, engine not running and the MIL DTC set suggests an open in the MIL control circuit.

### MIL Operation

The malfunction indicator lamp (MIL) is located on the instrument panel (CHECK ENGINE) or (SERVICE ENGINE SOON). The MIL performs the following functions:

- It informs the driver that a problem has occurred and that the vehicle should be taken for service as soon as possible.
- As a system check, the MIL will illuminate with the ignition switch ON and the engine not running. when the engine is started, the MIL will turn OFF. If the MIL remains ON, the self-diagnostic system has detected a problem. If the problem goes away, the MIL will turn OFF in most cases, but a diagnostic trouble code will remain stored.
- If the MIL is illuminated, then the engine stalls, the MIL will remain illuminated so long as the ignition switch is ON.
- Now, if the MIL is not illuminated and the engine stalls, the MIL will not illuminate until the ignition switch is cycled OFF, then ON.

Perform the Powertrain On-Board Diagnostic System Check first, when the following conditions are present:

- When the MIL does not turn ON when the ignition switch is turned to the RUN position.
- When the MIL remains ON while the engine is running.
- When you suspect a driveability problem.

### Diagnostic Aids

Inspect for the following:

- If the engine runs OK, test for a malfunctioning MIL, an open in the MIL control circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, test for an open PCM ignition or battery feed or a poor PCM to engine ground.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. If the MIL DTC is set, the MIL Control Circuit table will better diagnose the condition.
6. Using a test lamp connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present.

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## Malfunction Indicator Lamp (MIL) Inoperative

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Does the scan tool indicate the MIL DTC set? | — | Go to *DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit* | *Go to Step 3* |
| 3 | Inspect the PCM feed fuses.<br>Are the fuses OK? | — | *Go to Step 4* | *Go to Step 9* |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. Probe the PCM ignition feed circuit using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 5* | *Go to Step 8* |
| 5 | Probe the PCM battery feed circuit using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 6* | *Go to Step 8* |
| 6 | Test for faulty PCM grounds or poor PCM ground connections. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 7* |
| 7 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 8 | Repair open in PCM battery feed circuit or the PCM ignition feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 9 | Repair short to ground in PCM ignition feed circuit or the PCM battery feed circuit. Refer to *Wiring Repairs* in Wiring systems.<br>Did you complete the repair? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |

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## Data Link Connector Diagnosis

Refer to *Engine Controls Schematics*.

### Circuit Description

The Class 2 serial data circuit to the DLC allows bi-directional communication between the PCM and the scan tool. If communication between the scan tool and the PCM cannot be established, the procedure in the DLC Diagnosis table should be used to diagnose the condition.

### Diagnostic Aids

Inspect for the following:

- For the PCM to establish communication with the scan tool, system voltage must be between 9.0 and 16.0 volts. If system voltage is not within this range, refer to *Symptoms - Engine Electrical* in Engine Electrical.
- Ensure that the correct application (model year, carline, VIN code) has been selected on the scan tool. If communication still cannot be established try the scan tool on another vehicle to ensure that the scan tool or cables are not the cause of the condition.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The number below refers to the step number on the diagnostic table:

4. The serial data circuit voltage will constantly vary and should measure between 0.5 and 3.0 volts.
11. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

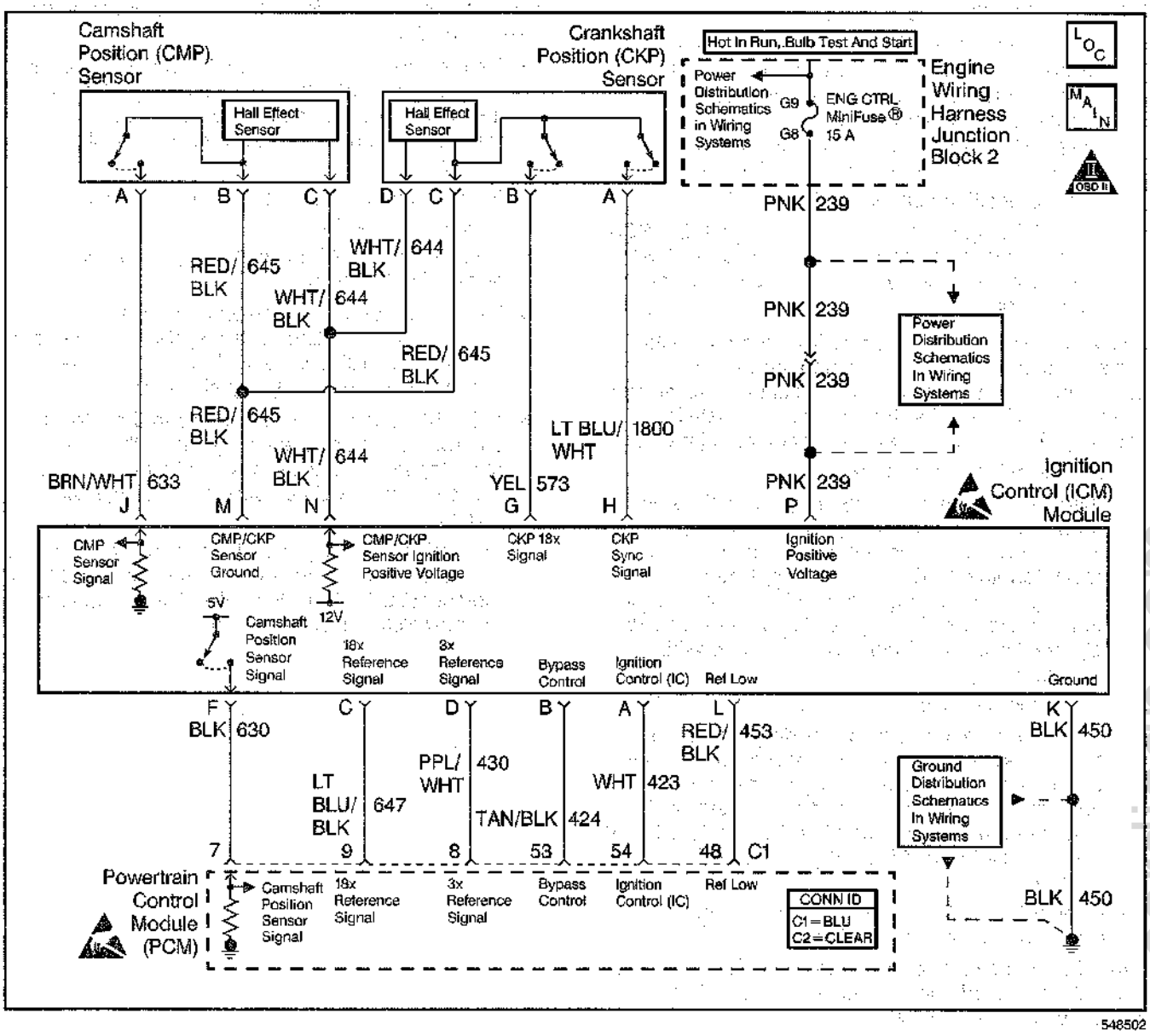
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## Data Link Connector Diagnosis

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. Connect a test lamp to the battery feed circuit of the Data Link Connector.<br>3. Using the test lamp, probe each of the DLC ground circuits.<br>Does the test lamp illuminate while probing both circuits? | — | *Go to Step 4* | *Go to Step 3* |
| 3 | Connect a test lamp between the battery feed circuit of the Data Link Connector and a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 9* | *Go to Step 10* |
| *4* | 1. Turn ON the ignition, with the engine OFF.<br>2. Connect a DMM between the Class II serial data circuit of the DLC and a good ground.<br>Does the voltage measure less than the specified value? | 4.5V | *Go to Step 5* | *Go to Step 7* |
| 5 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Connect a DMM between the Class II serial data circuit of the DLC and battery positive voltage.<br>Does the voltage measure at or near the specified value? | 0.0V | *Go to Step 6* | *Go to Step 8* |
| 6 | Repair the open in the Class II serial data circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 11* |
| 7 | Repair the short to voltage in the Class II serial data circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 11* |
| 8 | Repair the short to ground in the Class II serial data circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 9 | Repair the open in the DLC ground circuits. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 10 | Repair open or short to ground in the DLC battery feed circuit. Replace the fuse, if necessary. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| *11* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |

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## Engine Cranks but Does Not Run




### Circuit Description

The Electronic Ignition system uses a waste spark method of spark distribution. In this type of ignition system, the ignition control module triggers the correct coil based on the sync signal received from the crankshaft position sensor, resulting in both spark plugs connected to the coil firing at the same time. The spark plug for the cylinder on the exhaust stroke requires a lower energy requirement to fire, leaving the remaining high voltage to fire the spark plug for the cylinder on the compression stroke.

During crank, the ignition control module monitors the CKP sync signal. The CKP sync signal is used to determine the correct cylinder pair to fire first. The CKP sync signal is used only by the ignition control module to initiate ignition coil firing sequence. It is not passed to the PCM. After the ignition control module processes the CKP sync signal, the ignition control module monitors the 18X CKP signal and sends 18X and 3X reference pulses to the PCM. When the PCM receives these pulses, the PCM will command all six injectors to allow a priming shot of fuel for all the cylinders. After the priming, the injectors are left OFF during the next six 3X reference pulses from the ignition control module. This allows each cylinder a chance to use the fuel from the priming shot. During this waiting period, the PCM receives a camshaft position signal pulse. The camshaft position signal allows the PCM to operate the injectors sequentially based on camshaft position. If the camshaft position signal is not present at start-up, the PCM will begin fuel delivery with a 1 in 6 chance that fuel delivery is correct.

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### Diagnostic Aids

Inspect for the following:

- Malfunctioning engine coolant temperature sensor.

  Using a scan tool, compare engine coolant temperature with intake air temperature on a completely cool engine. engine coolant temperature should be within 10°C of intake air temperature. If not, replace the ECT sensor.

- Throttle position sensor.

  If the TP angle is more than 80 percent, the PCM may operate in clear flood mode. The PCM will not allow fuel delivery while operating in clear flood mode.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

5. Determines if the ignition control module (ICM) is receiving the 18X CKP Reference signal. If the 18X CKP signal to the ICM is not present, there will be no RPM, spark, or fuel injector pulses.
6. Ensures that the ICM has the proper voltage supply and ground.
8. Verifies that the ICM is supplying the proper sensor feed voltage.
24. Test for the proper operation of the CKP Sync signal, ICM and related spark system components. Without the CKP Sync signal the ICM is unable to properly sequence the ignition coils.
35. If the 18X and CKP Sync signals to the ICM or the 18X and 3X reference signals to the ICM short together the vehicle will not start and run. However, there will be spark and fuel injector pulses.
46. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

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## Engine Cranks but Does Not Run

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Before proceeding with this table, ensure that the vehicle battery is fully charged.<br>**Important:** If the engine cranks and does not run and multiple DTCs are present, test the ignition relay feed circuits to and from the ignition relay. Refer to *Power Distribution Schematics* and *Circuit Testing* in Wiring Systems.<br>**Important:** If any DTCs are stored as failed since code clear (except P1374, P0336, or P0341), diagnose the DTCs before continuing with this table.<br>1. Inspect the fuses which supply ignition positive voltage to the following components:<br>• Electronic ignition control module.<br>• Fuel injectors.<br>2. If either fuse is open, repair the short to ground in the affected ignition positive voltage circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Install a *J 34730-1A* fuel pressure gauge.<br>3. Turn ON the ignition.<br>4. Observe the fuel pressure gauge.<br>Does the fuel pressure measure within the specified values and holding? | 333-376 kPa (48-55 psi) | *Go to Step 5* | *Go to Step 4* |
| 4 | Is any fuel pressure indicated? | — | Go to *Fuel System Pressure Test* | Go to *Fuel Pump Electrical Circuit Diagnosis* |
| 5 | 1. Turn OFF the ignition.<br>2. Remove the fuel pressure gauge.<br>3. Turn ON the ignition.<br>4. With a scan tool, observe the engine RPM while cranking the engine.<br>Does the scan tool indicate an engine RPM? | — | *Go to Step 17* | *Go to Step 6* |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the ignition control module (ICM).<br>3. Turn ON the ignition.<br>4. Connect a test lamp between the ignition positive feed and ground circuits in the ICM connector.<br>Does the test lamp illuminate? | — | *Go to Step 8* | *Go to Step 7* |
| 7 | 1. Leave the ICM disconnected.<br>2. Probe the ignition positive feed circuit at the ICM connector using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 39* | *Go to Step 40* |
| 8 | 1. Turn OFF the ignition.<br>2. Reconnect the ICM.<br>3. Disconnect the 18X crankshaft position (CKP) sensor.<br>4. Turn ON the ignition.<br>5. Measure the voltage between the sensor feed and sensor ground circuits in the 18X sensor connector using a DMM.<br>Does the voltage measure near the specified value? | B+ | *Go to Step 9* | *Go to Step 11* |

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## Engine Cranks but Does Not Run (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 9 | Measure the voltage between the sensor signal and sensor ground circuits in the 18X sensor connector using a DMM.<br>Does the voltage measure within the specified values? | 6V-9V | *Go to Step 10* | *Go to Step 14* |
| 10 | Inspect for poor connections at the 18X sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 41* |
| 11 | Measure the voltage on the sensor feed circuit at the 18X sensor connector using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | B+ | *Go to Step 12* | *Go to Step 13* |
| 12 | Test the 18X sensor ground circuit for an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 38* |
| 13 | Test the 18X sensor feed circuit for an open or a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 41* |
| 14 | 1. Leave the DMM connected.<br>2. Turn OFF the ignition.<br>3. Disconnect the ICM.<br>4. Turn ON the ignition.<br>Does the DMM indicate any voltage? | — | *Go to Step 15* | *Go to Step 16* |
| 15 | Repair the short to voltage on the 18X sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 16 | Test the 18X signal circuit for an open or a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 38* |
| 17 | 1. Turn OFF the ignition.<br>2. Disconnect all fuel injectors.<br>3. Turn ON the ignition.<br>4. Observe the *J 34730-2C* fuel injector test lamp when installed in each injector connector.<br>Did the injector test lamp illuminate for any of the injectors? | — | *Go to Step 18* | *Go to Step 19* |
| 18 | 1. Leave the fuel injectors disconnected.<br>2. Turn OFF the ignition.<br>3. Disconnect the PCM.<br>4. Turn ON the ignition.<br>5. Observe the injector test lamp when installed in the each injector connector.<br>Did the injector test lamp illuminated for any of the injectors? | — | *Go to Step 43* | *Go to Step 46* |
| 19 | 1. Leave the fuel injectors disconnected.<br>2. Leave the injector test lamp installed in a injector connector.<br>3. Observe the injector test lamp while cranking the engine (repeat for each injector).<br>Did the injector test lamp blink for each injector? | — | *Go to Step 24* | *Go to Step 20* |
| 20 | Did the injector test lamp blink for any of the injectors? | — | *Go to Step 21* | *Go to Step 22* |

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## Engine Cranks but Does Not Run (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 21 | Test for an open in the fuel injector control circuits associated with the injector test lamp that did not blink. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 44* |
| 22 | 1. Leave the fuel injectors disconnected.<br>2. Turn ON the ignition.<br>3. Probe the ignition positive feed circuit at each injector connector using a Test Lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 24* | *Go to Step 23* |
| 23 | Repair the open ignition positive feed circuit to the fuel injectors. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 24 | 1. Turn OFF the ignition.<br>2. Disconnect a spark plug wire from the spark plug.<br>3. Install *J 26792* spark tester in the end of the spark plug wire.<br>4. Jumper the companion cylinder ignition wire to engine ground. The companion cylinder is the cylinder that shares the same ignition coil (i.e. 1/4, 2/5, 3/6).<br>5. Crank the engine while observing the spark tester. Spark should be observed.<br>6. Repeat the above test for each ignition wire, noting any cylinders that do not have spark.<br>Did you observe spark at all cylinders? | — | *Go to Step 34* | *Go to Step 25* |
| 25 | Did you observe spark at any cylinder? | — | *Go to Step 30* | *Go to Step 26* |
| 26 | 1. Turn OFF the ignition.<br>2. Disconnect the 18X sensor.<br>3. Turn ON the ignition.<br>4. Measure the voltage on the CKP Sync signal circuit using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 6V-9V | *Go to Step 27* | *Go to Step 28* |
| 27 | Inspect for poor connections at the 18X sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 41* |
| 28 | Test the CKP Sync signal circuit for a short to voltage or a short to the 18X sensor feed circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 29* |
| 29 | Test the CKP Sync signal circuit for an open or a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 38* |
| 30 | 1. Remove and visually/physically inspect the ignition coils and the ignition wires associated with the cylinders that did not have spark.<br>2. Ensure that the ignition wires, boots, coils, and coil towers are free of cracks and carbon tracking.<br>If a problem is found, replace the damaged ignition components. Refer to *Ignition Coil(s) Replacement.*<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 31* |

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## Engine Cranks but Does Not Run (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 31 | Measure the ignition coil secondary resistance using a DMM.<br>If any resistance is outside the specified values, replace the malfunctioning ignition coils as necessary. Refer to *Ignition Coil(s) Replacement.*<br>Did you find and correct the condition? | 5K-8K ohms (5000 - 8000 ohms) | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 32* |
| 32 | Measure the resistance of the ignition wires associated with the cylinders that did not have spark using a DMM.<br>Replace the ignition wires that measure more than the specified value. Refer to *Spark Plug Wire Harness Replacement (3.8 L Right Bank).*<br>Did you find and correct the condition? | 3280-4921 ohms/meter (1000-1500 ohms/ft) | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 33* |
| 33 | 1. Connect a test lamp across the ignition module primary circuit (between the electronic ignition control module terminals) for the coils associated with the cylinders which did not have spark.<br>2. Observe the test lamp while cranking the engine.<br>Does the test lamp blink continuously while the engine is cranking? | — | *Go to Step 45* | *Go to Step 42* |
| 34 | 1. Remove the spark plugs from all of the cylinders. Refer to *Spark Plug Replacement* in Engine Electrical.<br>2. Visually/physically inspect the spark plug electrodes.<br>Did the spark plug inspection reveal excessive fouling? | — | Go to *Base Engine Misfire Diagnosis* in Engine Mechanical | *Go to Step 35* |
| *35* | 1. Test for the following conditions:<br>• A short between the 18X CKP and CKP Sync signal inputs to the ICM<br>• A short between the 18X and 3X reference signal inputs to the PCM<br>• Skewed ECT sensor<br>• Skewed or unresponsive MAP sensor<br>• Faulty MAF sensor<br>• Faulty IAC valve<br>2. If a problem is found, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 36* |
| 36 | 1. Test the fuel for contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*<br>2. If a problem is found, clean the fuel system and correct the contaminated fuel conditions as necessary.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 37* |
| 37 | Repair the engine mechanical problem. Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical to diagnose the following conditions:<br>• Bent push rods<br>• Malfunctioning or incorrect camshaft<br>• Leaking or sticky valves or rings<br>• Excessive valve deposits<br>• Loose or worn rocker arms<br>• Weak valve springs<br>• Incorrect valve timing<br>• Leaking head gasket<br>Did you complete the repair? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 38 | Inspect for poor connections at the ICM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 42* |

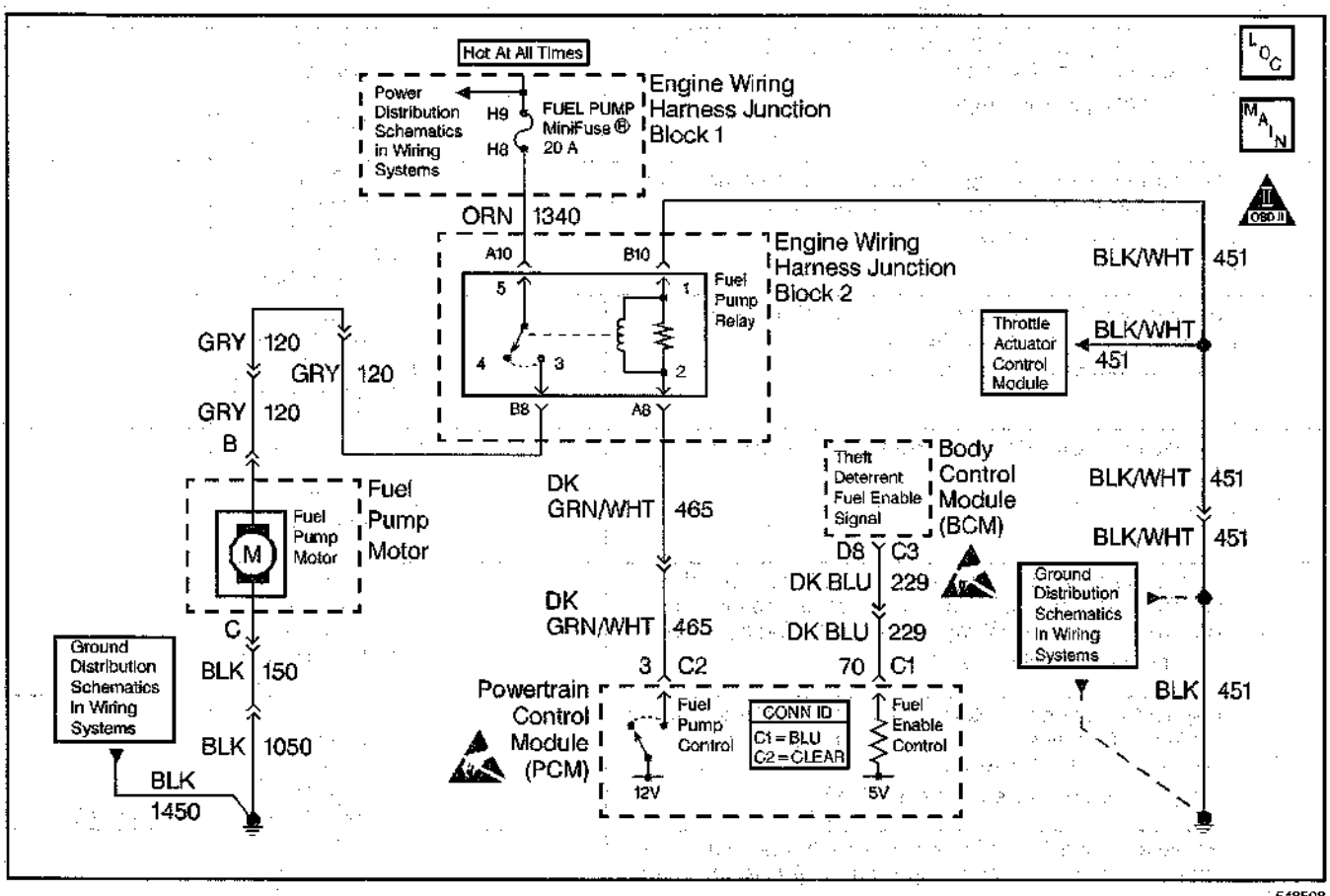
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**Engine Cranks but Does Not Run (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 39 | Repair the open in the ICM ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 40 | Repair the open in the ignition positive feed circuit to the ICM. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 41 | Replace the 18X CKP sensor. Refer to *Crankshaft Position (CKP) Sensor Replacement.*<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 42 | Replace the ICM. Refer to *Ignition Control Module Replacement.*<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 43 | Repair the short to ground in the fuel injector control circuits associated with the injector test lamps that stayed illuminated. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| 44 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | *Go to Step 46* |
| 45 | Replace the ignition coils associated with the cylinders that did not have spark. Refer to *Ignition Coil(s) Replacement.*<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |
| *46* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |

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## Fuel Pump Electrical Circuit Diagnosis




### Circuit Description

When the ignition switch is first turned on, the PCM energizes the fuel pump relay which applies power to the in-tank fuel pump. The fuel pump relay will remain on as long as the engine is running or cranking and the PCM is receiving reference pulses. If no reference pulses are present, the PCM de-energizes the fuel pump relay within 2 seconds after the ignition is turned on or the engine is stopped.

The fuel pump delivers fuel to the fuel rail and injectors, then to the fuel pressure regulator. The fuel pressure regulator controls fuel pressure by allowing excess fuel to be returned to the fuel tank.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. Tests the ignition feed circuit to the fuel pump relay.
3. Verifies that the fuel pump feed circuit is OK between the fuel pump relay and the fuel pump, and that the fuel pump can deliver adequate pressure to the fuel rail.

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4. Tests the fuel pump feed circuit for a short to battery positive voltage.
8. Tests whether the problem is caused by an open in the fuel pump feed circuit or the fuel pump ground circuit.

## Fuel Pump Electrical Circuit Diagnosis

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you Perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Disconnect the fuel pump relay.<br>2. Replace the fuel pump fuse, if necessary.<br>3. Connect a test lamp between the relay switch feed circuit at the fuel pump relay connector and a good ground.<br>4. Turn ON the ignition, with the engine OFF.<br>Does the test lamp illuminate? | — | *Go to Step 3* | *Go to Step 7* |
| 3 | 1. Turn OFF the ignition.<br>2. Connect a 10 amp fused jumper wire between the fuel pump feed circuit and the relay switch feed circuit at the fuel pump relay connector.<br>***Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.***<br>3. Install a *J 34730-1A* fuel pressure gauge.<br>4. Turn ON the ignition, with the engine OFF.<br>5. Observe the fuel pressure gauge.<br>Does the pressure measure within the specified range? | 338-380 kPa (49-55 psi) | *Go to Step 4* | *Go to Step 8* |
| 4 | 1. Disconnect the jumper wire.<br>2. Connect a test lamp between the fuel pump feed circuit and a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 5* | *Go to Step 6* |
| 5 | Test the fuel pump feed circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | — |
| 6 | Inspect for a poor connection at the fuel pump relay. Refer to *Testing for Intermittent and Poor Connections* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 11* |
| 7 | Repair the open or short to ground in the fuel pump relay switch feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | — |
| 8 | 1. Leave the fused jumper wire connected.<br>2. Disconnect the fuel pump.<br>3. Connect a test lamp between the fuel pump feed circuit at the fuel sender harness connector and a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 9* |

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**Fuel Pump Electrical Circuit Diagnosis (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 9 | 1. Repair the open or short to ground in the fuel pump feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>2. Replace the fuse if necessary.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 12* |
| 10 | Repair the open in the fuel pump ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 12* |
| 11 | Replace the fuel pump relay. Refer to *Fuel Pump Relay Replacement.*<br>Did you complete the replacement? | — | *Go to Step 14* | — |
| 12 | Repair the fuel pump harness for an external open or short between the fuel pump connector and the fuel tank. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 13* |
| 13 | Replace the fuel pump. Refer to *Fuel Sender Assembly Replacement.*<br>Did you complete the replacement? | — | *Go to Step 14* | — |
| 14 | 1. Turn ON the ignition, with the engine OFF.<br>2. Observe the fuel pressure gauge.<br>Does the fuel pressure measure within the specified range? | 338-380 kPa (49-55 psi) | System OK | *Go to Step 2* |

## Fuel System Diagnosis

### Fuel Metering System

Some failures of this system will result in an Engine Cranks But Will Not Run symptom. If this condition exists, Refer to *Engine Cranks but Does Not Run.* This will determine if the problem is caused by the ignition system, the PCM, or the fuel pump electrical circuit.

Refer to *Fuel Pump Electrical Circuit Diagnosis* for the fuel system wiring schematic.

If there is a fuel delivery problem, Refer to *Fuel System Pressure Test.* This diagnoses the fuel injectors, the fuel pressure regulator, and the fuel pump. If a malfunction occurs in the fuel metering system, it usually results in either a rich HO2S signal or lean HO2S signal. This condition is indicated by the HO2S voltage, causing the PCM to change the fuel calculation (fuel injector pulse width) based on the HO2S reading. Changes made to the fuel calculation will be indicated by a change in the long term fuel trim values which can be monitored with a scan tool.

Ideal long term fuel trim values are around 0 percent; for a lean HO2S signal, the PCM will add fuel, resulting in a fuel trim value above 0 percent and for a rich HO2S signal the PCM will take away fuel, resulting in a fuel trim value below 0 percent. Some variations in fuel trim values are normal due to powertrain design. If the fuel trim values are excessively greater or lower then 0 percent Refer to *DTC P0171 Fuel Trim System Lean Bank 1* or *DTC P0172 Fuel Trim System Rich Bank 1.*

### Mass Air Flow (MAF) Sensor

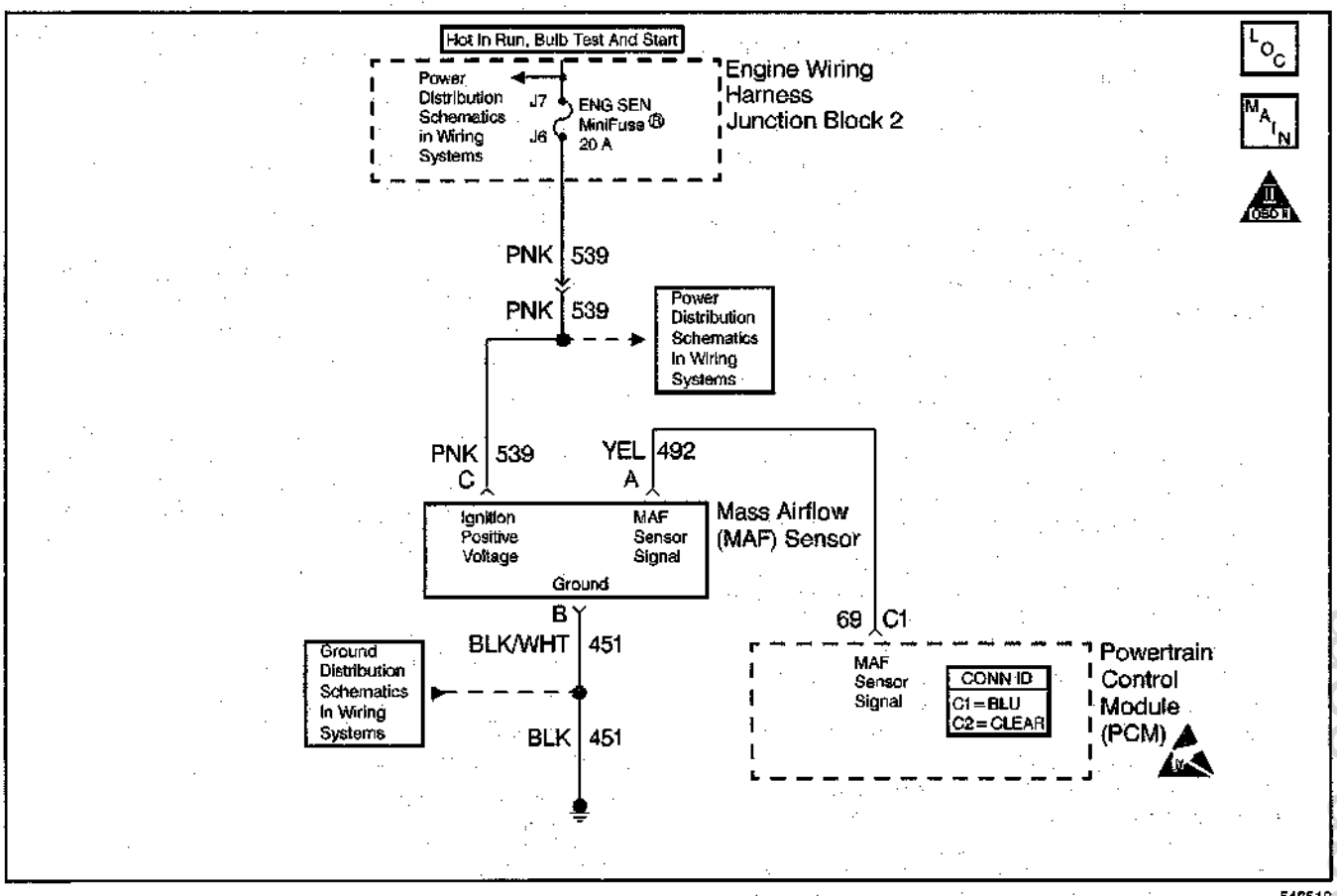
The MAF sensor is mounted to the front of the throttle body, and is used to measure the amount of air entering the engine. The PCM uses this information to determine the operating condition of the engine and to control fuel delivery. For further information, refer to *Information Sensors/Switches Description.*

### Fuel System Pressure Test

A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, refer to *Fuel System Pressure Test.*

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## DTC P0101 Mass Air Flow (MAF) Sensor Performance




### Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine. The PCM uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a scan tool. The frequency will vary within a range of around 2000 Hertz at idle to near 10,000 Hertz at maximum engine load. DTC P0101 will be set if the signal from the MAF sensor does not match a predicted value based on barometric pressure, air density, manifold pressure, throttle position and engine RPM.

### Conditions for Running the DTC

- The engine is running.
- Ignition voltage between 9.0 and 18.0 volts.
- Throttle is steady and less than 30 percent.
- EGR duty cycle is less than 100 percent.
- EGR pintle position is less than 100 percent.
- MAP is steady and less than 80 kPa.
- EVAP canister purge is less than 100 percent.

### Conditions for Setting the DTC

The difference between actual airflow and predicted airflow is more than a calibrated value.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

- Skewed or stuck TP sensor. A faulty TP sensor or TP sensor circuit can cause the PCM to incorrectly calculate the predicted mass air flow value. Observe throttle angle with the throttle closed. If the throttle angle reading is not 0 percent, test for the following conditions and repair as necessary:
- If none of the above conditions are noted and the throttle angle reading at closed throttle is not 0 percent, replace the TP sensor.
- Skewed MAP sensor. A skewed MAP sensor can cause the BARO reading to be incorrectly calculated. To test the MAP sensor, compare the MAP/BARO reading on the vehicle being diagnosed to the MAP/BARO reading on a normally operating vehicle. If a large difference is noted replace the MAP sensor.
- Plugged intake air duct or dirty air filter element.
- The actual mass air flow is compared to a calculated Mass Air Flow based on the MAP, TP, and engine RPM readings (speed density). A skewed/unresponsive MAP sensor at key ON will cause the calculated mass air flow value to be inaccurate. When the engine is started a calculated difference between actual Mass Air Flow and Calculated mass air flow occurs. DTC P0101 will set, the vehicle will stall, a default mass air flow based on the MAP sensor will occur. Because the MAP sensor is skewed/unresponsive the default mass air flow values are incorrect and vehicle may not restart. If a fault occurs which causes the MAP sensor value to be incorrect (poor vacuum connections, damaged vacuum source, or defective vacuum hoses, air entering the engine without passing through the MAF), DTC P0101 will set and the default mass airflow value will be substituted. Because the MAP sensor value is incorrect the vehicle may not start and run.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

3. Only, if sent here from the Engine Cranks But Does Not Run, continue to follow diagnostic table even if DTC P0101 has NOT failed this ignition.
4. This step tests the MAP sensor. By disconnecting the MAF sensor, the vehicle is forced into speed density. Speed density is based on the MAP, TP, and engine RPM readings. With a skewed/unresponsive MAP sensor, the speed density calculation is incorrect and vehicle may not start. For further information refer to diagnostic aids.
5. This step tests for skewed or sticking MAP sensor. MAP sensor should respond smoothly and gradually as RPM is increased. Compare MAP sensor of affected vehicle to that of a normally operating vehicle if a large difference is noted replace the MAP sensor.
9. Verifies that ignition feed voltage and a good ground are available at the MAF sensor.

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## DTC P0101 Mass Air Flow (MAF) Sensor Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | With a scan tool, select the Diagnostic Trouble Codes (DTCs).<br>Does the scan tool indicate any other DTCs set? | — | Go to applicable DTC | *Go to Step 3* |
| 3 | Operate the vehicle within Fail Records conditions.<br>Does the scan tool indicate DTC P0101 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | **Important:** DO NOT CLEAR DTCs.<br>1. Disconnect the MAF sensor.<br>2. Attempt to start engine.<br>Does engine start and continue to run? | — | *Go to Step 5* | *Go to Step 6* |
| 5 | 1. Turn OFF the ignition.<br>2. Reconnect the MAF sensor.<br>3. Start the engine.<br>4. With a scan tool, observe the MAP sensor parameter while slowly increasing engine speed to 3000 RPM.<br>Does the parameter value change as engine speed increases? | — | *Go to Step 7* | *Go to Step 6* |
| 6 | Diagnose the MAP sensor. Refer to *MAP Sensor Circuit Diagnosis*.<br>Did you find and correct the condition? | — | *Go to Step 20* | *Go to Step 7* |
| 7 | 1. Turn ON the ignition, with the throttle closed.<br>2. With a scan tool, observe throttle angle parameters.<br>Does the scan tool indicate both parameter less than the specified value? | 4% | *Go to Step 8* | Go to *DTC P1221 Throttle Position (TP) Sensor 1- 2 Correlation* |
| 8 | 1. Turn OFF the ignition.<br>2. Disconnect the MAF sensor.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Connect a DMM between the signal circuit of the MAF sensor and a good ground.<br>Does the voltage measure near the specified value? | 5.0V | *Go to Step 9* | *Go to Step 10* |
| 9 | Connect a test lamp between the ignition feed and ground circuits of the MAF sensor.<br>Does the test lamp illuminate? | — | *Go to Step 13* | *Go to Step 12* |
| 10 | Does the voltage measure less than the specified value? | 4.5V | *Go to Step 14* | *Go to Step 11* |
| 11 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Connect a DMM between the signal circuit of the MAF sensor and a good ground.<br>Does the voltage measure near the specified value? | 0.0V | *Go to Step 20* | *Go to Step 17* |
| 12 | Connect a test lamp between the ignition feed circuit of the MAF sensor and a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 15* | *Go to Step 16* |
| 13 | Inspect for a poor connection at the MAF sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 20* | *Go to Step 18* |

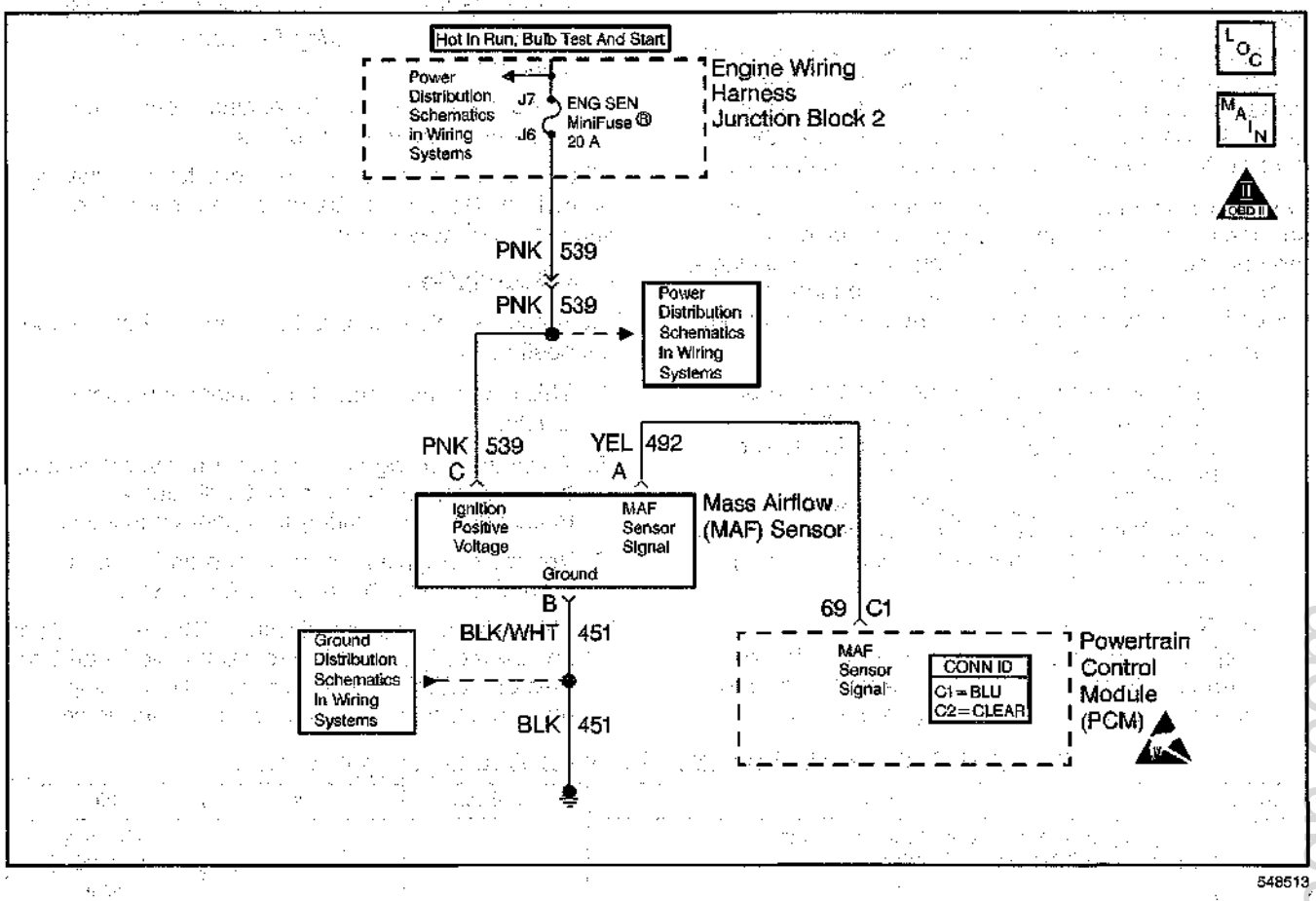
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## DTC P0101 Mass Air Flow (MAF) Sensor Performance (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 14 | Inspect the MAF sensor circuits for the following conditions:<br>1. Excessive resistance in the signal circuit of the MAF sensor.<br>2. Excessive resistance in the ground circuit of the MAF sensor.<br>3. Short to ground in the signal circuit of the MAF sensor.<br>4. Poor connection at the PCM.<br>Refer to *Testing for Intermittent and Poor Connections*, *Connector Repairs* or *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 20* | *Go to Step 19* |
| 15 | Repair the open or excessive resistance in the ground circuit of the MAF sensor. Refer to *Wiring Repairs* or *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 20* | — |
| 16 | Repair the open or excessive resistance in the ignition feed circuit of the MAF sensor. Refer to *Wiring Repairs* or *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 20* | — |
| 17 | Repair the short to voltage in the signal circuit of the MAF sensor. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 20* | — |
| 18 | Replace the MAF sensor. Refer to *MAF Sensor Replacement*.<br>Did you complete the replacement? | — | *Go to Step 20* | — |
| 19 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 20* | — |
| 20 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0102 Mass Air Flow (MAF) Sensor Circuit Low Frequency




548513

### Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine. The PCM uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle. The MAF sensor produces a frequency signal which can be monitored using a scan tool. The frequency will vary within a range of around 2000 Hertz at idle to about 10,000 Hertz at maximum engine load. DTC P0102 will be set if the signal frequency from the MAF sensor is lower than the possible range of a normally operating MAF sensor.

### Conditions for Running the DTC

- The engine is running.
- Throttle angle is less than 1.5 percent.
- Ignition voltage is more than 8.0 volts.
- Iac is more than 5 counts.

### Conditions for Setting the DTC

- MAF signal frequency is less than 800 Hertz.
- Above conditions are present for over 0.5 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

Plugged intake air duct or filter element. A wide-open throttle acceleration from a stop should cause the mass air flow displayed on a scan tool to increase from about 4-6 gm/s at idle to 100 gm/s or more at the time of the 1-2 shift. If not, inspect for a restriction.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the Step numbers on the diagnostic table:

2. This step verifies that the problem is present at idle.
5. A voltage reading of less than 4 or over 6 volts at the MAF sensor signal circuit indicates a malfunction in the wiring or a poor connection.
6. Verifies that ignition feed voltage and a good ground are available at the MAF sensor.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

### DTC P0102 Mass Air Flow (MAF) Sensor Circuit Low Frequency

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If DTC P0108 is set diagnose it first. Refer to *DTC P0108 Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage.*<br>1. Start the engine.<br>2. With a scan tool, observe the MAF Frequency parameter.<br>Does the scan tool indicate the parameter is less than the specified value? | 1200 Hz (1.2 kHz) | *Go to Step 4* | *Go to Step 3* |
| 3 | 1. Turn ON the ignition.<br>2. Operate the vehicle within Fail Records conditions.<br>Does the scan tool indicate DTC P0102 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect for the following conditions:<br>1. Objects blocking the MAF sensor inlet screen.<br>2. Vacuum leaks around the intake manifold.<br>3. Vacuum leaks at throttle body.<br>4. Vacuum leaks at the EGR valve flange and pipes.<br>5. Crankcase ventilation valve malfunctioning, missing, or incorrectly installed.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |
| 5 | 1. Turn OFF the ignition.<br>2. Disconnect the MAF sensor.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Connect a DMM between the signal circuit of the MAF sensor and a good ground.<br>Does the voltage measure near the specified value? | 5 V | *Go to Step 6* | *Go to Step 9* |

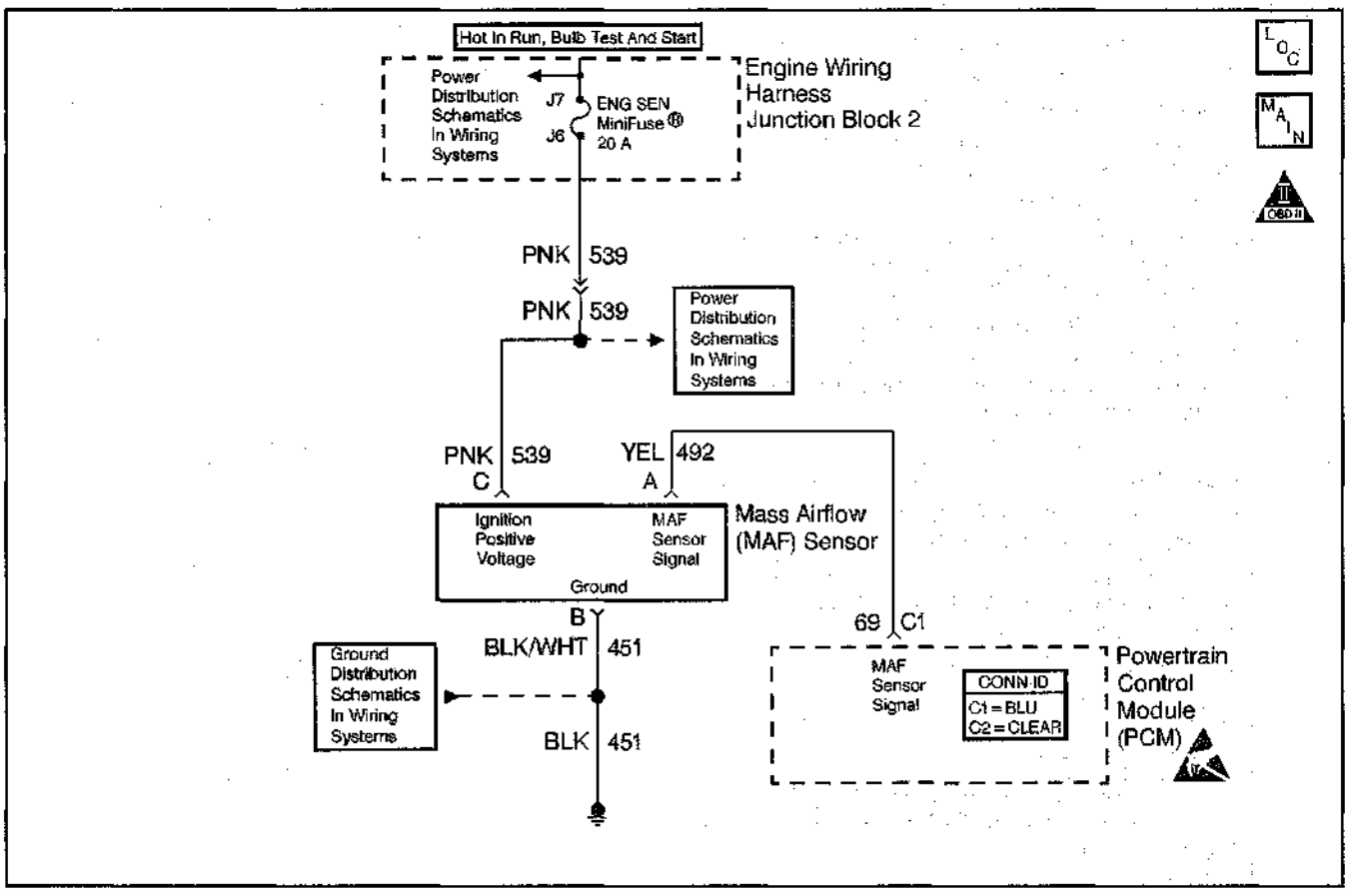
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## DTC P0102 Mass Air Flow (MAF) Sensor Circuit Low Frequency (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 6 | Connect a test lamp between the ignition feed circuit and the ground circuit of the MAF sensor.<br>Does the test lamp illuminate? | — | *Go to Step 8* | *Go to Step 7* |
| 7 | Connect a test lamp between the ignition feed circuit of the MAF sensor and a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 11* |
| 8 | Inspect for a poor connection at the MAF sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 9 | Test the signal circuit of the MAF sensor for an open, short to ground, or a short to voltage. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Repair the open in the ground circuit of the MAF sensor. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 11 | Repair the open or short to ground in the ignition feed circuit of the MAF sensor. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 12 | Replace the MAF sensor. Refer to *MAF Sensor Replacement*.<br>Did you complete the replacement? | — | *Go to Step 15* | — |
| 13 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0103 Mass Air Flow (MAF) Sensor Circuit High Frequency




### Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The PCM uses the mass air flow sensor information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored by using a scan tool. The frequency will vary within a range of around 2000 Hertz at idle to near 10,000 Hertz at maximum engine load. DTC P0103 will be set if the signal from the MAF sensor is more than the possible range of a normally operating MAF sensor.

### Conditions for Running the DTC

- The engine is running.
- The throttle angle is less than 1.5 percent
- Ignition voltage is more than 8.0 volts.
- IAC is more than 5 counts.

### Conditions for Setting the DTC

- MAF signal frequency is more than 11,500 Hertz (11.5 kHz).
- The condition are present for 0.5 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step verifies that the problem is present at idle.
4. A frequency reading with the MAF sensor connector disconnected indicates an Electromagnetic Interference (EMI) related malfunction or a poor connection.
9. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement/Programming.

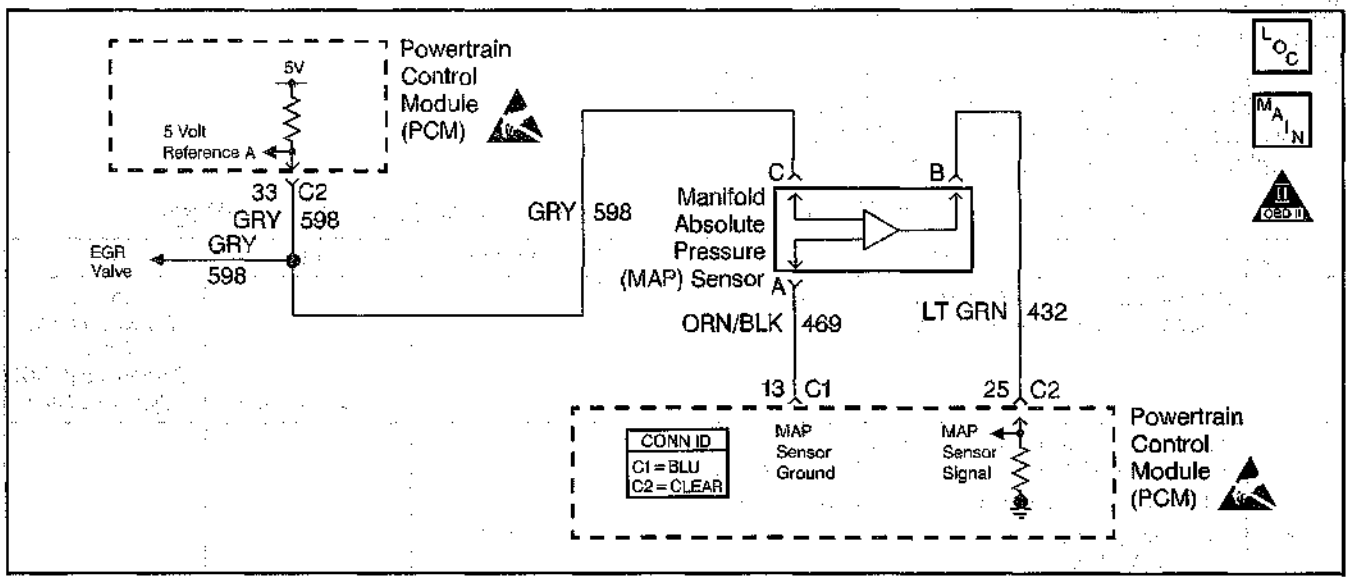
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## DTC P0103 Mass Air Flow (MAF) Sensor Circuit High Frequency

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Start the engine.<br>2. With a scan tool, observe the MAF Frequency parameter.<br>Does the scan tool indicate the parameter more than the specified value? | 10,500 Hz | *Go to Step 4* | *Go to Step 3* |
| 3 | 1. Turn ON the ignition, with the engine OFF.<br>2. Operate the vehicle within Fail Records conditions.<br>Does the scan tool indicate DTC P0103 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the MAF sensor.<br>3. Start the engine.<br>4. With a scan tool, observe the MAF Frequency parameter.<br>Does the scan tool indicate the parameter at or near the specified value? | 0 Hz | *Go to Step 5* | *Go to Step 7* |
| 5 | Inspect for a poor connection at the MAF sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 6* |
| 6 | Replace the MAF sensor. Refer to *MAF Sensor Replacement*.<br>Did you complete the replacement? | — | *Go to Step 10* | — |
| 7 | Inspect the MAF sensor harness for incorrect routing:<br>1. Inspect near the secondary ignition wires or coils.<br>2. Inspect near the other high voltage components (solenoids, relays, motors).<br>Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 8* |
| 8 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 9* |
| 9 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 10* | — |
| 10 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0107 Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage




368338

### Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from less than 2 volts at idle (high vacuum) to more than 4 volts with the key ON, engine not running or at wide-open throttle (low vacuum). The MAP sensor is used to determine manifold pressure changes while the EGR flow test diagnostic is being run, refer to *DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient.* Also to update the barometric pressure reading (BARO), as an enabling factor for other diagnostics. The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP sensor signal voltage that is excessively low, DTC P0107 will set.

### Conditions for Running the DTC

- No TP sensor DTCs present.
- Ignition voltage is more than 8 volts.
- The engine is running.
- Throttle angle is more than or equal to 10 percent, when engine speed is less than or equal to 900 RPM.

### Conditions for Setting the DTC

The MAP sensor indicates less than 12 kPa.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## Test Description

The numbers below refer to the step numbers on the diagnostic table:

12. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

### DTC P0107 Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Refer to *DTC P1635 5 Volt Reference 1 Circuit* or *DTC P1639 5 Volt Reference 2 Circuit* first, If set.<br>1. Turn ON the ignition, with the engine OFF.<br>2. With the scan tool and the throttle closed, observe the MAP voltage parameter.<br>Does the MAP voltage measure less then the specified value? | 0.1 volt | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate the vehicle within Fail Record conditions.<br>Does the scan tool indicate DTC P0107 failed? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Disconnect the MAP sensor.<br>2. Connect a 3 amp jumper between the 5 volt reference circuit and the MAP signal circuit.<br>3. With a scan tool, observe the MAP voltage parameter.<br>Does the scan tool indicate voltage at near the specified value? | 4.95V | *Go to Step 9* | *Go to Step 5* |
| 5 | 1. Disconnect the jumper wire.<br>2. Connect a test lamp between battery positive voltage and the MAP sensor signal circuit.<br>3. With a scan tool, observe the MAP voltage parameter.<br>Does the scan tool indicate voltage at or near the specified value? | 4.95V | *Go to Step 6* | *Go to Step 8* |
| 6 | 1. Turn OFF the ignition.<br>2. Test the 5 volt reference circuit of the MAP sensor for high resistance or an open.<br>3. Repair as necessary. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 7* |
| 7 | Inspect the 5 volt reference circuit of the MAP sensor for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 12* |
| 8 | Test the signal circuit of the MAP sensor for an open, short to ground, or short to the sensor ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 10* |
| 9 | Test the signal circuit and the 5 volt reference circuit of the MAP sensor for a poor connection at the MAP sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 11* |

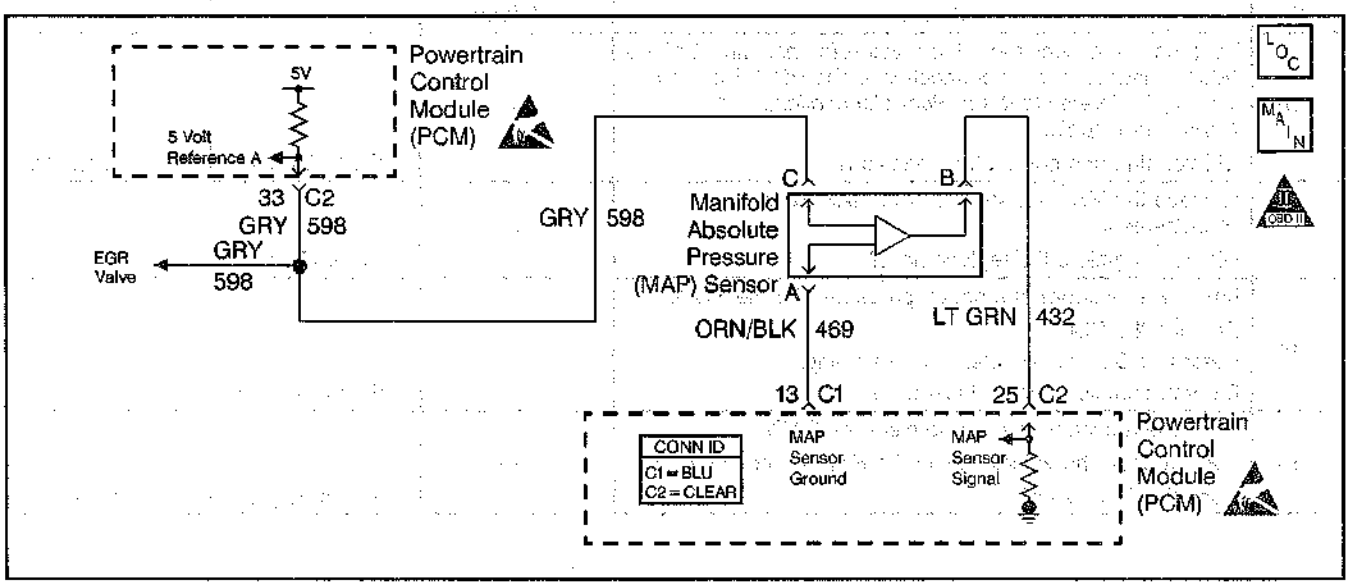
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## DTC P0107 Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 10 | Test the signal circuit and the 5 volt reference circuit of the MAP sensor for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 12* |
| 11 | Replace the MAP sensor. Refer to *MAP Sensor Replacement*.<br>Did you complete the replacement? | — | *Go to Step 13* | — |
| 12 | **Important:** Perform the set up procedure for the PCM.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 13* | — |
| 13 | 1. Use a scan to in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0108 Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage




368336

### Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from less than 2 volts at idle (high vacuum) to more than 4 volts with the key ON, engine not running or at wide-open throttle (low vacuum). The MAP sensor is used to determine manifold pressure changes while the EGR flow test diagnostic is being run, refer to *DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient*. Also to update the barometric pressure reading (BARO), as an enabling factor for other diagnostics. The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively high, DTC P0108 will set.

### Conditions for Running the DTC

- No TP sensor DTCs present.
- Engine is running.
- Throttle position is less than or equal to 0.5 percent when engine speed is less than or equal to 900 RPM.

### Conditions for Setting the DTC

The MAP sensor indicates more than 85 kPa.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

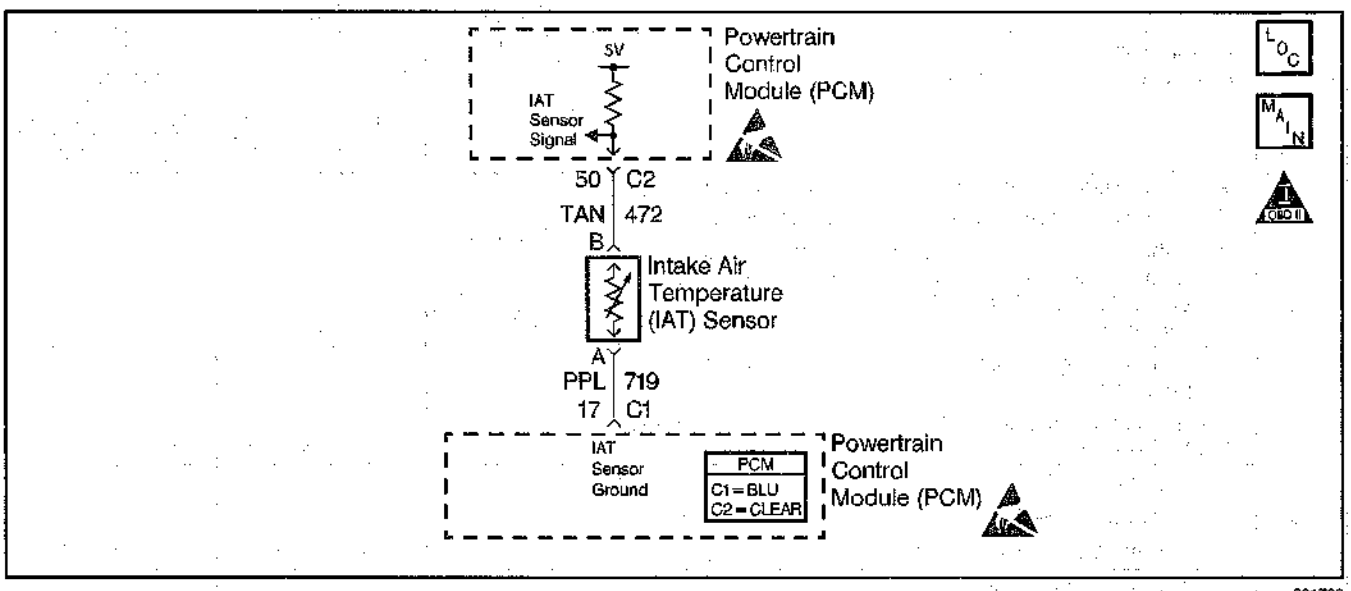
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## DTC P0108 Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Refer to *DTC P1635 5 Volt Reference 1 Circuit* or *DTC P1639 5 Volt Reference 2 Circuit* first, If set.<br>1. If the engine idle is rough, unstable or incorrect, repair the idle problem before continuing with this table. Refer to *Rough, Unstable, or Incorrect Idle and Stalling* in Symptoms.<br>2. With the engine idling, observe the MAP voltage parameter on a scan tool.<br>Does the scan tool indicate the parameter is more than the specified value? | 4.2 V | *Go to Step 4* | *Go to Step 3* |
| 3 | 1. Turn ON the ignition, with the engine OFF.<br>2. Operate the vehicle within Fail Records conditions.<br>Does the scan tool indicate DTC P0108 failed this ign? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the MAP sensor.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe the MAP voltage parameter.<br>Does the scan tool indicate the parameter is at the specified value? | 0 V | *Go to Step 5* | *Go to Step 7* |
| 5 | Inspect for a plugged or leaking vacuum supply to the MAP sensor.<br>Did you find and correct the condition? | — | *Go to Step 12* | *Go to Step 6* |
| 6 | Test the ground circuit of the MAP sensor for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 12* | *Go to Step 8* |
| 7 | Test the signal circuit of the MAP sensor for a short to voltage or short to 5 volt reference circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 12* | *Go to Step 11* |
| 8 | Inspect the ground circuit of the MAP sensor for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 12* | *Go to Step 9* |
| 9 | Inspect the ground circuit of the MAP sensor at the MAP sensor for poor connections at the harness connector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 12* | *Go to Step 10* |
| 10 | Replace the MAP sensor. Refer to *MAP Sensor Replacement.*<br>Did you complete the replacement? | — | *Go to Step 12* | — |
| 11 | **Important:** Perform the set up procedure for the PCM.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 12* | — |
| 12 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 4* | System OK |

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## DTC P0112 Intake Air Temperature (IAT) Sensor Circuit Low Voltage




221729

### Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The PCM applies 5.0 V through a pull up resistor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT sensor signal circuit. As the intake air warm, the sensor resistance becomes lower causing the PCM to monitor a lower voltage. If the PCM detects an excessively low IAT sensor signal voltage (high temperature indicated), DTC P0112 will set.

### Conditions for Running the DTC

- No active ECT sensor or VSS DTCs present.
- Engine running for over 10 seconds.
- Vehicle speed is more than 40km/h(25 mph).

### Conditions for Setting the DTC

- IAT signal voltage indicates an intake air temperature more than 135°C (275°F).
- The above conditions are present for more than 10 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The number below refers to the step number on the diagnostic table:

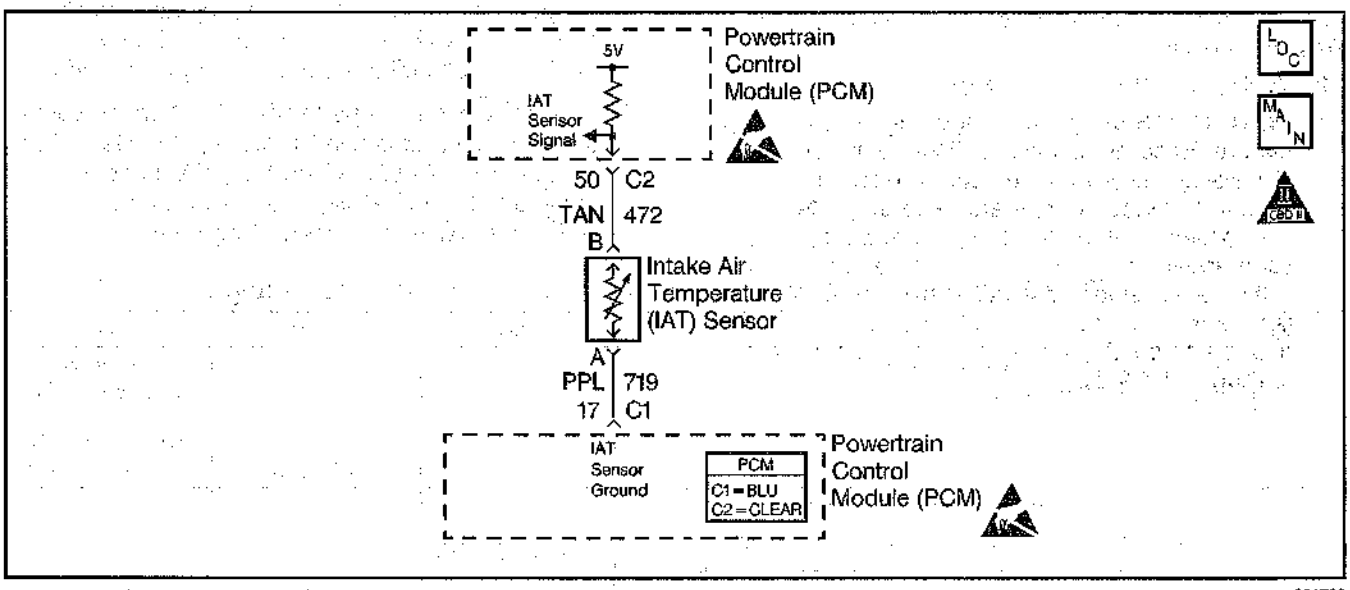
2. Verifies that the fault is present.
3. If DTC P0112 can be repeated only by duplicating the Fail Records conditions. Refer to Temperature vs Resistance table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a shifted sensor that may be shorted above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent refer to Diagnostic Aids.
7. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed. Refer to PCM Replacement/Programming.

**DTC P0112 Intake Air Temperature (IAT) Sensor Circuit Low Voltage**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe the IAT parameter.<br>Does the scan tool indicate the parameter is more than specified value? | 135°C (275°F) | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does scan tool indicate DTC P0112 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the IAT sensor.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe the IAT parameter.<br>Does the scan tool indicate the parameter is less than the specified value? | –37°C (–34°F) | *Go to Step 6* | *Go to Step 5* |
| 5 | 1. Turn OFF the ignition.<br>2. Test the signal circuit of the IAT sensor for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 7* |
| 6 | Replace the IAT sensor. Refer to *IAT Sensor Replacement.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 7 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Voltage




### Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The PCM applies 5.0V through a pull up resistor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT sensor signal circuit. As the intake air warm, the sensor resistance becomes lower causing the PCM to monitor a lower voltage. If the PCM detects an excessively high IAT sensor signal voltage (low temperature indicated), DTC P0113 will set.

### Conditions for Running The DTC

- No active ECT sensor or VSS DTCs present.
- The engine has been running for more than 3 minutes.
- Vehicle speed is less than 8km/h(5mph).
- Mass air flow is less than 8 gm/s.
- Engine coolant temperature is more than 60°C (140°F).

### Conditions for Setting the DTC

IAT signal voltage indicates an intake air temperature less than –38°C (–36°F).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. Verifies that the fault is present.
3. If DTC P0113 can be repeated only by duplicating the Fail Records conditions. The Temperature vs Resistance table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a shifted sensor that may be open above or below a certain temperature. If this is the case, replace the IAT sensor. Refer to IAT Sensor Replacement. If the IAT sensor appears to be OK, the fault is intermittent. Refer to Diagnostic Aids.
5. Use a fused jumper during this test. If the IAT signal circuit is shorted to battery or ignition positive voltage the fuse in the jumper will open, indicating a short in the signal circuit.
12. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed. Refer to PCM Replacement/Programming.

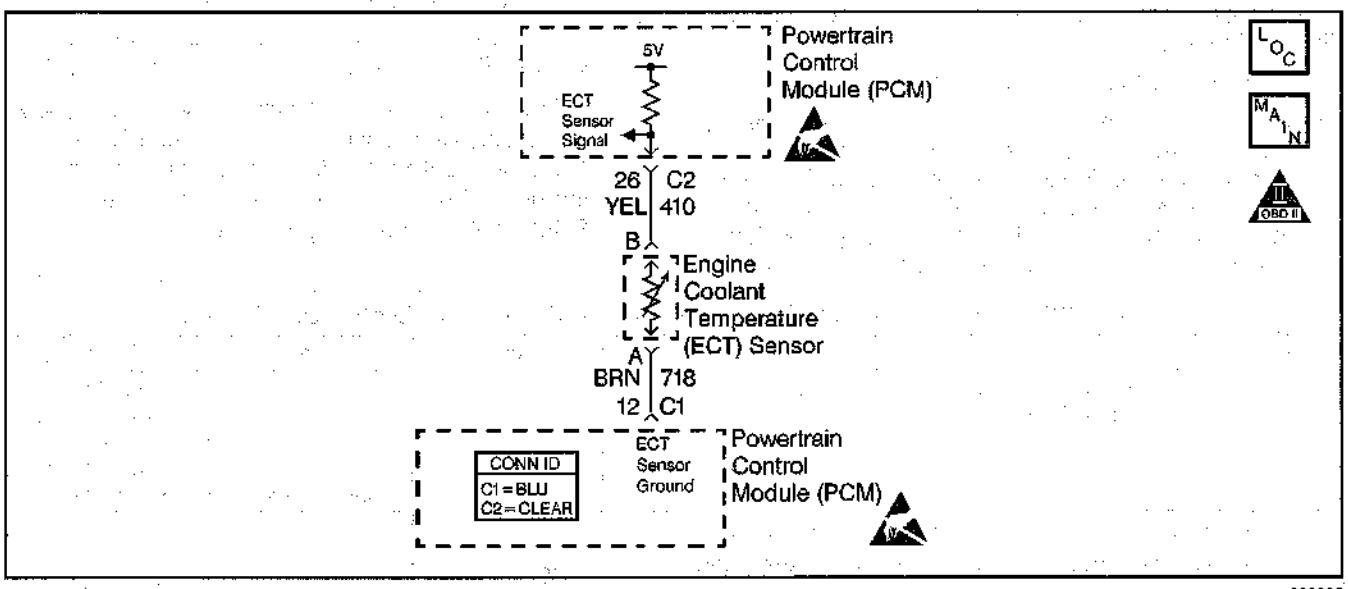
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## DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe the IAT parameter.<br>Does the scan tool indicate the parameter is less than the specified value? | −37°C (−34°F) | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does scan tool indicate DTC P0113 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the IAT sensor.<br>3. Connect a 3 amp fused jumper between the signal circuit of the IAT sensor and the ground circuit of the IAT sensor.<br>4. With a scan tool, observe the IAT parameter.<br>Does the scan tool indicate the parameter is more than the specified value? | 135°C (275°F) | *Go to Step 6* | *Go to Step 5* |
| 5 | 1. Jumper the IAT signal circuit to a good ground.<br>2. With a scan tool, observe the IAT parameter.<br>Does the scan tool indicate the parameter is more than the specified value? | 135°C (275°F) | *Go to Step 7* | *Go to Step 8* |
| 6 | Test the signal circuit of the IAT sensor for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 10* |
| 7 | Test the ground circuit of the IAT sensor for a high resistance or an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 9* |
| 8 | Test the signal circuit of the IAT sensor for an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 9* |
| 9 | Inspect for faulty IAT sensor ground or signal circuit connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 12* |
| 10 | Inspect for a faulty connections at the IAT sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 11* |
| 11 | Replace the IAT sensor. Refer to *IAT Sensor Replacement.*<br>Did you complete the replacement? | — | *Go to Step 13* | — |
| 12 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 13* | — |
| 13 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage




368395

### Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The PCM applies a voltage (about 5.0V) through a pull up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0V.

### Conditions for Running the DTC

The engine is running.

### Conditions for Setting the DTC

The ECT indicates an engine coolant temperature more than 140°C (284°F).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

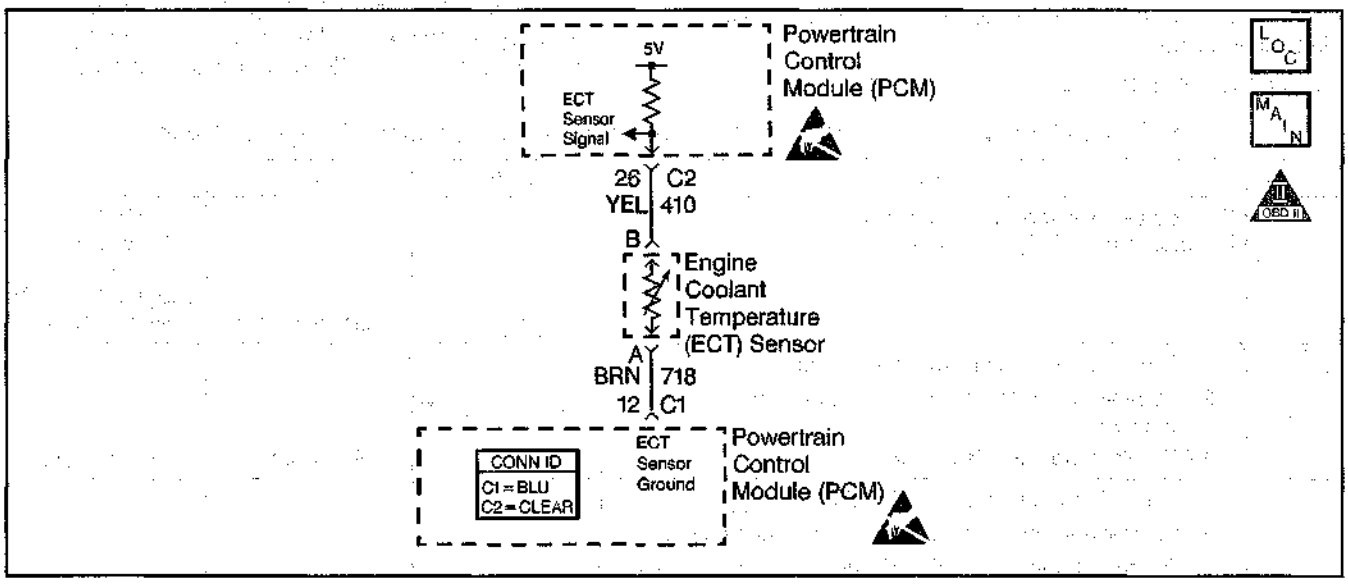
2. Verifies that the fault is present.
3. If DTC P0117 can be repeated only by duplicating the Fail Records conditions, refer to the Temperature to Resistance Value table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a shifted sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor, refer to ECT Sensor Replacement. If the ECT sensor appears to be OK, the fault is intermittent refer to Diagnostic Aids.
7. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement/Programming.

### DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe the ECT parameter.<br>Does the scan tool indicate the parameter is more than the specified value? | 139°C (282°F) | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does scan tool indicate DTC P0117 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the ECT sensor.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe the ECT parameter.<br>Does the scan tool indicate the parameter is less than the specified value? | –38°C (–36°F) | *Go to Step 6* | *Go to Step 5* |
| 5 | Test the ECT sensor signal circuit for a short to ground or a short to the sensor ground circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 7* |
| 6 | Replace the ECT sensor. Refer to *ECT Sensor Replacement.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 7 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage




368395

### Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The PCM applies a voltage (about 5.0V) through a pull up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0V.

### Conditions for Running the DTC

The engine is running for longer than 15 seconds.

### Conditions for Setting the DTC

The ECT sensor signal indicates an engine coolant temperature less than –39°C (–38°F).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. Verifies that the malfunction is present.
11. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

## DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. Observe the ECT parameter displayed on the scan tool.<br>Is ECT below the specified value? | -38°C or -36°F | *Go to Step 4* | *Go to Step 3* |
| 3 | 1. Verify that the ignition is ON, with the engine OFF.<br>2. Review and record scan tool Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a scan tool, monitor specific DTC info for DTC P0118.<br>Does the scan tool indicate DTC P0118 failed? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the ECT sensor.<br>**Important:** If the 3 amp fuse blows, locate and repair the short to voltage on the sensor signal wire and verify that the sensor was not damaged.<br>3. With a 3 amp fused jumper, connect the ECT signal circuit and the sensor ground circuit together at the ECT sensor harness connector.<br>4. Turn ON the ignition, with the engine OFF.<br>5. Observe the ECT parameter displayed on the scan tool.<br>Is ECT at the specified value? | 140°C or 284°F | *Go to Step 6* | *Go to Step 5* |
| 5 | **Important:** If the 3 amp fuse blows, locate and repair the short to voltage on the sensor signal wire and verify that the sensor was not damaged.<br>1. With a 3 amp fused jumper, connect the ECT signal circuit at the ECT sensor harness connector to a good ground.<br>2. Observe ECT displayed on the scan tool.<br>Is ECT at the specified value? | 140°C or 284°F | *Go to Step 7* | *Go to Step 8* |
| 6 | 1. Test for poor connections at the ECT sensor.<br>2. If a problem is found, replace terminals as necessary. Refer to *Testing for Continuity, Testing for Intermittent and Poor Connections, Repairing Connector Terminals* and *Connector Repairs* in Wiring Systems.<br>Was a problem found? | — | *Go to Step 12* | *Go to Step 10* |
| 7 | 1. Turn OFF the ignition switch.<br>2. Disconnect the PCM.<br>3. Test the ECT sensor ground circuit for an open or a short to voltage.<br>4. If a problem is found, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems.<br>Was a problem found? | — | *Go to Step 12* | *Go to Step 9* |

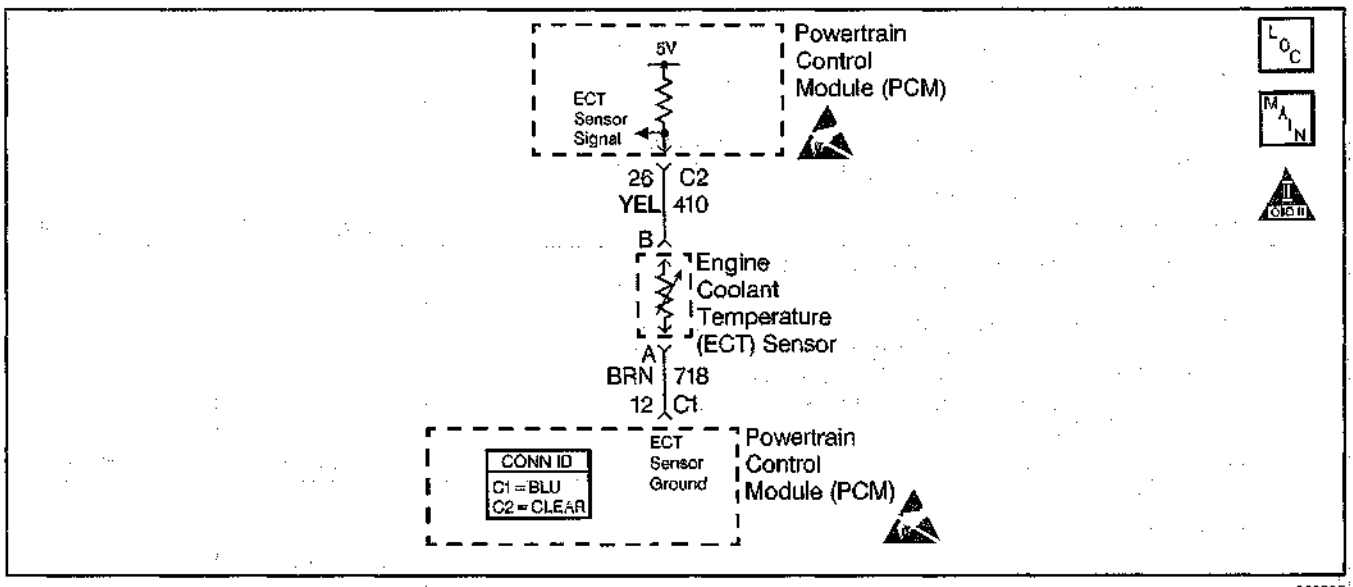
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## DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 8 | 1. Turn OFF the ignition switch.<br>2. Disconnect the PCM.<br>3. Test the ECT signal circuit for an open or a short to voltage.<br>4. If a problem is found, repair as necessary and verify that the sensor was not damaged. Refer to *Wiring Repairs* in Wiring Systems.<br>Was a problem found? | — | *Go to Step 12* | *Go to Step 9* |
| 9 | 1. Test for a poor sensor ground or ECT signal circuit terminal connection at the PCM<br>2. If a problem is found, replace terminals as necessary. Refer to *Testing for Continuity*, *Testing for Intermittent and Poor Connections*, *Repairing Connector Terminals*, *Connector Repairs* and *Wiring Repairs* in Wiring Systems.<br>Was a problem found? | — | *Go to Step 12* | *Go to Step 11* |
| 10 | Replace the ECT sensor. Refer to *ECT Sensor Replacement*.<br>Is action complete? | — | *Go to Step 12* | — |
| 11 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Is action complete? | — | *Go to Step 12* | — |
| 12 | 1. Review and record scan tool Failure Records data.<br>2. Clear DTCs<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a scan tool, monitor specific DTC info for DTC P0118.<br>Does the scan tool indicate DTC P0118 failed? | — | *Go to Step 2* | System OK |

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## DTC P0125 Engine Coolant Temperature (ECT) Excessive Time to Closed Loop Fuel Control




### Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a closed loop air/fuel metering system is used. When the vehicle is first started, the PCM controls fuel delivery in open loop, ignoring the HO2S signals and calculating air/fuel ratio based on inputs from the engine coolant temperature, throttle position, and mass air flow sensors. The PCM will begin using the HO2S 1 signal for controlling fuel delivery (Closed Loop). when the following conditions have been met:

- The HO2S output signal is varying, indicating that the sensor is hot enough to operate properly.
- The engine coolant temperature sensor indicates coolant temperature more than 40°C (104°F) with manual transmission vehicles or more than 20°C(68°F) with automatic transmission vehicles.
- Time since start-up is at least 15 seconds for a warm engine or 90 seconds for a cold engine.

The PCM monitors the amount of time for the cooling system to achieve closed loop operating temperature. This diagnostic is broken into three temperature regions. The diagnostic uses the ECT and IAT sensors to determine which region to operate in. The time to achieve closed loop temperature is monitored. A time based decision is made depending on the temperature region. The diagnostic will monitor the following conditions prior to setting the DTC:

- Total airflow must exceed a calibrated amount.
- Engine idle time must be less than a calibrated amount.

### Conditions for Running the DTC

- No active IAT or ECT DTCs present.
- Minimum air temperature is more than –7°C (19°F).
- Start-up engine coolant temperature is less than 40°C (104°F) with manual transmission vehicles.
- Start-up engine coolant temperature is less than 20°C (68°F) with automatic transmission vehicles.
- Region 1—air temperature more than 10°C (50°F) and the start up coolant temperature more than 10°C (50°F).
- Region 2—air temperature more than –7°C (20°F) and the start up coolant temperature between –7°C (20°F) and 10°C (50°F).
- Region 3—air temperature more than –7°C (20°F) and the start up coolant temperature between –40°C (–40°F) and –7°C (20°F).

### Conditions for Setting the DTC

**Region 1 (Automatic Transmission):**

- Engine run time over 139 seconds to achieve closed loop temperature of 20°C (68°F).
- Calibrated minimum amount of total airflow has been exceeded.
- Maximum idle time less than 104 seconds.

**Region 1 (Manual Transmission):**

- Engine run time over 325 seconds to achieve closed loop temperature of 40°C (104°F).
- Calibrated minimum amount of total airflow has been exceeded.
- Maximum idle time less than 250 seconds.

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**Region 2 (Automatic Transmission):**

- Engine run time over 251 seconds to achieve closed loop temperature of 20°C (68°F).
- Calibrated minimum amount of total airflow has been exceeded.
- Maximum idle time less than 188 seconds.

**Region 2 (Manual Transmission):**

- Engine run time over 400 seconds to achieve closed loop temperature of 40°C (104°F).
- Calibrated minimum amount of total airflow has been exceeded.
- Maximum idle time less than 300 seconds.

**Region 3 (Automatic Transmission):**

- Engine run time over 324 seconds to achieve closed loop temperature of 20°C (68°F).
- Calibrated minimum amount of total airflow has been exceeded.
- Maximum idle time more than 243 seconds.

**Region 3 (Manual Transmission):**

- Engine run time over 475 seconds to achieve closed loop temperature of 40°C (104°F).
- Calibrated minimum amount of total airflow has been exceeded.
- Maximum idle time less than 375 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

DTC P0125 set indicates a skewed ECT sensor. Comparing the engine coolant temperature displayed on a scan tool with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the Step numbers on the diagnostic table:

07. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

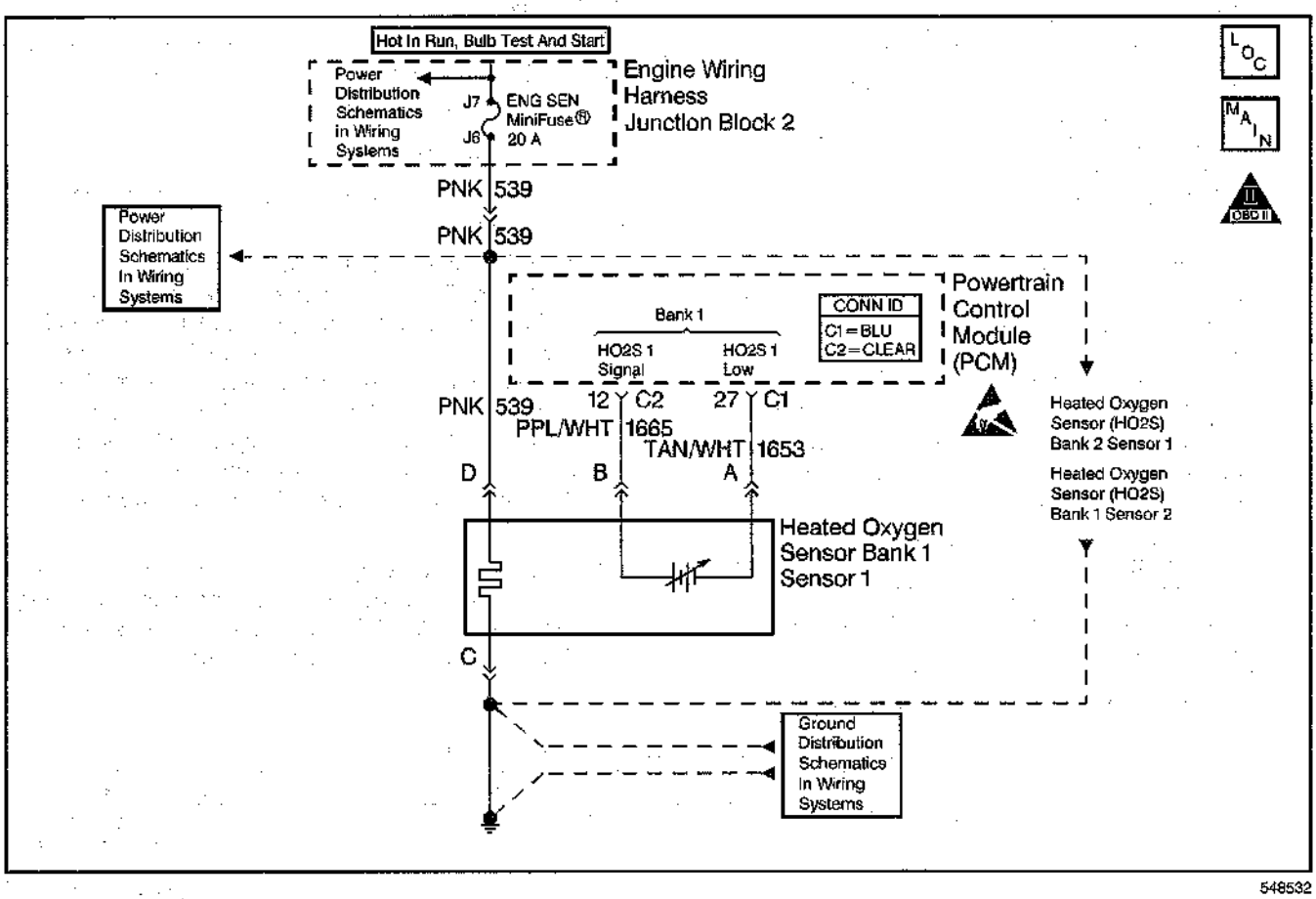
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## DTC P0125 Engine Coolant Temperature (ECT) Excessive Time to Closed Loop Fuel Control

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Was the Powertrain ON-Board Diagnostic System Check performed? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Are any ECT sensor DTCs set? | — | Go to applicable DTC. Go to *Diagnostic Trouble Code (DTC) List/Type.* | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the ECT sensor.<br>3. Install a fused jumper wire between the two terminals at the sensor harness connector.<br>4. Turn ON the ignition, with the engine OFF.<br>5. With a scan tool, observe the ECT parameter.<br>Is the ECT parameter near the specified value? | 140°C or 284°F | *Go to Step 6* | *Go to Step 4* |
| 4 | 1. Check for high resistance in the wiring related to the ECT sensor.<br>2. Check for poor connections at the ECT sensor and the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Was a problem found? | — | *Go to Step 5* | *Go to Step 7* |
| 5 | Replace the faulty terminals or repair the faulty wiring as necessary. Refer to *Testing for Intermittent and Poor Connections* and *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 6 | Replace ECT sensor. Refer to *ECT Sensor Replacement.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 7 | **Important:** The new PCM must be reprogrammed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 8 | 1. Allow the engine to cool until the ECT and IAT sensor parameters are within 5 degrees of each other.<br>2. Clear DTCs.<br>3. Start engine.<br>4. With the engine idling, monitor the ECT parameter on the scan tool.<br>Does ECT increase to above the specified value within 9 minutes? | −10°C or 14°F | System OK | *Go to Step 2* |

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## DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1




548532

### Circuit Description

The PCM supplies a bias voltage of about 450 mV between the HO2S signal and low circuits. When measured with a digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 100 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the HO2S voltage remains excessively low for an extended period of time, this DTC will be set.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- The vehicle is in closed loop.
- The Air/Fuel Ratio is more than or equal to 14.5 but less than or equal to 14.8
- Throttle angle is between 5 percent and 40 percent

### Conditions for Setting the DTC

HO2S signal voltage remains less than 175 mV during normal closed loop operation

OR

HO2S signal voltage remains less than 600 mV during power enrichment.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

- Throttle body inlet screen blockage
- Low fuel pressure — The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a HO2S DTC may set. Refer to *Fuel System Pressure Test*.
- Fuel injectors contaminated or faulty — Refer to *Fuel Injector Balance Test*
- Exhaust leaks — An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Inspect for exhaust leaks that may cause a false lean condition to be indicated.
- Faulty MAF sensor — Disconnect the MAF sensor and see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination — Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis* for procedure to test for fuel contamination.

If none of the conditions are present, replace the affected HO2S.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to step numbers on the diagnostic table:

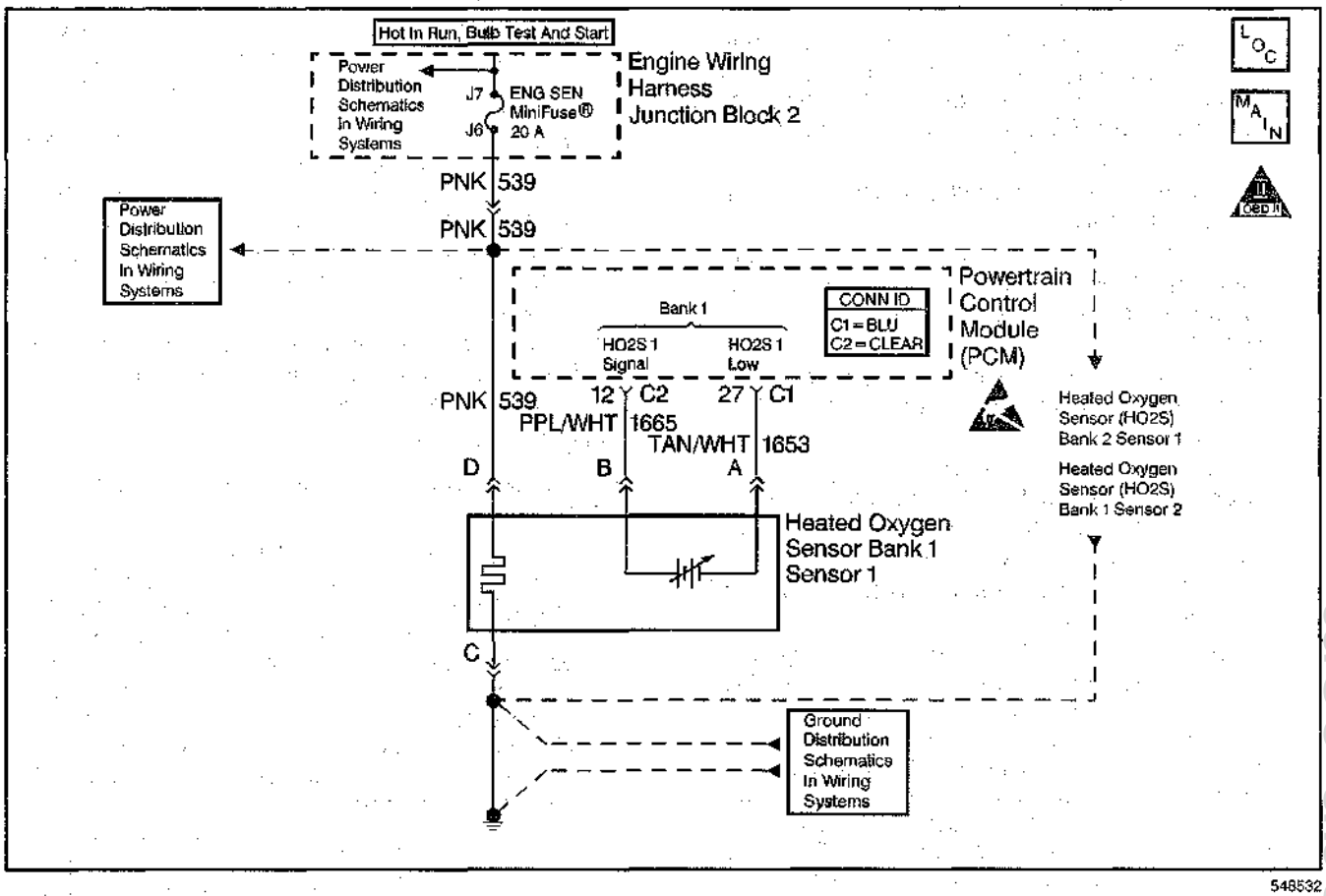
3. This DTC failing during power enrichment operation (TP angle above 60 percent) may indicate a condition described in Diagnostic Aids. If this DTC test passes while the Fail Records conditions are being duplicated, an intermittent condition is indicated. Review the Fail Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.
6. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** During this step, observe all HO2S voltage parameters. If all parameters remain below the specified value refer to Diagnostic Aids.<br>1. Operate vehicle within the Conditions for Setting parameters.<br>2. With a scan tool, observe HO2S voltage parameter.<br>Does the HO2S voltage remain below the specified value? | 400 mV | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Disconnect the HO2S.<br>2. Turn ON the ignition.<br>Does scan tool indicate HO2S voltage less than the specified value? | 400 mV | *Go to Step 5* | *Go to Step 7* |
| 5 | Test the HO2S signal circuit for a short to ground or a short to the sensor ground circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 6* |
| 6 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 7 | Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement*.<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1




548532

### Circuit Description

The PCM supplies a bias voltage of about 450 mV between the HO2S signal and low circuits. When measured with a digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the HO2S voltage remains excessively high for an extended period of time, this DTC will be set.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- The vehicle is in closed loop.
- The Air/Fuel Ratio is more than or equal to 14.5 but less than or equal to 14.8
- Throttle angle is between 5 percent and 40 percent

### Conditions for Setting the DTC

HO2S signal voltage remains more than 975 mV during normal closed loop operation

OR

HO2S signal voltage remains more than 200 mV during decel fuel cutoff.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

- High fuel pressure — The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a HO2S DTC may set. Refer to *Fuel System Pressure Test.*
- Fuel injectors contaminated or faulty — Refer to *Fuel Injector Balance Test.*
- Inspect the EVAP Canister for Fuel Saturation. If the EVAP Canister is full of fuel, inspect canister control and hoses. Refer to *EVAP Control System Diagnosis.*
- Disconnect the MAF sensor and see if the rich condition is corrected. If so, replace the MAF sensor.
- Inspect for a leaking fuel pressure regulator diaphragm by inspecting the vacuum line to the fuel pressure regulator for the presence of fuel.
- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine accelerating.
- Shorted HO2S — If the HO2S is internally shorted the HO2S voltage displayed on the scan tool will be over 1 volt. Disconnect the affected HO2S and jumper the HO2S low circuit to ground with the key ON. If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery white deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal or Low Circuit or Faulty HO2S — A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a scan tool. If the HO2S voltage is limited within a range between 300mV to 600mV, inspect the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to step numbers on the diagnostic table:

3. This DTC failing during deceleration fuel mode operation (vehicle speed above 25 mph, TP angle below 3 percent) may indicate a condition described in Diagnostic Aids. If this DTC test passes while the Fail Records conditions are being duplicated, an intermittent condition is indicated. Review the Fail Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.
7. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

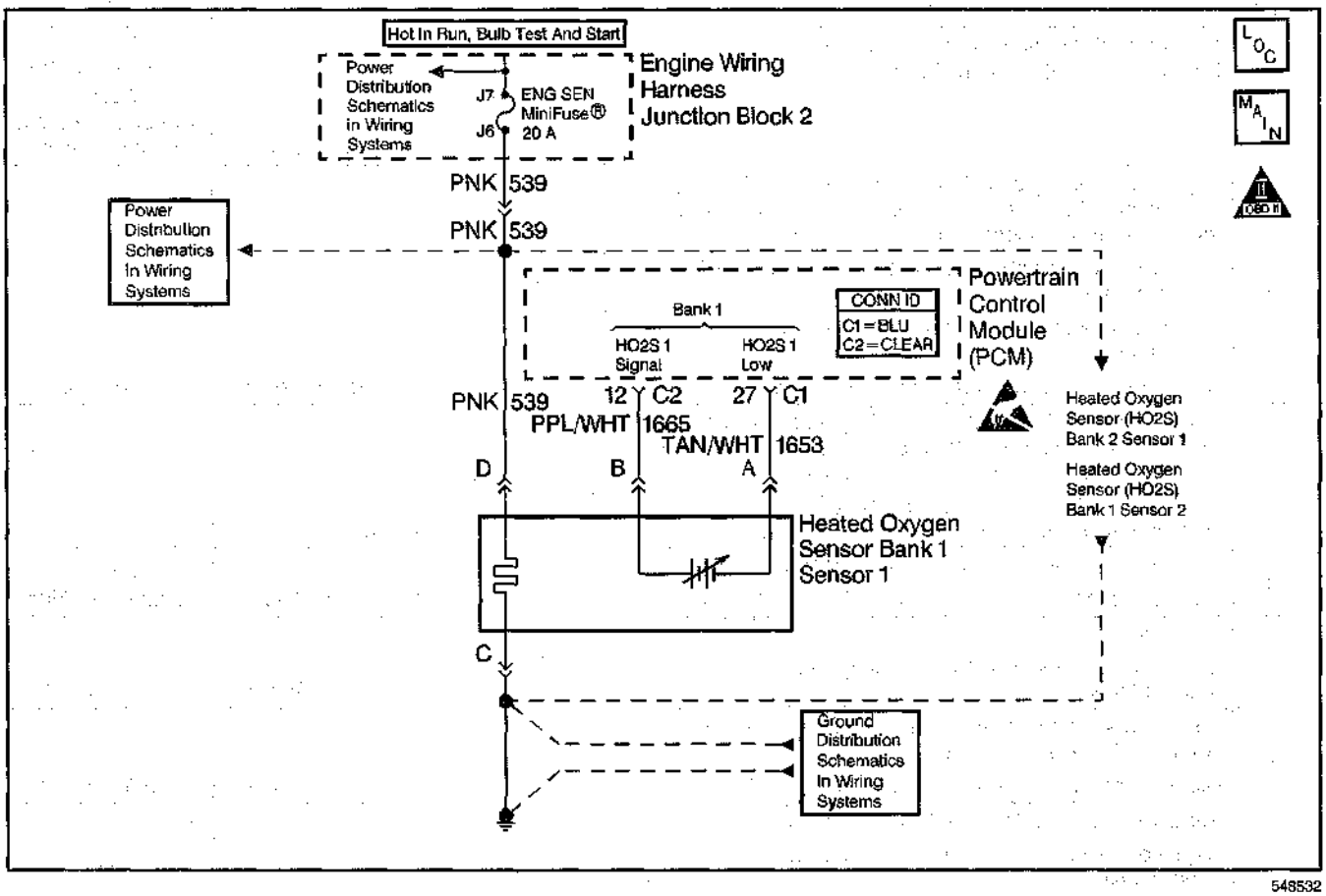
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## DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** During this step, observe all HO2S voltage parameters. If all parameters remain above the specified value refer to Diagnostic Aids.<br>1. Operate the vehicle within the Conditions for Setting parameters.<br>2. With a scan tool, observe the HO2S voltage parameter.<br>Does the HO2S voltage remain above the specified value? | 600 mV | *Go to Step 5* | *Go to Step 3* |
| 3 | Operate vehicle in Decel fuel mode (vehicle speed above 25 mph, TP angle below 3 percent) while observing the HO2S voltage parameter on the scan tool.<br>Does the HO2S voltage remain above the specified value while in Decel fuel mode? | 110 mV | *Go to Step 5* | *Go to Step 4* |
| 4 | Operate the vehicle within the Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 5* | Go to Diagnostic Aids |
| 5 | Disconnect the HO2S.<br>Does scan tool indicate HO2S voltage more than the specified value? | 500 mV | *Go to Step 6* | *Go to Step 8* |
| 6 | Test for a short to voltage on the HO2S signal circuit. Refer to *Circuit Testing* and *Wiring Repairs.*<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 7* |
| 7 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/ Programming.*<br>Did you complete the repair? | — | *Go to Step 9* | — |
| 8 | Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 9* | — |
| 9 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0133 HO2S Slow Response Bank 1 Sensor 1




548532

### Circuit Description

The PCM continuously monitors the heated oxygen sensor (HO2S) activity. The PCM counts the number of times that a rich to lean and a lean to rich response is indicated. Then, the PCM adds the amount of time it took to complete all transitions for a 100 second test period. With this information, an average time for each transition can be determined. If the average response time is too slow, this DTC will set. A lean to rich transition is indicated when the HO2S voltage changes from less than 300 mV to more than 600 mV. A rich to lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- The engine coolant temperature is more than 50°C (122°F).
- Engine speed is between 1000 RPM and 3000 RPM.
- Mass air flow is between 10.0 g/s and 30 g/s.

### Conditions for Setting the DTC

H02S lean to rich average transition response time was longer than 63 milliseconds. The rich to lean average transition response time was longer than 190 milliseconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. When the system is operating correctly the HO2S voltage should toggle above and below the specified values.
5. If the low circuit is shorted to ground the HO2S voltage will be less than 400 mV when the signal circuit is jumped to ground.
6. The specified value is what is measured on a correctly operating system.
7. The specified value is what is measured on a correctly operating system.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0133 HO2S Slow Response Bank 1 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| *2* | **Important:** If any other DTCs are set (except HO2S DTCs), refer to other DTCs first before proceeding with this table.<br>1. Engine at operating temperature.<br>2. Operate engine above 1200 RPM for two minutes.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does scan tool indicate HO2S voltage varying outside the specified values? | 400-500 mV | *Go to Step 3* | *Go to Step 4* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect and test for the following:<br>• Exhaust leak. Refer to *Exhaust System Inspection* and *Exhaust Leakage* in Engine Exhaust.<br>• The HO2S is installed correctly.<br>• Damaged wiring. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |

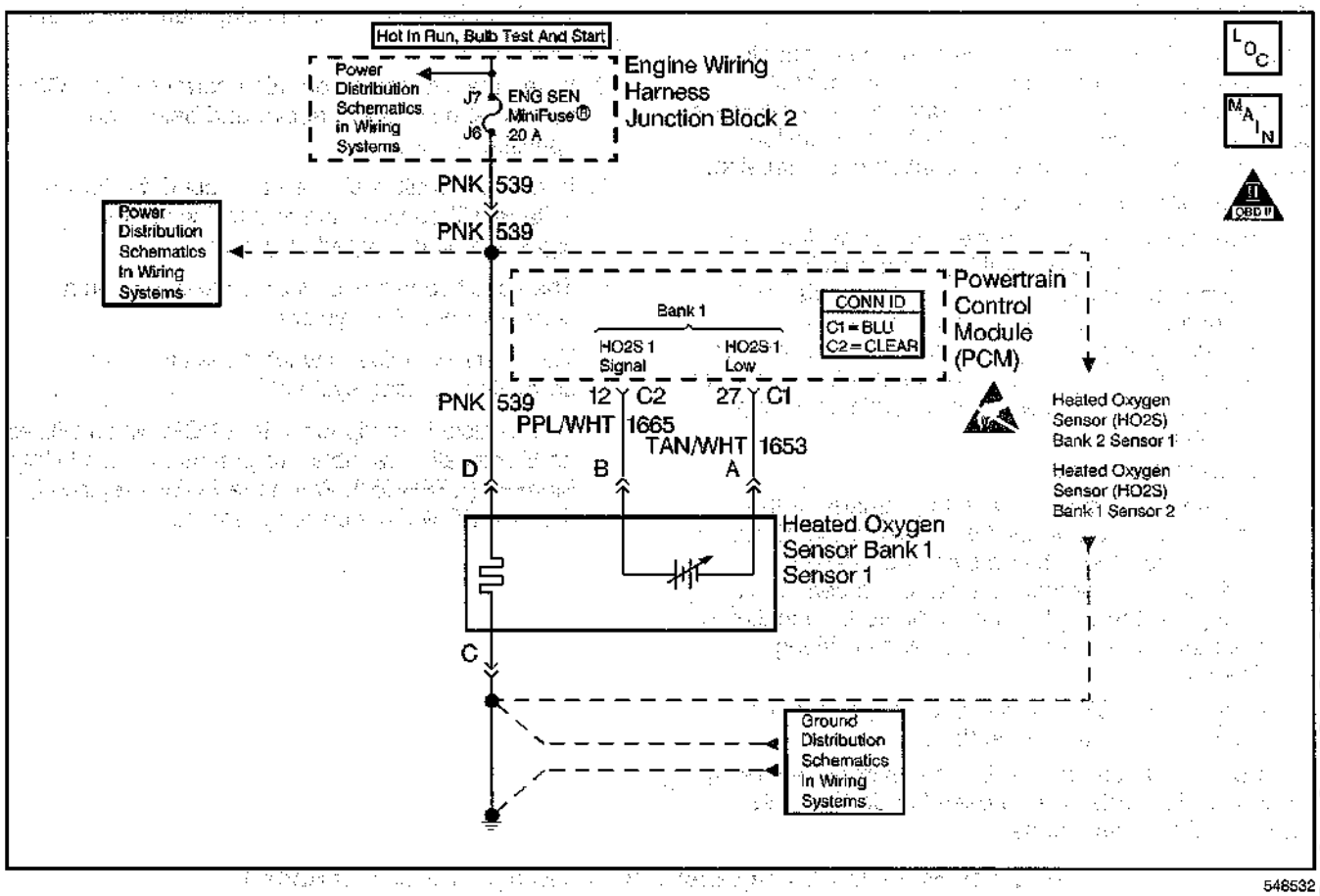
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## DTC P0133 HO2S Slow Response Bank 1 Sensor 1 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Disconnect the HO2S.<br>3. Jumper the signal circuit (PCM side) to a good ground.<br>4. With a scan tool, observe HO2S voltage parameter.<br>Does the scan tool indicate HO2S voltage more than the specified value? | 400 mV | *Go to Step 6* | *Go to Step 10* |
| 6 | 1. Remove the jumper wire.<br>2. Measure the voltage on the HO2S signal circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 4.5V | *Go to Step 7* | *Go to Step 9* |
| 7 | Measure the voltage on the HO2S low circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the low circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Test the low circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 12 | **Important:** Determine the cause of contamination before replacing the sensor.<br>Inspect and test for the following:<br>• Fuel Contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*<br>Engine oil or coolant consumption. Refer to *Oil Consumption Diagnosis* in Engine Mechanical.<br>• Use of improper RTV sealant. Refer to *Silicon Contamination of Heated Oxygen Sensors Notice* in Cautions and Notices.<br>Replace the effected HO2S sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Test for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Use the scan tool in order to check for DTCs.<br>Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1




548532

### Circuit Description

The PCM supplies a bias voltage of about 450 mV between the HO2S signal and low circuits. When measured with a DMM, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the HO2S voltage remains at or near the 450 mV bias for an extended period of time, this DTC will be set, indicating an open sensor signal or sensor low circuit.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- Engine has been running for longer than 4 minutes.

### Conditions for Setting the DTC

HO2S signal voltage remains between 400 mV and 500 mV.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. When the system is operating correctly the HO2S voltage should toggle above and below the specified values.
5. If the low circuit is shorted to ground the HO2S voltage will be less than 400 mV when the signal circuit is jumped to ground.
6. The specified value is what is measured on a correctly operating system.
7. The specified value is what is measured on a correctly operating system.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set (except HO2S DTCs), refer to other DTCs first before proceeding with this table.<br>1. Engine at operating temperature.<br>2. Operate engine above 1200 RPM for two minutes.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does scan tool indicate HO2S voltage varying outside the specified values? | 400-500 mV | *Go to Step 3* | *Go to Step 4* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect and test for the following:<br>• Exhaust leak. Refer to *Exhaust System Inspection* and *Exhaust Leakage* in Engine Exhaust.<br>• The HO2S is installed correctly.<br>• Damaged wiring. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |

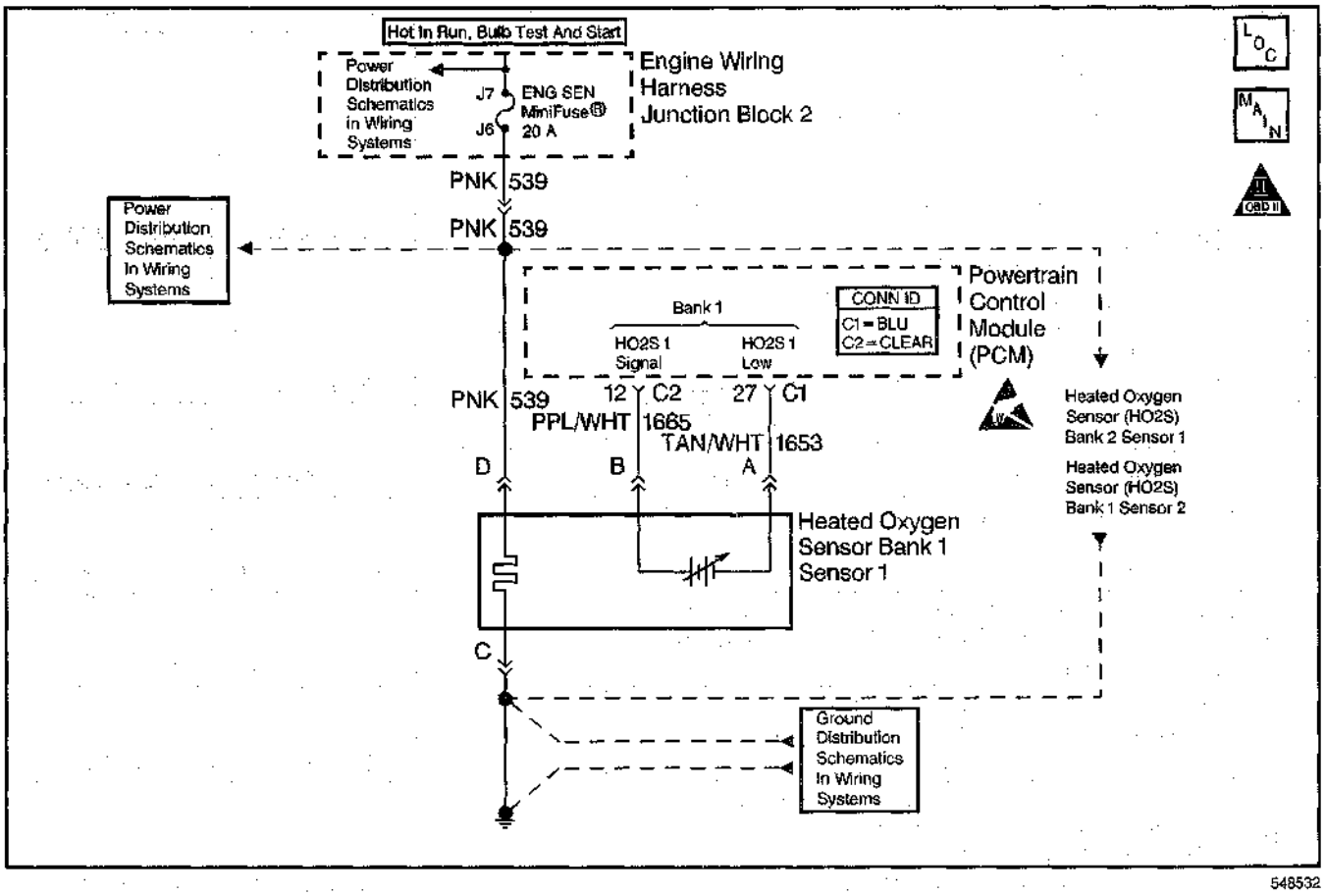
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## DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Disconnect the HO2S.<br>3. Jumper the signal circuit (PCM side) to a good ground.<br>4. With a scan tool, observe HO2S voltage parameter.<br>Does the scan tool indicate HO2S voltage more than the specified value? | 400 mV | *Go to Step 6* | *Go to Step 10* |
| 6 | 1. Remove the jumper wire.<br>2. Measure the voltage on the HO2S signal circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 4.5V | *Go to Step 7* | *Go to Step 9* |
| 7 | Measure the voltage on the HO2S low circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the low circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Test the low circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 12 | **Important:** Determine the cause of contamination before replacing the sensor.<br>Inspect and test for the following:<br>• Fuel Contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*<br>Engine oil or coolant consumption. Refer to *Oil Consumption Diagnosis* in Engine Mechanical.<br>• Use of improper RTV sealant. Refer to *Silicon Contamination of Heated Oxygen Sensors Notice* in Cautions and Notices.<br>Replace the effected HO2S sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Test for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/ Programming.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Use the scan tool in order to check for DTCs.<br>Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0135 HO2S Heater Performance Bank 1 Sensor 1




### Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors to become active. An Oxygen sensor heater is also required by catalyst monitor sensor to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of startup) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since startup. If the PCM determines that too much time was required for the HO2S to become active, this DTC will set. The time it should take the HO2S to reach operating temperature is based on the engine coolant temperature at start-up and the average mass air flow since startup (higher average airflow or higher startup engine coolant temperature = shorter time to HO2S activity).

### Conditions for Running the DTC

- No Misfire, CKP, Fuel Injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- Intake air temperature (IAT) is less than 35°C (95°F) at startup
- Engine coolant temperature (ECT) is less than 35°C (95°F) at startup.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- Average mass air flow for the sample period is less than 20 g/s.
- The system voltage is between 9 and 18 volts.

### Conditions for Setting the DTC

HO2S voltage remains within 150 mV of the bias voltage (about 450 mV) for a longer amount of time than it should. The amount of time ranges between 42 seconds and 2 minutes.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

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### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450mv bias voltage.
4. This step ensures that the ignition feed circuit to the HO2S is not open or shorted. The test lamp should be connected to a good ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This step tests the HO2S heater ground circuit.
6. This step checks for an open or shorted HO2S heater element. The heater element resistance will vary according to HO2S temperature (a hot HO2S heater element will measure a much higher resistance than a HO2S heater element at room temperature). It is important to allow the HO2S to cool before measuring HO2S heater element resistance.

### DTC P0135 HO2S Heater Performance Bank 1 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| *2* | **Important:** If engine has just been operating, allow engine to cool for about one half hour before proceeding.<br>1. Turn ON the ignition.<br>2. With a scan tool, observe the HO2S voltage parameter.<br>Does HO2S voltage go from bias voltage to more than the first specified value or less than the second specified value? | 600 mV<br>300 mV | Go to Diagnostic Aids | *Go to Step 3* |
| 3 | Inspect the HO2S ignition feed fuse.<br>Is the fuse open? | — | *Go to Step 13* | *Go to Step 4* |

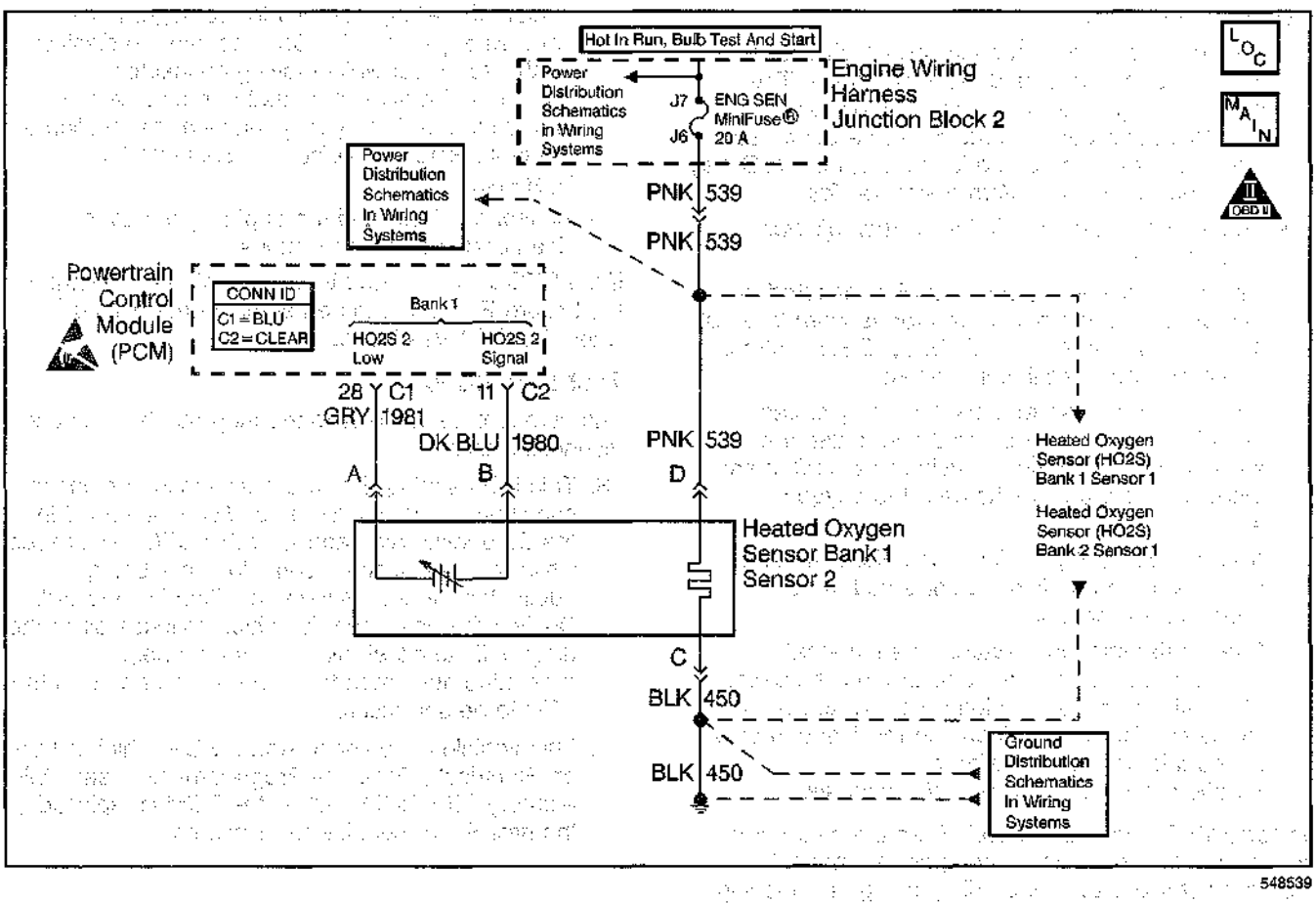
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## DTC P0135 HO2S Heater Performance Bank 1 Sensor 1 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 4 | **Important:** Use a known good ground. Do not use the HO2S heater ground or low circuit.<br>1. Disconnect the HO2S.<br>2. Probe the ignition feed circuit (PCM harness side) using a test lamp that is connected to a good ground<br>Does the test lamp illuminate? | — | *Go to Step 5* | *Go to Step 7* |
| 5 | Connect the test lamp between the HO2S ignition feed circuit and the HO2S heater ground.<br>Does test lamp illuminate? | — | *Go to Step 6* | *Go to Step 8* |
| 6 | 1. Allow the HO2S to cool for at least 10 minutes.<br>2. Measure the resistance between the HO2S ignition feed and HO2S heater ground at the pigtail using a DMM.<br>Does the resistance measure within the specified range? | 5 -10 ohms | *Go to Step 9* | *Go to Step 12* |
| 7 | Repair the open HO2S ignition feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 8 | Repair the open HO2S heater ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 9 | 1. Inspect for a poor connection at the HO2S.<br>2. If a problem is found, repair as necessary. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 10* |
| 10 | Test the HO2S signal and low circuits for an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 11* |
| 11 | Inspect the HO2S signal or low circuits for a poor connection at the PCM and HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring System.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 12* |
| 12 | Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 13 | Repair the short to ground in HO2S ignition feed circuit and replace faulty fuse. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 14 | **Important:** If engine has just been operating, allow engine to cool for about one half hour before proceeding.<br>1. Use the scan tool in order to clear the DTCs.<br>2. Turn ON the ignition.<br>3. With a scan tool, observe the HO2S voltage for at least 2 minutes.<br>Does HO2S voltage go from bias voltage to more than the first specified value or less than the second specified value? | 600 mV<br>300 mV | System OK | *Go to Step 2* |

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## DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2




### Circuit Description

To control emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the post-catalyst HO2S. This HO2S produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalysts ability to convert exhaust gases efficiently. If the post HO2S signal voltage remains excessively low for an extended period of time, this DTC will set.

### Conditions for Running the DTC

- No Misfire, Transmission, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- Closed loop commanded air/fuel ratio is between 14.5 - 14.8.
- Throttle angle is between 5 percent and 40 percent.
- The engine coolant temperature is more than 75°C (165°F).

### Conditions for Setting the DTC

Post HO2S signal voltage remains less than 60 mV during normal closed loop operation.

OR

Post HO2S signal voltage remains less than 600 mV during power enrichment mode.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

- Fuel pressure low – A condition which causes a lean exhaust can cause this DTC to set. The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, this DTC may set. Refer to *Fuel System Pressure Test.*
- Fuel injectors faulty – Refer to *Fuel Injector Balance Test.*
- Vacuum leaks – Inspect for a disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and crankcase ventilation system.
- Exhaust leaks - An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing this DTC to set. Inspect for exhaust leaks near the oxygen sensors.
- MAF sensor faulty – Disconnect the MAF sensor and see if the condition is corrected. If so, replace MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

3. This DTC setting during power enrichment mode conditions may indicate a condition described in the Diagnostic Aids above. If this DTC test passes while the Fail Records conditions are being duplicated, an intermittent condition is indicated. Review the Fail Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.
7. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

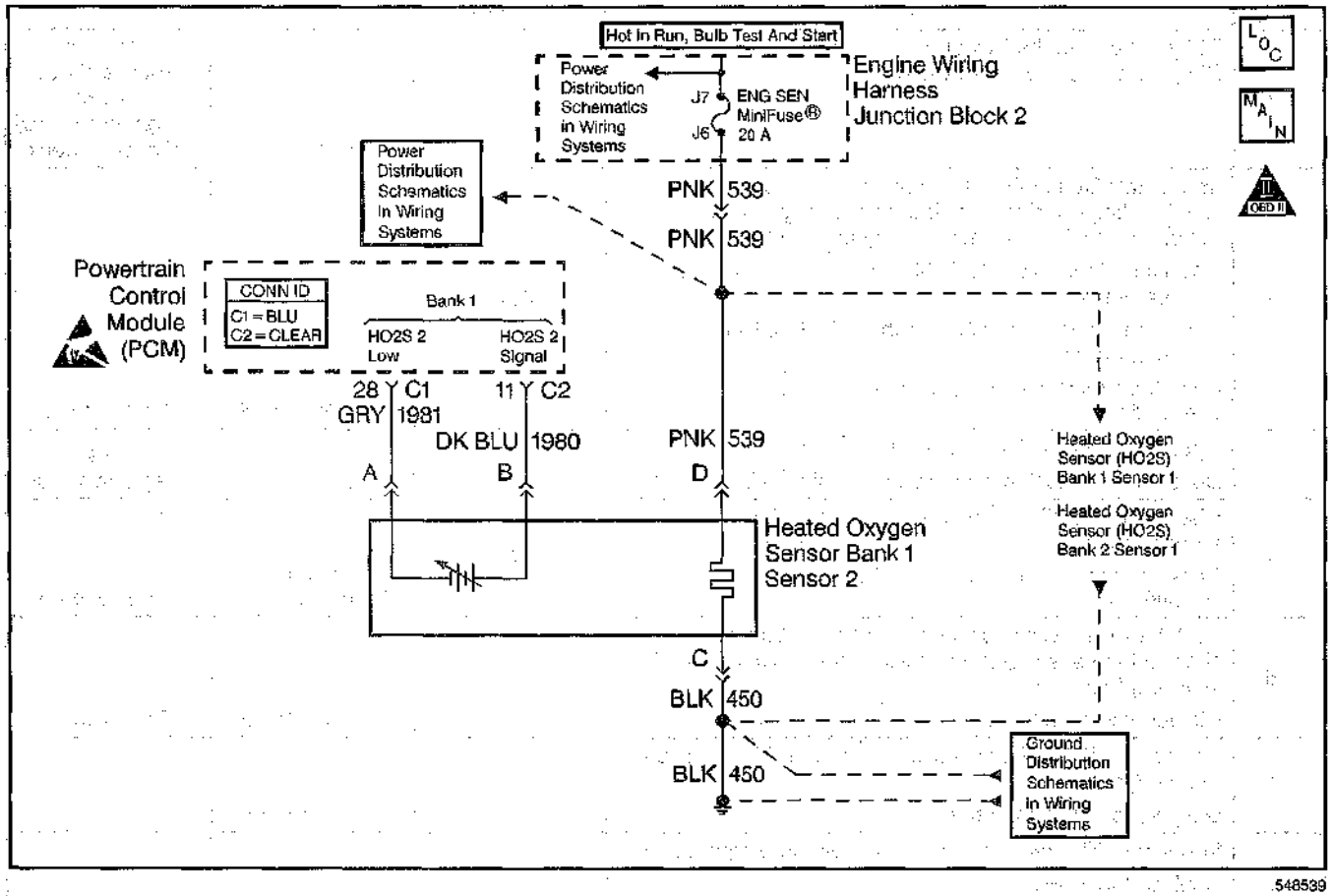
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## DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** During this step, observe the pre-catalyst HO2S voltage parameters. If the pre-catalyst parameters remain below 400mV refer to Diagnostic Aids.<br>1. Operate the vehicle within the Conditions for Setting parameters.<br>2. With a scan tool, observe the HO2S voltage parameter.<br>Does the HO2S voltage remain less than the specified value? | 75 mV | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Disconnect HO2S and jumper the low circuit (PCM side) to a good ground.<br>Does scan tool indicate HO2S voltage near the specified value? | 450 mV | Go to Diagnostic Aids | *Go to Step 5* |
| 5 | Test the HO2S signal circuit for a short to ground or a short to the sensor ground circuit. Refer to *Circuit Testing* in Wiring Systems.<br>Did you find a problem? | — | *Go to Step 6* | *Go to Step 7* |
| 6 | Repair the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 7 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2




### Circuit Description

To control emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the post-catalyst HO2S. This sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalysts ability to convert exhaust gases efficiently. If the post HO2S voltage remains excessively high for an extended period of time, this DTC will set.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are set.
- Closed loop with commanded Air/Fuel ratio between 14.5 and 14.8.
- The throttle position is between 5 percent and 40 percent.

### Conditions for Setting the DTC

Post HO2S signal voltage remains more than 999 mV during normal closed loop operation.

OR

Post HO2S signal voltage remains more than 200 mV during deceleration fuel mode operation.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

- Fuel pressure high – An excessively rich fuel mixture can cause this DTC to set. Refer to *Fuel System Pressure Test*
- Fuel injectors faulty – Refer to *Fuel Injector Balance Test*
- Inspect the EVAP Canister for Fuel Saturation. If the EVAP Canister is full of fuel, inspect canister control and hoses. Refer to *EVAP Control System Diagnosis*
- Disconnect the MAF sensor and see if the rich condition is corrected. If so, replace the MAF sensor. Refer to *MAF Sensor Replacement*
- Inspect for a leaking fuel pressure regulator diaphragm by inspecting the vacuum line to the fuel pressure regulator for the presence of fuel.
- An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted HO2S – If the HO2S is internally shorted the HO2S voltage displayed on the scan tool will be over 1 volt. Try disconnecting the affected HO2S and jumper the HO2S low circuit to ground with the key ON. If the displayed HO2S voltage changes from over 1000mV to around 450mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery white deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is evident, replace the affected HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement*
- Open HO2S Signal or Low Circuit or Faulty HO2S – A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a scan tool. If the HO2S voltage is limited within a range between 300mV to 600mV, inspect the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement*

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

3. This DTC setting during deceleration fuel mode operation may indicate a condition described in the Diagnostic Aids above. If this DTC test passes while the Fail Records conditions are being duplicated, an intermittent condition is indicated. Review the Fail Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.
7. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

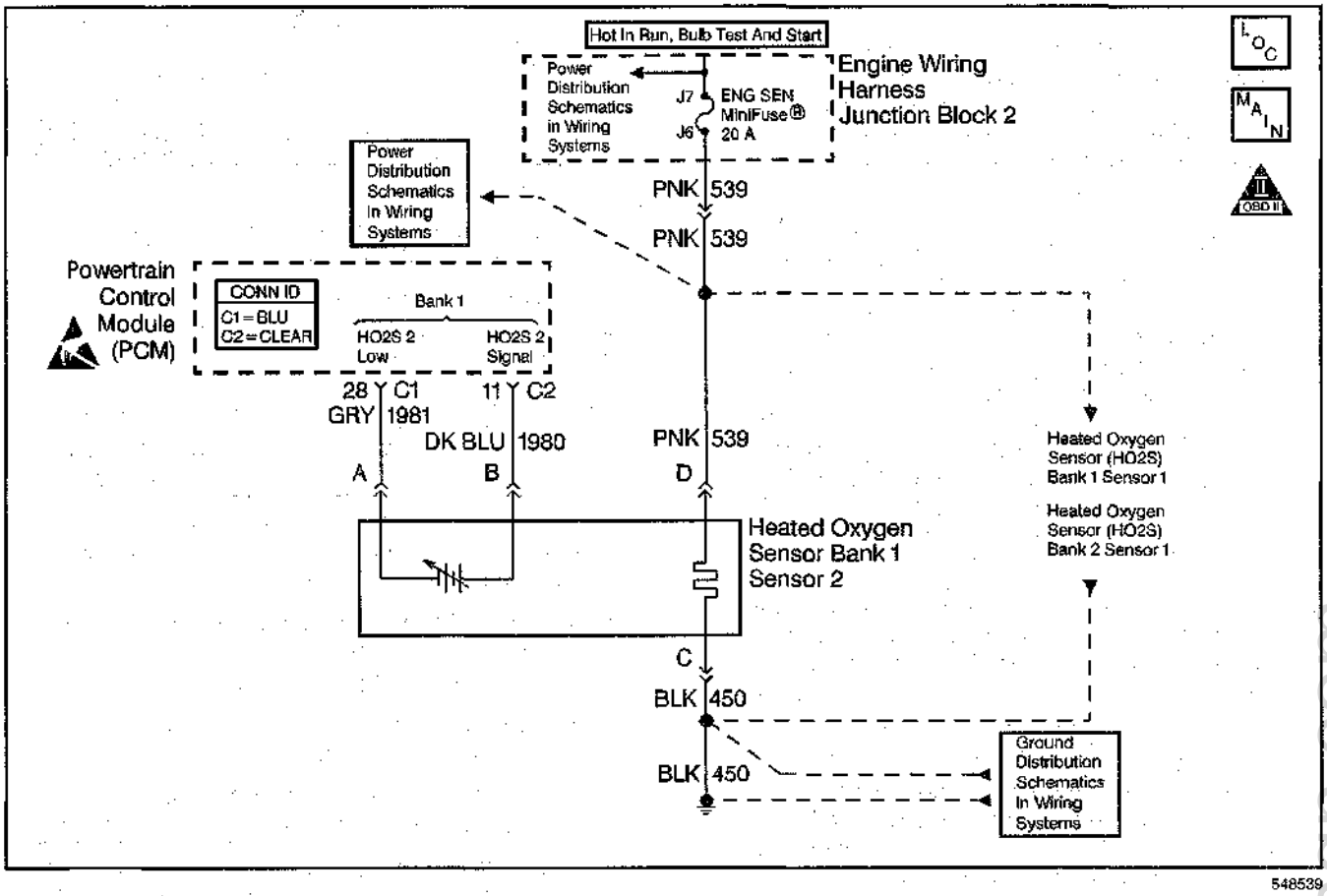
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## DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** During this step, observe the pre-catalyst HO2S voltage parameters. If the pre-catalyst parameters remain above 600mV refer to Diagnostic Aids.<br>1. Operate the vehicle within the Conditions for Setting parameters.<br>2. With a scan tool, observe the HO2S voltage parameter.<br>Does the HO2S voltage remain more than the specified value? | 999 mV | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Disconnect the HO2S.<br>2. Jumper low circuit to a good ground.<br>Does scan tool indicate HO2S voltage near the specified value? | 450 mV | Go to Diagnostic Aids | *Go to Step 5* |
| 5 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. Measure the voltage of the HO2S signal circuit at the PCM harness connector using a DMM that is connected to a good ground.<br>Does the voltage measure more than the specified value? | 500 mV | *Go to Step 6* | *Go to Step 7* |
| 6 | Repair short to voltage in the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 7 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2




### Circuit Description

To control emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the post-catalyst HO2S. This sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the post HO2S signal voltage remains at or near the 450mV bias for an extended period of time, this DTC will set.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel Injector, MAF, TP, EVAP, IAT, MAP, Fuel Trim, EGR or ECT DTCs are set.
- Engine has been running for more than 4 minutes.

### Conditions for Setting the DTC

Post HO2S signal voltage remains between 412 mV and 490 mV during normal closed loop operation.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

- Corroded exhaust flange bolts – Using a *J 39200* Digital Multimeter, ensure that continuity exists between the engine block and the heated oxygen sensor shell. If resistance is excessively high, replace corroded exhaust flange attaching hardware as necessary.
- Faulty HO2S heater or heater circuit – With the ignition ON the HO2S voltage displayed on a scan tool should gradually drop to less than 300mV or rise to more than 600mV. If not, disconnect the HO2S and connect a test lamp between the HO2S ignition feed and heater ground circuits. If the test lamp does not illuminate, repair the open ignition feed or sensor ground circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. If the test lamp illuminates and the HO2S signal and low circuits are OK, replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement*

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. When the system is operating correctly the HO2S voltage should toggle above and below the specified values.
5. If the low circuit is shorted to ground the HO2S voltage will be less than 400 mV when the signal circuit is jumped to ground.
6. The specified value is what is measured on a correctly operating system.
7. The specified value is what is measured on a correctly operating system.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set (except HO2S DTCs), refer to other DTCs first before proceeding with this table.<br>1. Engine at operating temperature.<br>2. Operate engine above 1200 RPM for two minutes.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does scan tool indicate HO2S voltage varying outside the specified values? | 400-500 mV | *Go to Step 3* | *Go to Step 4* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect and test for the following:<br>• Exhaust leak. Refer to *Exhaust System Inspection* and *Exhaust Leakage* in Engine Exhaust.<br>• The HO2S is installed correctly.<br>• Damaged wiring. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |

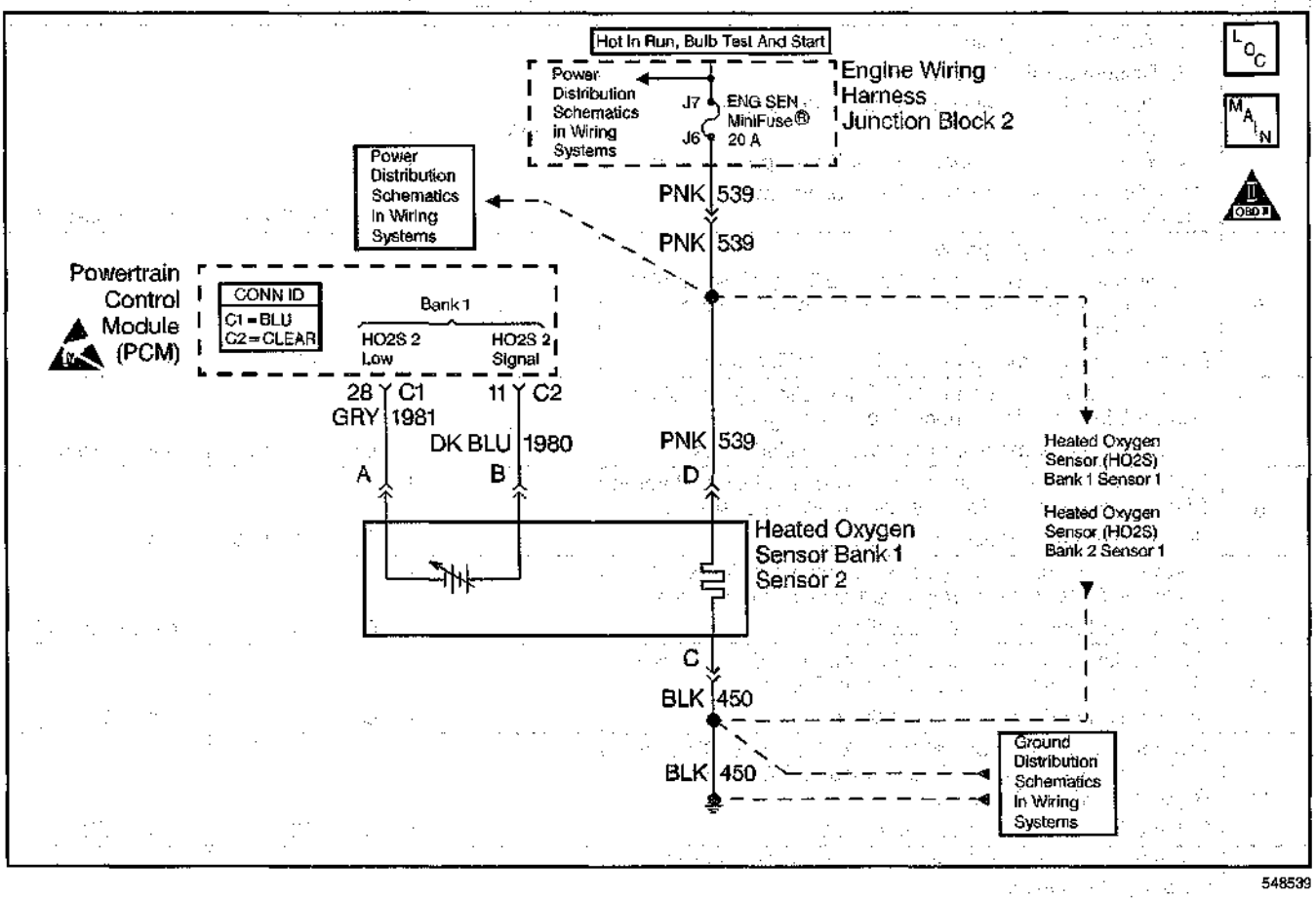
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## DTC P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Disconnect the HO2S.<br>3. Jumper the signal circuit (PCM side) to a good ground.<br>4. With a scan tool, observe HO2S voltage parameter.<br>Does the scan tool indicate HO2S voltage more than the specified value? | 400 mV | *Go to Step 6* | *Go to Step 10* |
| 6 | 1. Remove the jumper wire.<br>2. Measure the voltage on the HO2S signal circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 4.5V | *Go to Step 7* | *Go to Step 9* |
| 7 | Measure the voltage on the HO2S low circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the low circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Test the low circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 12 | **Important:** Determine the cause of contamination before replacing the sensor.<br>Inspect and test for the following:<br>• Fuel Contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*<br>Engine oil or coolant consumption. Refer to *Oil Consumption Diagnosis* in Engine Mechanical.<br>• Use of improper RTV sealant. Refer to *Silicon Contamination of Heated Oxygen Sensors Notice* in Cautions and Notices.<br>Replace the effected HO2S sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Test for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/ rogramming.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Use the scan tool in order to check for DTCs.<br>Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0141 HO2S Heater Performance Bank 1 Sensor 2




548539

### Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for the pre-catalyst oxygen sensors to become active. An oxygen sensor heater is required by catalyst monitor sensor to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of startup) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the post HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since startup. If the PCM determines that too much time was required for the post HO2S to become active, this DTC will set. The time it should take the HO2S to reach operating temperature is based on the engine coolant temperature at start-up and the average Mass Air Flow since startup (higher average airflow or higher startup engine coolant temperature = shorter time to HO2S activity).

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs.
- System voltage is between 9 and 18 volts.
- Intake air temperature (IAT) is less than 35°C (95°F) at startup
- Engine coolant temperature (ECT) is less than 35°C (95°F) at startup.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- The average mass air flow for the sample period is less than 22.7 gm/s.

### Conditions for Setting the DTC

- Post HO2S voltage remains within 150 mV of the bias voltage (about 450 mV).
- The amount of time depends on engine coolant temperature at startup and the average air flow since startup.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

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### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450mV bias voltage.
4. This step ensures that the ignition feed circuit to the HO2S is not open or shorted. The test lamp should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This step tests the HO2S heater ground circuit.
6. This step tests for an open or shorted HO2S heater element. The heater element resistance will vary according to HO2S temperature (a hot HO2S heater element will measure a much higher resistance than a HO2S heater element at room temperature). It is important to allow the HO2S to cool before measuring HO2S heater element resistance.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. inspect these circuits before replacing the sensor.

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**DTC P0141 HO2S Heater Performance Bank 1 Sensor 2**

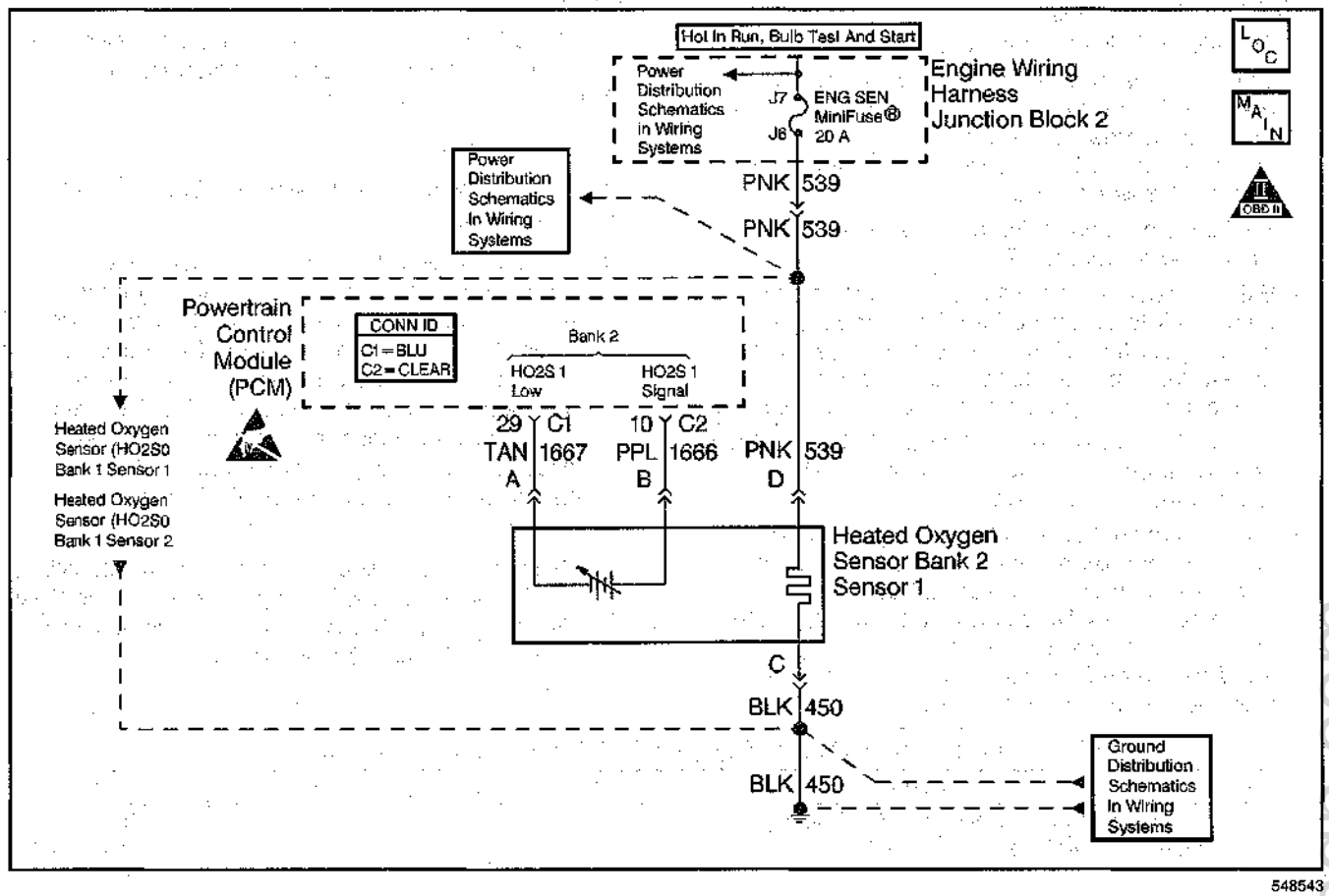
| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If engine has just been operating, allow engine to cool for about one half hour before proceeding.<br>1. Turn ON the ignition.<br>2. With a scan tool, observe the HO2S voltage parameter.<br>Does HO2S voltage vary from bias voltage to more than the first specified value or less than the second specified value? | 600 mV<br>300 mV | Go to Diagnostic Aids | *Go to Step 3* |
| 3 | Inspect ignition feed fuse for the HO2S.<br>Is the fuse open? | — | *Go to Step 15* | *Go to Step 4* |

## DTC P0141 HO2S Heater Performance Bank 1 Sensor 2 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 4 | **Important:** Use a known good ground. Do not use the HO2S heater ground circuit or the HO2S low circuit.<br>1. Disconnect the HO2S.<br>2. Probe the HO2S ignition feed circuit (PCM side) using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 5* | *Go to Step 7* |
| 5 | Connect a test lamp between HO2S ignition feed and HO2S heater ground.<br>Does the test lamp illuminate? | — | *Go to Step 6* | *Go to Step 8* |
| 6 | 1. Allow the HO2S to cool for at least 10 minutes.<br>2. Measure the resistance between the ignition feed circuit and the heater ground circuit at the HO2S pigtail using a DMM.<br>Does the resistance measure within the specified range? | 5-10 ohms | *Go to Step 9* | *Go to Step 14* |
| 7 | Repair the open HO2S ignition feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 16* | — |
| 8 | Repair open HO2S heater ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 16* | — |
| 9 | Inspect for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 10* |
| 10 | 1. Test for continuity of the HO2S signal circuit and the HO2S low circuit. Refer to *Circuit Testing* in Wiring Systems.<br>2. If either circuit measures over 5 ohms, repair open or poor connection as necessary. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* or *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 11* |
| 11 | Inspect for a poor HO2S signal or low circuit connection at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 12* |
| 12 | Inspect for a poor HO2S low circuit connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 13* |
| 13 | Inspect for a poor HO2S signal circuit connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 14* |
| 14 | Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement*<br>Did you complete the replacement? | — | *Go to Step 16* | — |
| 15 | Repair the short to ground in HO2S ignition feed circuit and replace the faulty fuse. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 16* | — |
| 16 | **Important:** If engine has just been operating, allow engine to cool for about one half hour before proceeding.<br>1. Clear the DTCs<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does HO2S voltage go from bias voltage to more than the first specified value or less than the second specified value? | 600 mV<br>300 mV | System OK | *Go to Step 2* |

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## DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1




548543

### Circuit Description

The PCM supplies a bias voltage of about 450 mV between the HO2S signal and low circuits. When measured with a DMM, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 100 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the HO2S voltage remains excessively low for an extended period of time, this DTC will be set.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- The vehicle is in closed loop.
- The Air/Fuel Ratio is more than or equal to 14.5 but less than or equal to 14.8
- Throttle angle is between 5 percent and 40 percent

### Conditions for Setting the DTC

HO2S signal voltage remains less than 175 mV during normal closed loop operation

OR

HO2S signal voltage remains less than 6000 mV during power enrichment.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

- Throttle body inlet screen blockage
- Low fuel pressure — The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a HO2S DTC may set. Refer to *Fuel System Pressure Test*.
- Fuel injectors contaminated or faulty — Refer to *Fuel Injector Balance Test*
- Exhaust leaks — An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Inspect for exhaust leaks that may cause a false lean condition to be indicated.
- Faulty MAF sensor — Disconnect the MAF sensor and see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination — Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis* for procedure to test for fuel contamination.

If none of the above conditions are present, replace the affected HO2S.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to step numbers on the diagnostic table:

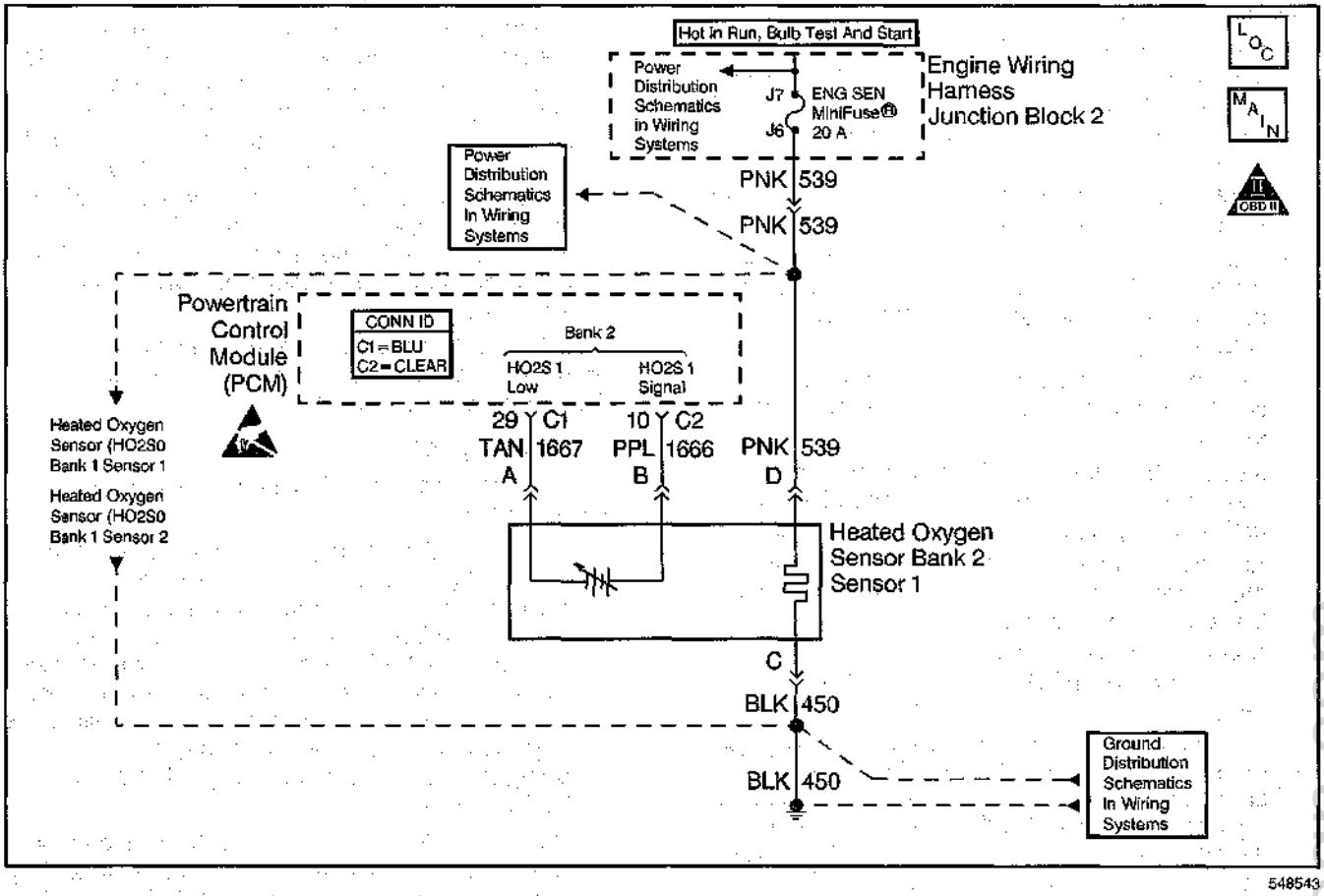
3. This DTC failing during power enrichment operation (TP angle above 60 percent) may indicate a condition described in Diagnostic Aids. If this DTC test passes while the Fail Records conditions are being duplicated, an intermittent condition is indicated. Review the Fail Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.
6. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** During this step, observe all HO2S voltage parameters. If all parameters remain below the specified value refer to Diagnostic Aids.<br>1. Operate vehicle within the Conditions for Setting parameters.<br>2. With a scan tool, observe HO2S voltage parameter.<br>Does the HO2S voltage remain below the specified value? | 400 mV | *Go to Step 4* | *Go to Step 3* |
| *3* | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Disconnect the HO2S.<br>2. Turn ON the ignition.<br>Does scan tool indicate HO2S voltage less than the specified value? | 400 mV | *Go to Step 5* | *Go to Step 7* |
| 5 | Test the HO2S signal circuit for a short to ground or a short to the sensor ground circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 6* |
| *6* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 7 | Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement*.<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1




### Circuit Description

The PCM supplies a bias voltage of about 450 mV between the HO2S signal and low circuits. When measured with a DMM, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the HO2S voltage remains excessively high for an extended period of time, this DTC will be set.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- The vehicle is in closed loop.
- The Air/Fuel Ratio is more than or equal to 14.5 but less than or equal to 14.8
- Throttle angle is between 5 percent and 40 percent

### Conditions for Setting the DTC

HO2S signal voltage remains more than 975 mV during normal closed loop operation

OR

HO2S signal voltage remains more than 200 mV during decel fuel cutoff.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

- High fuel pressure — The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a HO2S DTC may set. Refer to *Fuel System Pressure Test*.
- Fuel injectors contaminated or faulty — Refer to *Fuel Injector Balance Test*.
- Inspect the EVAP Canister for Fuel Saturation. If the EVAP Canister is full of fuel, inspect canister control and hoses. Refer to *EVAP Control System Diagnosis*.
- Disconnect the MAF sensor and see if the rich condition is corrected. If so, replace the MAF sensor.
- Inspect for a leaking fuel pressure regulator diaphragm by inspecting the vacuum line to the fuel pressure regulator for the presence of fuel.
- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine accelerating.
- Shorted HO2S — If the HO2S is internally shorted the HO2S voltage displayed on the scan tool will be over 1 volt. Disconnect the affected HO2S and jumper the HO2S low circuit to ground with the key ON. If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery white deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal or Low Circuit or Faulty HO2S — A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a scan tool. If the HO2S voltage is limited within a range between 300mV to 600mV, inspect the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to step numbers on the diagnostic table:

3. This DTC failing during deceleration fuel mode operation (vehicle speed above 25 mph, TP angle below 3 percent) may indicate a condition described in Diagnostic Aids. If this DTC test passes while the Fail Records conditions are being duplicated, an intermittent condition is indicated. Review the Fail Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.
7. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

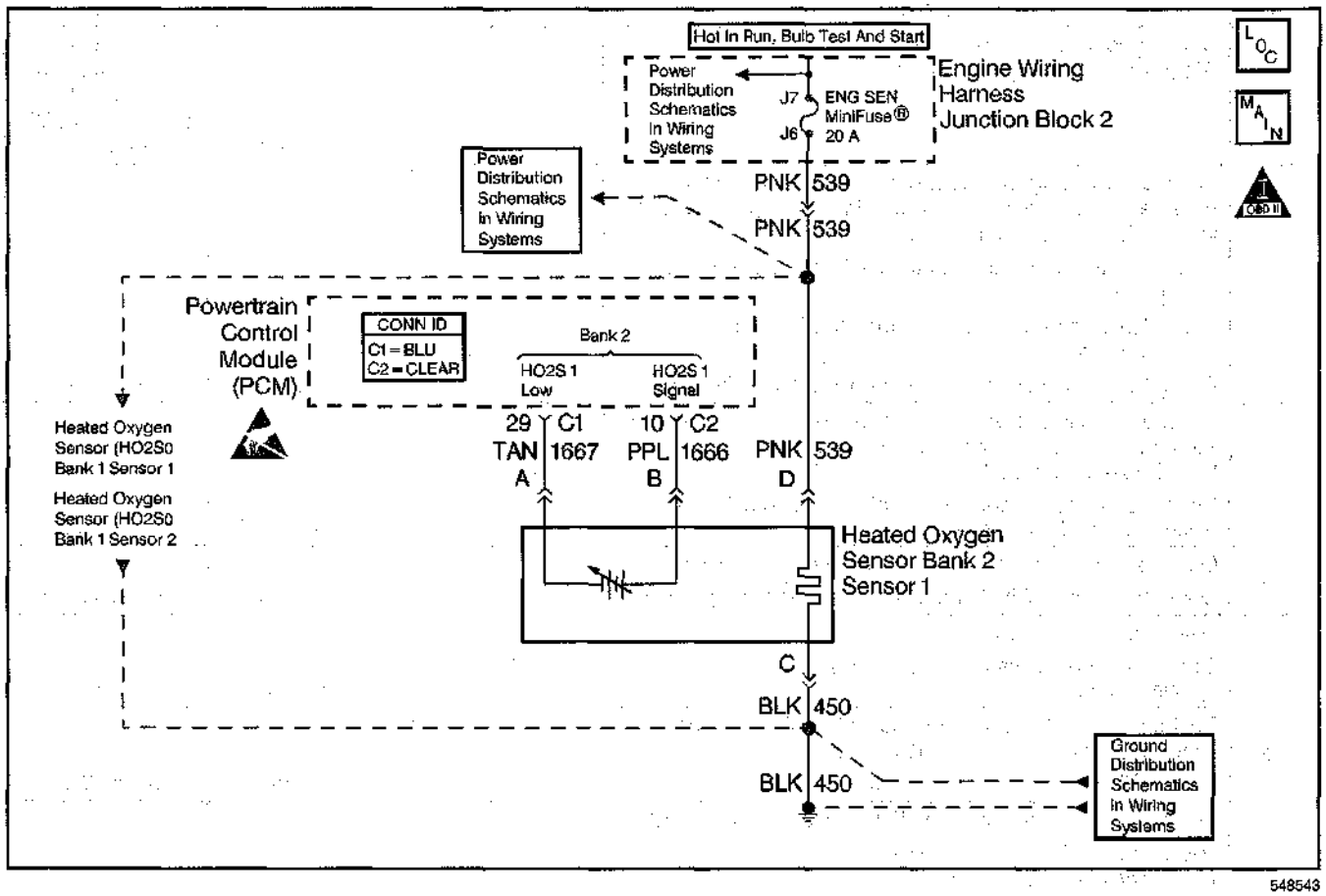
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## DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** During this step, observe all HO2S voltage parameters. If all parameters remain above the specified value refer to Diagnostic Aids.<br>1. Operate the vehicle within the Conditions for Setting parameters.<br>2. With a scan tool, observe the HO2S voltage parameter.<br>Does the HO2S voltage remain above the specified value? | 600 mV | *Go to Step 5* | *Go to Step 3* |
| 3 | Operate vehicle in Decel fuel mode (vehicle speed above 25 mph, TP angle below 3 percent) while observing the HO2S voltage parameter on the scan tool.<br>Does the HO2S voltage remain above the specified value while in Decel fuel mode? | 110 mV | *Go to Step 5* | *Go to Step 4* |
| 4 | Operate the vehicle within the Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 5* | Go to Diagnostic Aids |
| 5 | Disconnect the HO2S.<br>Does scan tool indicate HO2S voltage more than the specified value? | 500 mV | *Go to Step 6* | *Go to Step 8* |
| 6 | Test for a short to voltage on the HO2S signal circuit. Refer to *Circuit Testing* and *Wiring Repairs.*<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 7* |
| 7 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the repair? | — | *Go to Step 9* | — |
| 8 | Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 9* | — |
| 9 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0153 HO2S Slow Response Bank 2 Sensor 1




548543

### Circuit Description

The PCM continuously monitors the heated oxygen sensor (HO2S) activity. The PCM counts the number of times that a rich to lean and a lean to rich response is indicated. Then, the PCM adds the amount of time it took to complete all transitions for a 100 second test period. With this information, an average time for each transition can be determined. If the average response time is too slow, a DTC P0133 will be set. A lean to rich transition is indicated when the HO2S voltage changes from less than 300 mV to more than 600 mV. A rich to lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- The engine coolant temperature is more than 50°C (122°F).
- Engine speed is between 1000 RPM and 3000 RPM.
- Mass air flow is between 10.0 g/s and 30 g/s.

### Conditions for Setting the DTC

H02S lean to rich average transition response time was longer than 63 milliseconds. The rich to lean average transition response time was longer than 190 milliseconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. When the system is operating correctly the HO2S voltage should toggle above and below the specified values.
5. If the low circuit is shorted to ground the HO2S voltage will be less than 400 mV when the signal circuit is jumped to ground.
6. The specified value is what is measured on a correctly operating system.
7. The specified value is what is measured on a correctly operating system.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0153 HO2S Slow Response Bank 2 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set (except HO2S DTCs), refer to other DTCs first before proceeding with this table.<br>1. Engine at operating temperature.<br>2. Operate engine above 1200 RPM for two minutes.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does scan tool indicate HO2S voltage varying outside the specified values? | 400-500 mV | *Go to Step 3* | *Go to Step 4* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect and test for the following:<br>• Exhaust leak. Refer to *Exhaust System Inspection* and *Exhaust Leakage* in Engine Exhaust.<br>• The HO2S is installed correctly.<br>• Damaged wiring. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |

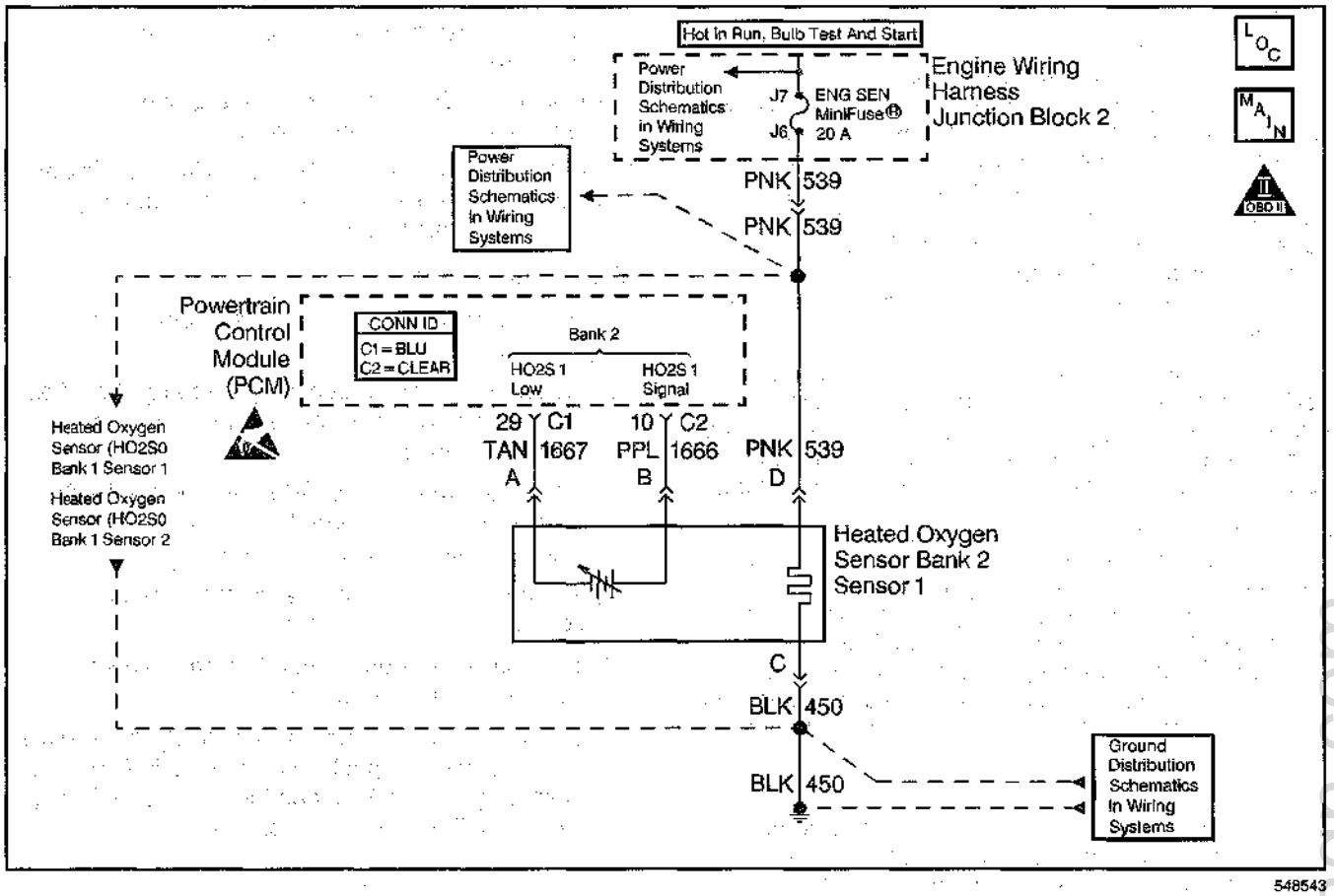
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## DTC P0153 HO2S Slow Response Bank 2 Sensor 1 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Disconnect the HO2S.<br>3. Jumper the signal circuit (PCM side) to a good ground.<br>4. With a scan tool, observe HO2S voltage parameter.<br>Does the scan tool indicate HO2S voltage more than the specified value? | 400 mV | *Go to Step 6* | *Go to Step 10* |
| 6 | 1. Remove the jumper wire.<br>2. Measure the voltage on the HO2S signal circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 4.5V | *Go to Step 7* | *Go to Step 9* |
| 7 | Measure the voltage on the HO2S low circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the low circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Test the low circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 12 | **Important:** Determine the cause of contamination before replacing the sensor.<br>Inspect and test for the following:<br>• Fuel Contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*<br>Engine oil or coolant consumption. Refer to *Oil Consumption Diagnosis* in Engine Mechanical.<br>• Use of improper RTV sealant. Refer to *Silicon Contamination of Heated Oxygen Sensors Notice* in Cautions and Notices.<br>Replace the effected HO2S sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Test for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/ Programming.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Use the scan tool in order to check for DTCs.<br>Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1




### Circuit Description

The PCM supplies a bias voltage of about 450 mV between the HO2S signal and low circuits. When measured with a DMM, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the HO2S voltage remains at or near the 450 mV bias for an extended period of time, this DTC will be set, indicating an open sensor signal or sensor low circuit.

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- Engine has been running for longer than 4 minutes.

### Conditions for Setting the DTC

HO2S signal voltage remains between 400 mV and 500 mV.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

Faulty HO2S heater or heater circuit — With the ignition ON the HO2S voltage displayed on a scan tool should gradually drop to less than 250 mV or rise to more than 600 mV. If not, disconnect the HO2S and connect a test lamp between the HO2S ignition feed and heater ground circuits. If the test lamp does not illuminate, repair the open ignition feed or sensor ground circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. If the test lamp illuminates and the HO2S signal and low circuits are OK, replace the HO2S.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. When the system is operating correctly the HO2S voltage should toggle above and below the specified values.
5. If the low circuit is shorted to ground the HO2S voltage will be less than 400 mV when the signal circuit is jumped to ground.
6. The specified value is what is measured on a correctly operating system.
7. The specified value is what is measured on a correctly operating system.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set (except HO2S DTCs), refer to other DTCs first before proceeding with this table.<br>1. Engine at operating temperature.<br>2. Operate engine above 1200 RPM for two minutes.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does scan tool indicate HO2S voltage varying outside the specified values? | 400-500 mV | *Go to Step 3* | *Go to Step 4* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect and test for the following:<br>• Exhaust leak. Refer to *Exhaust System Inspection* and *Exhaust Leakage* in Engine Exhaust.<br>• The HO2S is installed correctly.<br>• Damaged wiring. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |

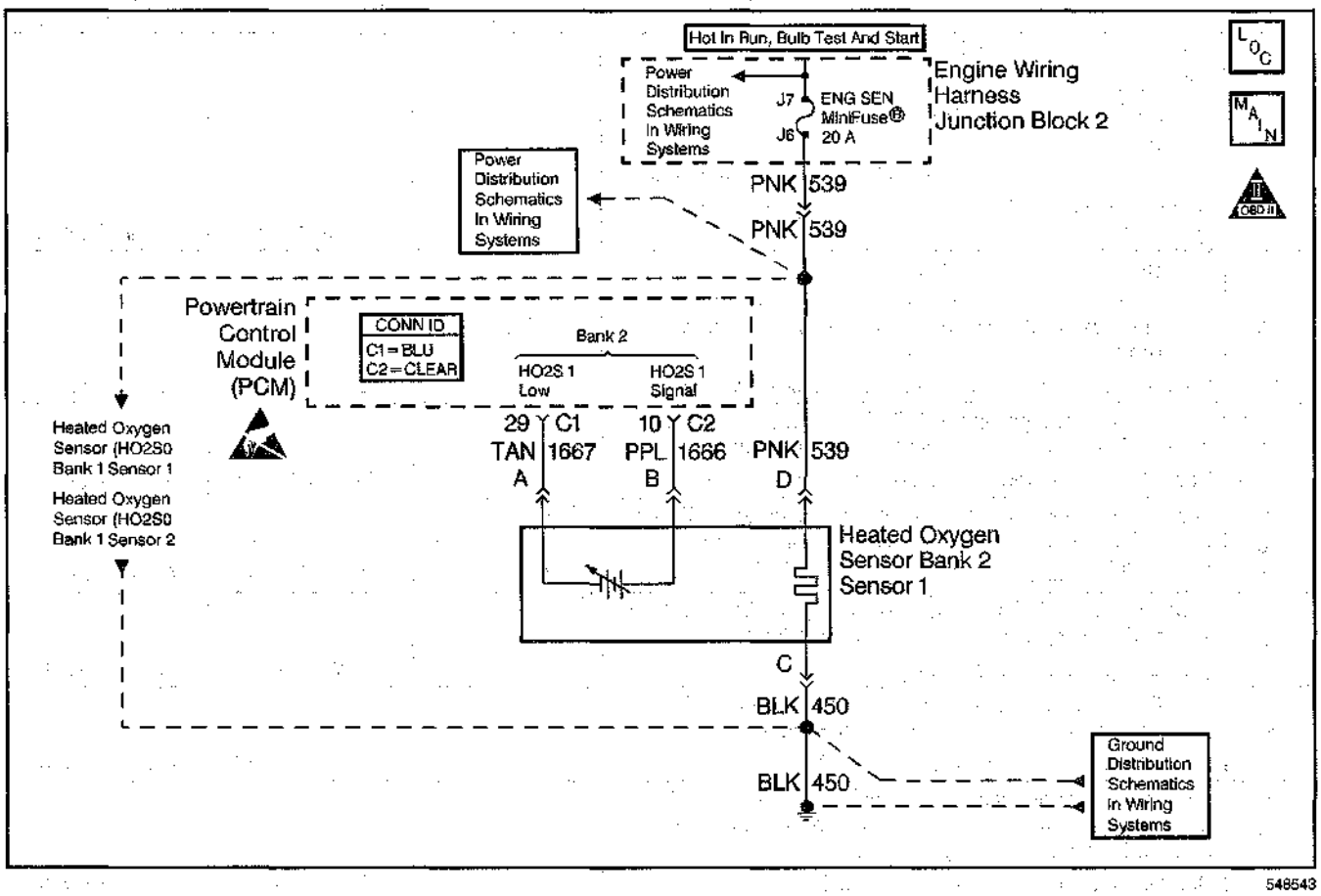
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## DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Disconnect the HO2S.<br>3. Jumper the signal circuit (PCM side) to a good ground.<br>4. With a scan tool, observe HO2S voltage parameter.<br>Does the scan tool indicate HO2S voltage more than the specified value? | 400 mV | *Go to Step 6* | *Go to Step 10* |
| 6 | 1. Remove the jumper wire.<br>2. Measure the voltage on the HO2S signal circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 4.5V | *Go to Step 7* | *Go to Step 9* |
| 7 | Measure the voltage on the HO2S low circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the low circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Test the low circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 12 | **Important:** Determine the cause of contamination before replacing the sensor.<br>Inspect and test for the following:<br>• Fuel Contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*<br>Engine oil or coolant consumption. Refer to *Oil Consumption Diagnosis* in Engine Mechanical.<br>• Use of improper RTV sealant. Refer to *Silicon Contamination of Heated Oxygen Sensors Notice* in Cautions and Notices.<br>Replace the effected HO2S sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Test for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/ Programming.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Use the scan tool in order to check for DTCs.<br>Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0155 HO2S Heater Performance Bank 2 Sensor 1




548543

### Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors to become active. An Oxygen sensor heater is also required by catalyst monitor HO2S to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of startup) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since startup. If the PCM determines that too much time was required for the HO2S to become active, this DTC will set. The time it should take the HO2S to reach operating temperature is based on the engine coolant temperature at start-up and the average mass air flow since startup (higher average airflow or higher startup engine coolant temperature = shorter time to HO2S activity).

### Conditions for Running the DTC

- No Misfire, CKP, Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are present.
- Intake air temperature (IAT) is less than 35°C (95°F) at startup
- Engine coolant temperature (ECT) is less than 35°C (95°F) at startup.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- Average mass air flow for the sample period is less than 20 g/s.
- The system voltage is between 9 and 18 volts.

### Conditions for Setting the DTC

HO2S voltage remains within 150 mV of the bias voltage (about 450 mV) for a longer amount of time than it should. The amount of time ranges between 42 seconds and 2 minutes.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

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### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mv bias voltage.
4. This step ensures that the ignition feed circuit to the HO2S is not open or shorted. The test lamp should be connected to a good ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This step tests the HO2S heater ground circuit.
6. This step checks for an open or shorted HO2S heater element. The heater element resistance will vary according to HO2S temperature (a hot HO2S heater element will measure a much higher resistance than a HO2S heater element at room temperature). It is important to allow the HO2S to cool before measuring HO2S heater element resistance.

### DTC P0155 HO2S Heater Performance Bank 2 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If engine has just been operating, allow engine to cool for about one half hour before proceeding.<br>1. Turn ON the ignition.<br>2. With a scan tool, observe the HO2S voltage parameter.<br>Does HO2S voltage go from bias voltage to more than the first specified value or less than the second specified value? | 600 mV<br>300 mV | Go to Diagnostic Aids | *Go to Step 3* |
| 3 | Inspect the HO2S ignition feed fuse.<br>Is the fuse open? | — | *Go to Step 13* | *Go to Step 4* |

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## DTC P0155 HO2S Heater Performance Bank 2 Sensor 1 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 4 | **Important:** Use a known good ground. Do not use the HO2S heater ground or low circuit.<br>1. Disconnect the HO2S.<br>2. Probe the ignition feed circuit (PCM harness side) using a test lamp that is connected to a good ground<br>Does the test lamp illuminate? | — | *Go to Step 5* | *Go to Step 7* |
| 5 | Connect the test lamp between the HO2S ignition feed circuit and the HO2S heater ground.<br>Does test lamp illuminate? | — | *Go to Step 6* | *Go to Step 8* |
| 6 | 1. Allow the HO2S to cool for at least 10 minutes.<br>2. Measure the resistance between the HO2S ignition feed and HO2S heater ground at the pigtail using a DMM.<br>Does the resistance measure within the specified range? | 5 -10 ohms | *Go to Step 9* | *Go to Step 12* |
| 7 | Repair the open HO2S ignition feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 8 | Repair the open HO2S heater ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 9 | 1. Inspect for a poor connection at the HO2S.<br>2. If a problem is found, repair as necessary. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 10* |
| 10 | Test the HO2S signal and low circuits for an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 11* |
| 11 | Inspect the HO2S signal or low circuits for a poor connection at the PCM and HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring System.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 12* |
| 12 | Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 13 | Repair the short to ground in HO2S ignition feed circuit and replace faulty fuse. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 14 | **Important:** If engine has just been operating, allow engine to cool for about one half hour before proceeding.<br>1. Use the scan tool in order to clear the DTCs.<br>2. Turn ON the ignition.<br>3. With a scan tool, observe the HO2S voltage for at least 2 minutes.<br>Does HO2S voltage go from bias voltage to more than the first specified value or less than the second specified value? | 600 mV<br>300 mV | System OK | *Go to Step 2* |

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## DTC P0171 Fuel Trim System Lean Bank 1

### Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a closed loop air/fuel metering system is used. While in closed loop, the PCM monitors the pre-catalyst HO2S signals and adjusts fuel delivery based upon these voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a scan tool. Ideal fuel trim values are around 0 percent; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values more than 0 percent. If a rich condition is detected, the fuel trim values will be less than 0 percent, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected, the PCM will set this DTC. The PCM s maximum authority to control long term fuel trim allows a range between –20 percent and +20 percent. The PCM s maximum authority to control short term fuel trim allows a range between –20 percent and +20 percent. The PCM monitors fuel trim under various operating conditions (fuel trim cells) before determining the status of the fuel trim diagnostic. The fuel trim cells are as follows:

| Cell | Purge ON | Purge OFF |
|---|---|---|
| Idle (Cell 0) | X | — |
| Decel (Cell 1) | — | — |
| Normal (Cell 2) | X | X |
| Accel (Cell 3) | X | X |
| High Flow (Cell 4) | X | — |

The vehicle may have to be operated in all of the above conditions (marked with X) before the PCM determines fuel trim status. The amount of fuel trim deviates from 0 percent in each cell and the amount that each cell is used directly affects whether or not the vehicle must be operated in all of the cells described above to complete the diagnostic.

**Important:** Some conditions can cause multiple cells to indicate lean.

Below are some examples of why each cell could indicate a lean condition in each cell.

- Idle (Purge ON) - An EVAP system leak, manifold vacuum leak, severe lack of fuel supply, fuel contamination or an exhaust leak.
- Idle (Purge OFF) - A manifold vacuum leak, severe lack of fuel supply, fuel contamination or an exhaust leak.
- Decel (Purge ON) - An EVAP system leak, manifold vacuum leak, fuel contamination or an exhaust leak.
- Decel (Purge OFF) - A manifold vacuum leak, fuel contamination or an exhaust leak.
- Normal (Purge ON or OFF) - A lack of fuel supply, fuel contamination or an exhaust leak.
- Accel (Purge ON or OFF) - A lack of fuel supply, fuel contamination or an exhaust leak.
- High Flow (Purge ON or OFF) - A lack of fuel supply, fuel contamination or an exhaust leak.

Below are some reasons for a lack of fuel supply.

- A faulty or restricted fuel injector.
- A restricted fuel line.
- A faulty or restricted fuel pump.
- A faulty or restricted fuel regulator.
- A restricted fuel filter.

### Conditions for Running the DTC

- No VSS, EST, CKP, CAM, TP, Misfire, Fuel injector, MAF, O2, MAP, EGR, EVAP, ECT or IAT DTCs are set.
- Engine coolant temperature between 20°C (68°F) and 110°C (230°F).
- Intake air temperature is between –18°C (0°F) and 70°C (158°F).
- Manifold absolute pressure is between 15 kPa and 85 kPa.
- Throttle angle is steady and less than 90 percent.
- Vehicle speed is less than 132 km/h (82 mph).
- Engine speed is between 600 and 4000 RPM.
- Baro is more than 70 kPa.
- Air flow is between 3 gm/s and 150 gm/s.

### Conditions for Setting the DTC

- Long term fuel trim average is more than +17 percent and the short term fuel trim average is more than +2 percent of the indicated cells in the Fuel Trim Cell Table.
- All of the conditions described above have been met in the Fuel Trim Cells for more than 1 second.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

- Fuel pressure/flow low – The system will go lean and add fuel during high fuel demand. The Accel and the High Flow cells will increase to more than 0 percent if this condition is present. The PCM can compensate for some decrease. However, if fuel pressure is too low, both DTC P0171 and P0174 may be set. Refer to *Fuel System Pressure Test.*
- Fuel injectors faulty – The system will go lean and add fuel if a fuel injector is not suppling enough fuel. All cells could increase to more than 0 percent depending on the severity of the problem. In most cases high fuel demand cells such as Accel and High Flow will be more likely to show the problem. Refer to *Fuel Injector Balance Test.*
- Vacuum leaks – Inspect for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system and crankcase ventilation system. The Idle cells (Purge ON or OFF) will increase to more than 0 percent if this condition is present.
- EVAP system leaks - Inspect for disconnected or damaged EVAP lines and hoses. The Idle cell with (purge ON) will increase to more than 0 percent if this condition is present.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Inspect for exhaust leaks that may cause a false lean condition to be indicated. All cells could increase to more than 0 percent depending on the severity of the problem.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.* All cells could increase to more than 0 percent depending on the severity of the problem.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step determines whether the fault is present. For any test that requires probing the PCM or a component harness connector, use the Connector Test Adapter Kit. Using this kit prevents damage to the harness connector terminals.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the DTC, the information included in the Freeze Frame and/or Failure Records data can help determine how many miles since the DTC set. The Fail Counter and Pass Counter can also help determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed. For an intermittent condition, refer to Symptoms.
4. If both lean DTCs are set, both banks of the engine are operating lean. Inspect the items that would cause both banks to operate lean.
5. A vacuum leak causes DTCs P0171 and P0174 to set at the same time. Inspect all areas of the engine for a vacuum leak. Also inspect the PCV valve for being the correct one for this application. Make sure the engine oil fill cap is in place and that it is tight. Insure the engine oil dip stick is fully seated.

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## DTC P0171 Fuel Trim System Lean Bank 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any DTCs are set, except P0171 and P0174 refer to those DTCs before proceeding with this table.<br>1. Idle the engine at the normal operating temperature.<br>2. Fuel system in Closed Loop.<br>3. With a scan tool, observe the Long Term FT parameter.<br>Does the scan tool indicate fuel trim less than the specified value indicated? | +17% LT | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. Turn ON the ignition, with the engine OFF.<br>2. Turn OFF the ignition for 15 seconds.<br>3. Start the engine.<br>4. Operate the vehicle within the Conditions for Setting the DTC, and as close to the Failure Records conditions as possible.<br>Does the scan tool indicate that this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Is the other Lean DTC also set? | — | *Go to Step 5* | *Go to Step 6* |
| 5 | Visually/physically inspect the following items:<br>• Vacuum hoses for splits, kinks, and proper connections. Refer to Under Hood Vacuum Hose Routing Diagrams.<br>• Crankcase ventilation valve and/or system for leaks. Refer to *Crankcase Ventilation System Inspection.*<br>• Contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*<br>• PCM and sensor grounds are clean, tight and in the proper locations. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>• Engine mechanical failure. Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical.<br>Did you find any problems in any of the above areas? | — | *Go to Step 7* | Go to *Fuel System Pressure Test* |
| 6 | Visually/physically inspect the following items:<br>• Exhaust leaks, missing or loose exhaust hardware.<br>• HO2S is installed securely and the electrical connector not contacting exhaust system or ignition wires.<br>• Engine mechanical failure. Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical.<br>• Vacuum leaks that will only affect this bank, such as the intake manifold, the injector O-rings, etc.<br>Was a problem found in any of the above areas? | — | *Go to Step 7* | Go to *Fuel System Diagnosis* |
| 7 | Repair or replace any faulty items found.<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does this DTC reset? | — | *Go to Step 2* | *Go to Step 9* |
| 9 | Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0172 Fuel Trim System Rich Bank 1

### Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a closed loop air/fuel metering system is used. While in closed loop, the PCM monitors the pre-catalyst HO2S signals and adjusts fuel delivery based upon these voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a scan tool. Ideal fuel trim values are around 0 percent; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values more than 0 percent. If a rich condition is detected, the fuel trim values will be less than 0 percent, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected, the PCM will set this DTC. The PCM maximum authority to control long term fuel trim allows a range between –20 percent and +20 percent. The PCM s maximum authority to control short term fuel trim allows a range between –20 percent and +20 percent. The PCM monitors fuel trim under various operating conditions (fuel trim cells) before determining the status of the fuel trim diagnostic. The fuel trim cells are as follows:

| Cell | Purge ON | Purge OFF |
|---|---|---|
| Idle (Cell 0) | X | — |
| Decel (Cell 1) | — | — |
| Normal (Cell 2) | X | X |
| Accel (Cell 3) | X | X |
| High Flow (Cell 4) | X | — |

The vehicle may have to be operated in all of the above conditions (marked with X) before the PCM determines fuel trim status. The amount of fuel trim deviates from 0 percent in each cell and the amount that each cell is used directly affects whether or not the vehicle must be operated in all of the cells described above to complete the diagnostic.

**Important:** Some conditions can cause multiple cells to indicate rich

Below are some examples of why a rich condition could exist in the above cells.

- A saturated EVAP canister - This will affect the purge ON cells
- A faulty fuel regulator
- Gas in the oil pan
- A fuel return restriction
- A engine misfire
- A faulty fuel injector
- A restricted exhaust

### Conditions for Running the DTC

- No VSS, EST, CKP, CAM, TP, Misfire, Fuel injector, MAF, O2, MAP, EGR, EVAP, ECT or IAT DTCs are set.
- Engine coolant temperature between 20°C (68°F) and 110°C (230°F).
- Intake air temperature is between –18°C (0°F) and 70°C (158°F).
- Manifold absolute pressure is between 15 kPa and 85 kPa.
- Throttle angle is steady and less than 90 percent.
- Vehicle speed is less than 132 km/h (82 mph).
- Engine speed is between 600 and 4000 RPM.
- Baro is more than 70 kPa.
- Air flow is between 3 gm/s and 150 gm/s.

### Conditions for Setting the DTC

- The long term fuel trim average is at or near maximum authority of –18 percent and the short term average fuel trim is at or near maximum authority of –2 percent of the indicated cells in the Fuel trim table.
- All conditions have been met in the Fuel trim cells for more than 1 second.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

- Fuel pressure high – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0172 and P0175 may set. Refer to *Fuel System Pressure Test.*
- Fuel injectors faulty – Refer to *Fuel Injector Balance Test.*
- Inspect the EVAP Canister for Fuel Saturation. If the EVAP Canister is full of fuel, inspect canister control and hoses. Refer to *EVAP Control System Diagnosis.*
- Inspect for a leaking fuel pressure regulator diaphragm by inspecting the vacuum line to the fuel pressure regulator for the presence of fuel. If there is fuel in the vacuum line, refer to *Fuel System Pressure Test.*
- Fuel in the oil pan - The system will go rich if the large amounts of fuel are purged from the oil pan.
- Engine misfire - The sill go rich due to the lack of complete combustion.
- Poor connection at the PCM - Inspect harness connectors for the following conditions:
- Restricted exhaust - The system could indicate a rich condition. Refer to *Restricted Exhaust System Check.*

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step determines whether the fault is present.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the DTC, the information included in the Freeze Frame and/or Failure Records data can help determine how many miles since the DTC set. The Fail Counter and Pass Counter can also help determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed. For an intermittent condition, refer to Symptoms.
4. If the both rich DTCs are set, both banks are operating rich. Inspect items that would cause both banks to operate rich.
5. Excessive fuel in the oil will cause DTCs P0172 and P0175 to set at the same time. Remove the PCV valve from the intake manifold and plug with a suitable stopper. Also disconnect the fresh air pipe from the rocker cover and plug using a suitable stopper. If the long term and short term fuel trim values increase, indicates there is fuel in the oil.

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## DTC P0172 Fuel Trim System Rich Bank 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any DTCs are set, except P0172 and P0175, refer to those DTCs before proceeding with this table.<br>1. Idle the engine at the normal operating temperature.<br>2. Fuel system in Closed Loop.<br>3. With a scan tool, observe the Long Term FT Bank parameter.<br>Does the scan tool indicate fuel trim more than the specified value indicated? | –18 % LT | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. Turn ON the ignition, with the engine OFF.<br>2. Turn OFF the ignition for 15 seconds.<br>3. Start the engine.<br>4. Operate the vehicle within the Conditions for Setting the DTC, and as close to the Failure Records conditions as possible.<br>Does the scan tool indicate that this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Is the other Rich DTC also set? | — | *Go to Step 5* | *Go to Step 6* |
| 5 | Visually/physically inspect the following items:<br>• Collapsed air intake duct.<br>• The air filter element for being restricted. Refer to *Air Cleaner Element Replacement.*<br>• MAF sensor for being installed in the proper direction and for foreign objects blocking the inlet screen. Refer to *MAF Sensor Replacement.*<br>• For fuel in the pressure regulator hose. Refer to *Fuel Pressure Regulator Replacement.*<br>• For excessive fuel in the crankcase. Change oil as necessary.<br>Was a problem found in any of the above areas? | — | *Go to Step 7* | Go to *Fuel System Pressure Test* |
| 6 | **Important:** When the fuel system check is finished, return to this table.<br>Inspect the injectors for leakage, refer to *Fuel Injector Balance Test.*<br>Are any injectors leaking? | — | *Go to Step 9* | *Go to Step 8* |
| 7 | Repair or replace any faulty items found.<br>Did you complete the repair? | — | *Go to Step 9* | — |
| 8 | Replace the faulty HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the replacement? | — | *Go to Step 9* | — |
| 9 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does this DTC reset? | — | *Go to Step 2* | *Go to Step 10* |
| 10 | Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0174 Fuel Trim System Lean Bank 2

### Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a closed loop air/fuel metering system is used. While in closed loop, the PCM monitors the pre-catalyst HO2S signals and adjusts fuel delivery based upon these voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a scan tool. Ideal fuel trim values are around 0 percent; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values more than 0 percent. If a rich condition is detected, the fuel trim values will be less than 0 percent, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected, the PCM will set this DTC. The PCM s maximum authority to control long term fuel trim allows a range between –20 percent and +20 percent. The PCM s maximum authority to control short term fuel trim allows a range between –20 percent and +20 percent. The PCM monitors fuel trim under various operating conditions (fuel trim cells) before determining the status of the fuel trim diagnostic. The fuel trim cells are as follows:

| Cell | Purge ON | Purge OFF |
|---|---|---|
| Idle (Cell 0) | X | — |
| Decel (Cell 1) | — | — |
| Normal (Cell 2) | X | X |
| Accel (Cell 3) | X | X |
| High Flow (Cell 4) | X | — |

The vehicle may have to be operated in all of the above conditions (marked with X) before the PCM determines fuel trim status. The amount of fuel trim deviates from 0 percent in each cell and the amount that each cell is used directly affects whether or not the vehicle must be operated in all of the cells described above to complete the diagnostic.

**Important:** Some conditions can cause multiple cells to indicate lean.

Below are some examples of why each cell could indicate a lean condition in each cell.

- Idle (Purge ON) - An EVAP system leak, manifold vacuum leak, severe lack of fuel supply, fuel contamination or an exhaust leak.
- Idle (Purge OFF) - A manifold vacuum leak, severe lack of fuel supply, fuel contamination or an exhaust leak.
- Decel (Purge ON) - An EVAP system leak, manifold vacuum leak, fuel contamination or an exhaust leak.
- Decel (Purge OFF) - A manifold vacuum leak, fuel contamination or an exhaust leak.
- Normal (Purge ON or OFF) - A lack of fuel supply, fuel contamination or an exhaust leak.
- Accel (Purge ON or OFF) - A lack of fuel supply, fuel contamination or an exhaust leak.
- High Flow (Purge ON or OFF) - A lack of fuel supply, fuel contamination or an exhaust leak.

Below are some reasons for a lack of fuel supply.

- A faulty or restricted fuel injector
- A restricted fuel line
- A faulty or restricted fuel pump
- A faulty or restricted fuel regulator
- A restricted fuel filter

### Conditions for Running the DTC

- No VSS, EST, CKP, CAM, TP, Misfire, Fuel injector, MAF, O2, MAP, EGR, EVAP, ECT or IAT DTCs are set.
- Engine coolant temperature between 20°C (68°F) and 110°C (230°F).
- Intake air temperature is between –18°C (0°F) and 70°C (158°F).
- Manifold absolute pressure is between 15 kPa and 85 kPa.
- Throttle angle is steady and less than 90 percent.
- Vehicle speed is less than 132 km/h (82 mph).
- Engine speed is between 600 and 4000 RPM.
- Baro is more than 70 kPa.
- Air flow is between 3 gm/s and 150 gm/s.

### Conditions for Setting the DTC

- Long term fuel trim average is more than +17 percent and the short term fuel trim average is more than +2 percent of the indicated cells in the Fuel Trim Cell Table.
- All of the conditions described above have been met in the Fuel Trim Cells for more than 1 second.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

- Fuel pressure/flow low – The system will go lean and add fuel during high fuel demand. The Accel and the High Flow cells will increase to more than 0 percent if this condition is present. The PCM can compensate for some decrease. However, if fuel pressure is too low, both DTC P0171 and P0174 may be set. Refer to *Fuel System Pressure Test*.
- Fuel injectors faulty – The system will go lean and add fuel if a fuel injector is not suppling enough fuel. All cells could increase to more than 0 percent depending on the severity of the problem. In most cases high fuel demand cells such as Accel and High Flow will be more likely to show the problem. Refer to *Fuel Injector Balance Test*.
- Vacuum leaks – Inspect for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system and crankcase ventilation system. The Idle cells (Purge ON or OFF) will increase to more than 0 percent if this condition is present.
- EVAP system leaks - Inspect for disconnected or damaged EVAP lines and hoses. The Idle cell with (purge ON) will increase to more than 0 percent if this condition is present.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Inspect for exhaust leaks that may cause a false lean condition to be indicated. All cells could increase to more than 0 percent depending on the severity of the problem.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. All cells could increase to more than 0 percent depending on the severity of the problem.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step determines whether the fault is present. For any test that requires probing the PCM or a component harness connector, use the Connector Test Adapter Kit. Using this kit prevents damage to the harness connector terminals.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the DTC, the information included in the Freeze Frame and/or Failure Records data can help determine how many miles since the DTC set. The Fail Counter and Pass Counter can also help determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed. For an intermittent condition, refer to Symptoms.
4. If both lean DTCs are set, both banks of the engine are operating lean. Inspect the items that would cause both banks to operate lean.
5. A vacuum leak causes DTCs P0171 and P0174 to set at the same time. Inspect all areas of the engine for a vacuum leak. Also inspect the PCV valve for being the correct one for this application. Make sure the engine oil fill cap is in place and that it is tight. Insure the engine oil dip stick is fully seated.

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## DTC P0174 Fuel Trim System Lean Bank 2

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any DTCs are set, except P0171 and P0174 refer to those DTCs before proceeding with this table.<br>1. Idle the engine at the normal operating temperature.<br>2. Fuel system in Closed Loop.<br>3. With a scan tool, observe the **Long Term FT** parameter.<br>Does the scan tool indicate fuel trim less than the specified value indicated? | +17% LT | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. Turn ON the ignition, with the engine OFF.<br>2. Turn OFF the ignition for 15 seconds.<br>3. Start the engine.<br>4. Operate the vehicle within the Conditions for Setting the DTC, and as close to the Failure Records conditions as possible.<br>Does the scan tool indicate that this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Is the other Lean DTC also set? | — | *Go to Step 5* | *Go to Step 6* |
| 5 | Visually/physically inspect the following items:<br>• Vacuum hoses for splits, kinks, and proper connections. Refer to Under Hood Vacuum Hose Routing Diagrams.<br>• Crankcase ventilation valve and/or system for leaks. Refer to *Crankcase Ventilation System Inspection.*<br>• Contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*<br>• PCM and sensor grounds are clean, tight and in the proper locations. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>• Engine mechanical failure. Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical.<br>Did you find any problems in any of the above areas? | — | *Go to Step 7* | Go to *Fuel System Pressure Test* |
| 6 | Visually/physically inspect the following items:<br>• Exhaust leaks, missing or loose exhaust hardware.<br>• HO2S is installed securely and the electrical connector not contacting exhaust system or ignition wires.<br>• Engine mechanical failure. Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical.<br>• Vacuum leaks that will only affect this bank, such as the intake manifold, the injector O-rings, etc.<br>Was a problem found in any of the above areas? | — | *Go to Step 7* | Go to *Fuel System Diagnosis* |
| 7 | Repair or replace any faulty items found.<br>Did you complete the repair? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does this DTC reset? | — | *Go to Step 2* | *Go to Step 9* |
| 9 | Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0175 Fuel Trim System Rich Bank 2

### Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a closed loop air/fuel metering system is used. While in closed loop, the PCM monitors the pre-catalyst HO2S signals and adjusts fuel delivery based upon these voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a scan tool. Ideal fuel trim values are around 0 percent; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values more than 0 percent. If a rich condition is detected, the fuel trim values will be less than 0 percent, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected, the PCM will set this DTC. The PCM maximum authority to control long term fuel trim allows a range between –20 percent and +20 percent. The PCM s maximum authority to control short term fuel trim allows a range between –20 percent and +20 percent. The PCM monitors fuel trim under various operating conditions (fuel trim cells) before determining the status of the fuel trim diagnostic. The fuel trim cells are as follows:

| Cell | Purge ON | Purge OFF |
|---|---|---|
| Idle (Cell 0) | X | — |
| Decel (Cell 1) | — | — |
| Normal (Cell 2) | X | X |
| Accel (Cell 3) | X | X |
| High Flow (Cell 4) | X | — |

The vehicle may have to be operated in all of the above conditions (marked with X) before the PCM determines fuel trim status. The amount of fuel trim deviates from 0 percent in each cell and the amount that each cell is used directly affects whether or not the vehicle must be operated in all of the cells described above to complete the diagnostic.

**Important:** Some conditions can cause multiple cells to indicate rich

Below are some examples of why a rich condition could exist in the above cells.

- A saturated EVAP canister - This will affect the purge ON cells
- A faulty fuel regulator
- Gas in the oil pan
- A fuel return restriction
- A engine misfire
- A faulty fuel injector
- A restricted exhaust

### Conditions for Running the DTC

- No VSS, EST, CKP, CAM, TP, Misfire, Fuel injector, MAF, O2, MAP, EGR, EVAP, ECT or IAT DTCs are set.
- Engine coolant temperature between 20°C (68°F) and 110°C (230°F).
- Intake air temperature is between –18°C (0°F) and 70°C (158°F).
- Manifold absolute pressure is between 15 kPa and 85 kPa.
- Throttle angle is steady and less than 90 percent.
- Vehicle speed is less than 132 km/h (82 mph).
- Engine speed is between 600 and 4000 RPM.
- Baro is more than 70 kPa.
- Air flow is between 3 gm/s and 150 gm/s.

### Conditions for Setting the DTC

- The long term fuel trim average is at or near maximum authority of –18 percent and the short term average fuel trim is at or near maximum authority of –2 percent of the indicated cells in the Fuel trim table.
- All conditions have been met in the Fuel trim cells for more than 1 second.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

- Fuel pressure high – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0172 and P0175 may set. Refer to *Fuel System Pressure Test*.
- Fuel injectors faulty – Refer to *Fuel Injector Balance Test*.
- Inspect the EVAP Canister for Fuel Saturation. If the EVAP Canister is full of fuel, inspect canister control and hoses. Refer to *EVAP Control System Diagnosis*.
- Inspect for a leaking fuel pressure regulator diaphragm by inspecting the vacuum line to the fuel pressure regulator for the presence of fuel. If there is fuel in the vacuum line, refer to *Fuel System Pressure Test*.
- Fuel in the oil pan - The system will go rich if the large amounts of fuel are purged from the oil pan.
- Engine misfire - The sill go rich due to the lack of complete combustion.
- Restricted exhaust - The system could indicate a rich condition. Refer to *Restricted Exhaust System Check*.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step determines whether the fault is present.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the DTC, the information included in the Freeze Frame and/or Failure Records data can help determine how many miles since the DTC set. The Fail Counter and Pass Counter can also help determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed. For an intermittent condition, refer to Symptoms.
4. If the both rich DTCs are set, both banks are operating rich. Inspect items that would cause both banks to operate rich.
5. Excessive fuel in the oil will cause DTCs P0172 and P0175 to set at the same time. Remove the PCV valve from the intake manifold and plug with a suitable stopper. Also disconnect the fresh air pipe from the rocker cover and plug using a suitable stopper. If the long term and short term fuel trim values increase, indicates there is fuel in the oil.

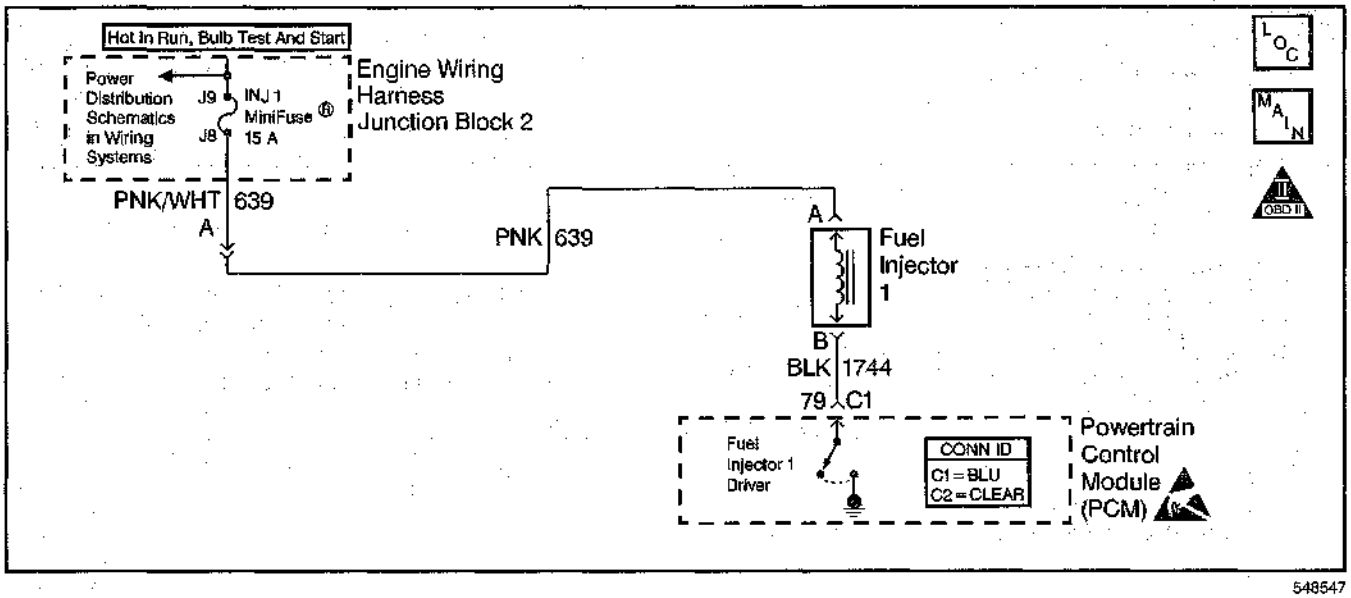
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## DTC P0175 Fuel Trim System Rich Bank 2

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any DTCs are set, except P0172 and P0175, refer to those DTCs before proceeding with this table.<br>1. Idle the engine at the normal operating temperature.<br>2. Fuel system in Closed Loop.<br>3. With a scan tool, observe the Long Term FT Bank parameter.<br>Does the scan tool indicate fuel trim more than the specified value indicated? | –18 % LT | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. Turn ON the ignition, with the engine OFF.<br>2. Turn OFF the ignition for 15 seconds.<br>3. Start the engine.<br>4. Operate the vehicle within the Conditions for Setting the DTC, and as close to the Failure Records conditions as possible.<br>Does the scan tool indicate that this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Is the other Rich DTC also set? | — | *Go to Step 5* | *Go to Step 6* |
| 5 | Visually/physically inspect the following items:<br>• Collapsed air intake duct.<br>• The air filter element for being restricted. Refer to *Air Cleaner Element Replacement.*<br>• MAF sensor for being installed in the proper direction and for foreign objects blocking the inlet screen. Refer to *MAF Sensor Replacement.*<br>• For fuel in the pressure regulator hose. Refer to *Fuel Pressure Regulator Replacement.*<br>• For excessive fuel in the crankcase. Change oil as necessary.<br>Was a problem found in any of the above areas? | — | *Go to Step 7* | Go to *Fuel System Pressure Test* |
| 6 | **Important:** When the fuel system check is finished, return to this table.<br>Inspect the injectors for leakage, refer to *Fuel Injector Balance Test.*<br>Are any injectors leaking? | — | *Go to Step 9* | *Go to Step 8* |
| 7 | Repair or replace any faulty items found.<br>Did you complete the repair? | — | *Go to Step 9* | — |
| 8 | Replace the faulty HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the replacement? | — | *Go to Step 9* | — |
| 9 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does this DTC reset? | — | *Go to Step 2* | *Go to Step 10* |
| 10 | Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0201 Injector 1 Control Circuit




548547

### Circuit Description

The PCM controls the fuel injector control circuit using a Multi Function Driver (MFD). The MFD has the ability to detect an electrical malfunction. If an electrical malfunction is detected, the MFD signals the PCM to set this DTC.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An incorrect voltage level is being detected on the injector driver circuit.
- Above condition for over 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Monitor the injector fault parameter in the scan tool. Move the electrical harnesses for the effected electrical circuit. If the status changes on the scan tool, that may be an indicator where an intermittent fault may be located.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

4. If the scan tool indicates STUCK HIGH there is a short to battery positive voltage on the fuel injector control circuit.
5. If the scan tool indicates STUCK LOW there is an open or a short to ground on the fuel injector control circuit.
6. If the scan tool indicates a STUCK HIGH while cranking, the short to battery positive voltage is between the injector connector and the PCM. If the scan tool indicates STUCK LOW while cranking the problem is within the injector.
9. This step is testing for a short to ground in the circuit.
10. The fuel injector in this circuit will need to be tested after the short to ground is repaired or after the PCM is replaced.
11. This step is testing the function of the PCM. If the test lamp flashes then the PCM is able to supply the ground.
13. This step will find a open between the splice and the injector.
16. This vehicle is equipped with a PCM which utilizes an Electronically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0201 Injector 1 Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Start and idle the engine.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate the vehicle within Fail Record conditions.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| *4* | 1. Start the engine.<br>2. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector.<br>Does scan tool indicate this parameter STUCK HIGH? | — | *Go to Step 6* | *Go to Step 5* |
| *5* | Does the scan tool indicate this parameter STUCK LOW? | — | *Go to Step 9* | Go to Diagnostic Aids |
| *6* | 1. Turn OFF the ignition.<br>2. Disconnect the fuel injector connector.<br>3. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector while cranking the engine.<br>Does the scan tool indicate this parameter STUCK HIGH when the engine is cranking? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | Test for a short to voltage on the control circuit for this injector. Refer to *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 8 | Does the scan tool indicate this parameter STUCK LOW while cranking the engine? | — | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* | — |
| *9* | 1. Disconnect the fuel injector connector.<br>2. Probe the control circuit using a test lamp that is connected to battery positive voltage.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 11* |
| *10* | Test for a short to ground on this injector control circuit. Refer to *Circuit Testing* and *Wiring Repairs*<br>Did you find and correct the conditions? | — | *Go to Step 17* | *Go to Step 16* |

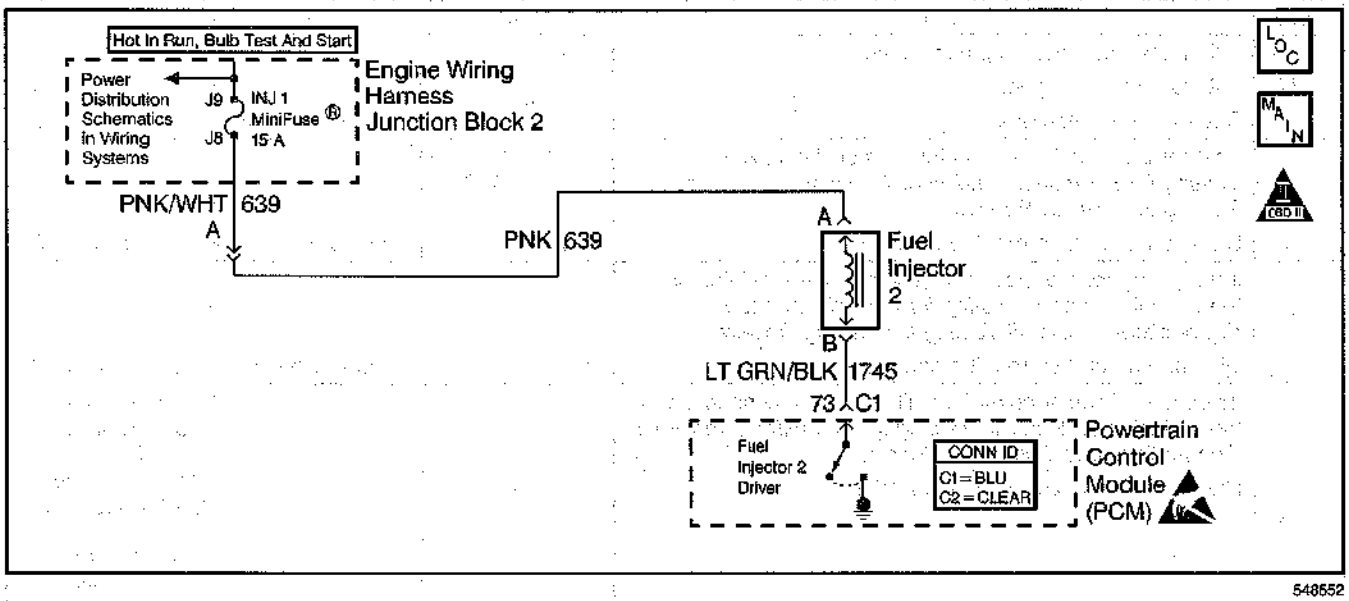
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## DTC P0201 Injector 1 Control Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 11 | 1. Leave the test lamp connected.<br>2. Crank the engine.<br>Does the test lamp flash? | — | Go to Step 13 | Go to Step 12 |
| 12 | Test for an open in the injector control circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | Go to Step 17 | Go to Step 15 |
| 13 | Test for an open or poor connection in the fuel injector feed circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | Go to Step 17 | Go to Step 14 |
| 14 | Inspect the injector control circuit for a poor connection at the fuel injector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | Go to Step 17 | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* |
| 15 | Inspect the injector control circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | Go to Step 17 | Go to Step 16 |
| 16 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | Go to Step 17 | — |
| 17 | 1. Turn ON the ignition, with the engine OFF.<br>2. Use the scan tool in order to clear the DTCs.<br>3. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | Go to Step 2 | System OK |

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## DTC P0202 Injector 2 Control Circuit




### Circuit Description

The PCM controls the fuel injector control circuit using a Multi Function Driver (MFD). The MFD has the ability to detect an electrical malfunction. If an electrical malfunction is detected, the MFD signals the PCM to set this DTC.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An incorrect voltage level is being detected on the injector driver circuit.
- Above condition for over 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Monitor the injector fault parameter in the scan tool. Move the electrical harnesses for the effected electrical circuit. If the status changes on the scan tool, that may be an indicator where an intermittent fault may be located.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

4. If the scan tool indicates STUCK HIGH there is a short to battery positive voltage on the fuel injector control circuit.
5. If the scan tool indicates STUCK LOW there is an open or a short to ground on the fuel injector control circuit.
6. If the scan tool indicates a STUCK HIGH while cranking, the short to battery positive voltage is between the injector connector and the PCM. If the scan tool indicates STUCK LOW while cranking the problem is within the injector.
9. This step is testing for a short to ground in the circuit.
10. The fuel injector in this circuit will need to be tested after the short to ground is repaired or after the PCM is replaced.
11. This step is testing the function of the PCM. If the test lamp flashes then the PCM is able to supply the ground.
13. This step will find a open between the splice and the injector.
16. This vehicle is equipped with a PCM which utilizes an Electronically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0202 Injector 2 Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Start and idle the engine.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate the vehicle within Fail Record conditions.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Start the engine.<br>2. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector.<br>Does scan tool indicate this parameter STUCK HIGH? | — | *Go to Step 6* | *Go to Step 5* |
| 5 | Does the scan tool indicate this parameter STUCK LOW? | — | *Go to Step 9* | Go to Diagnostic Aids |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the fuel injector connector.<br>3. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector while cranking the engine.<br>Does the scan tool indicate this parameter STUCK HIGH when the engine is cranking? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | Test for a short to voltage on the control circuit for this injector. Refer to *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 8 | Does the scan tool indicate this parameter STUCK LOW while cranking the engine? | — | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* | — |
| 9 | 1. Disconnect the fuel injector connector.<br>2. Probe the control circuit using a test lamp that is connected to battery positive voltage.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 11* |
| 10 | Test for a short to ground on this injector control circuit. Refer to *Circuit Testing* and *Wiring Repairs*<br>Did you find and correct the conditions? | — | *Go to Step 17* | *Go to Step 16* |

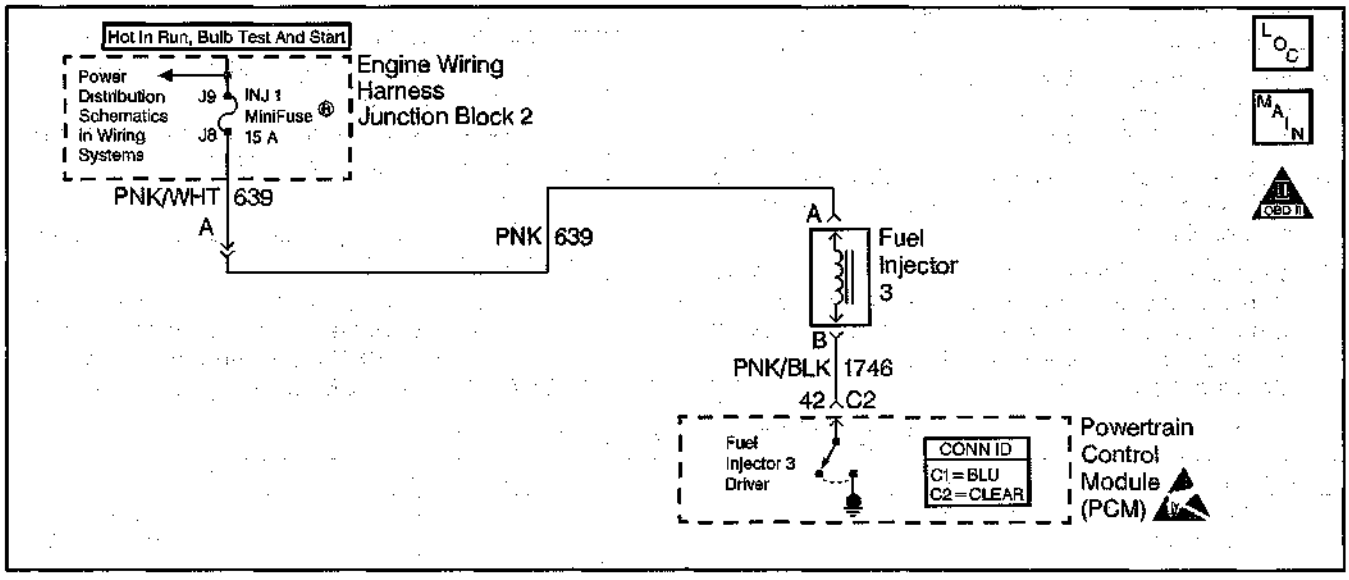
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**DTC P0202 Injector 2 Control Circuit (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 11 | 1. Leave the test lamp connected.<br>2. Crank the engine.<br>Does the test lamp flash? | — | *Go to Step 13* | *Go to Step 12* |
| 12 | Test for an open in the injector control circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 15* |
| 13 | Test for an open or poor connection in the fuel injector feed circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 14* |
| 14 | Inspect the injector control circuit for a poor connection at the fuel injector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* |
| 15 | Inspect the injector control circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 16 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 17 | 1. Turn ON the ignition, with the engine OFF.<br>2. Use the scan tool in order to clear the DTCs.<br>3. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0203 Injector 3 Control Circuit




548554

### Circuit Description

The PCM controls the fuel injector control circuit using a Multi Function Driver (MFD). The MFD has the ability to detect an electrical malfunction. If an electrical malfunction is detected, the MFD signals the PCM to set this DTC.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An incorrect voltage level is being detected on the injector driver circuit.
- Above condition for over 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Monitor the injector fault parameter in the scan tool. Move the electrical harnesses for the effected electrical circuit. If the status changes on the scan tool, that may be an indicator where an intermittent fault may be located.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

4. If the scan tool indicates STUCK HIGH there is a short to battery positive voltage on the fuel injector control circuit.
5. If the scan tool indicates STUCK LOW there is an open or a short to ground on the fuel injector control circuit.
6. If the scan tool indicates a STUCK HIGH while cranking, the short to battery positive voltage is between the injector connector and the PCM. If the scan tool indicates STUCK LOW while cranking the problem is within the injector.
9. This step is testing for a short to ground in the circuit.
10. The fuel injector in this circuit will need to be tested after the short to ground is repaired or after the PCM is replaced.
11. This step is testing the function of the PCM. If the test lamp flashes then the PCM is able to supply the ground.
13. This step will find a open between the splice and the injector.
16. This vehicle is equipped with a PCM which utilizes an Electronically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0203 Injector 3 Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Start and idle the engine.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate the vehicle within Fail Record conditions.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Start the engine.<br>2. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector.<br>Does scan tool indicate this parameter STUCK HIGH? | — | *Go to Step 6* | *Go to Step 5* |
| 5 | Does the scan tool indicate this parameter STUCK LOW? | — | *Go to Step 9* | Go to Diagnostic Aids |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the fuel injector connector.<br>3. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector while cranking the engine.<br>Does the scan tool indicate this parameter STUCK HIGH when the engine is cranking? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | Test for a short to voltage on the control circuit for this injector. Refer to *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 8 | Does the scan tool indicate this parameter STUCK LOW while cranking the engine? | — | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* | — |
| 9 | 1. Disconnect the fuel injector connector.<br>2. Probe the control circuit using a test lamp that is connected to battery positive voltage.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 11* |
| 10 | Test for a short to ground on this injector control circuit. Refer to *Circuit Testing* and *Wiring Repairs*<br>Did you find and correct the conditions? | — | *Go to Step 17* | *Go to Step 16* |

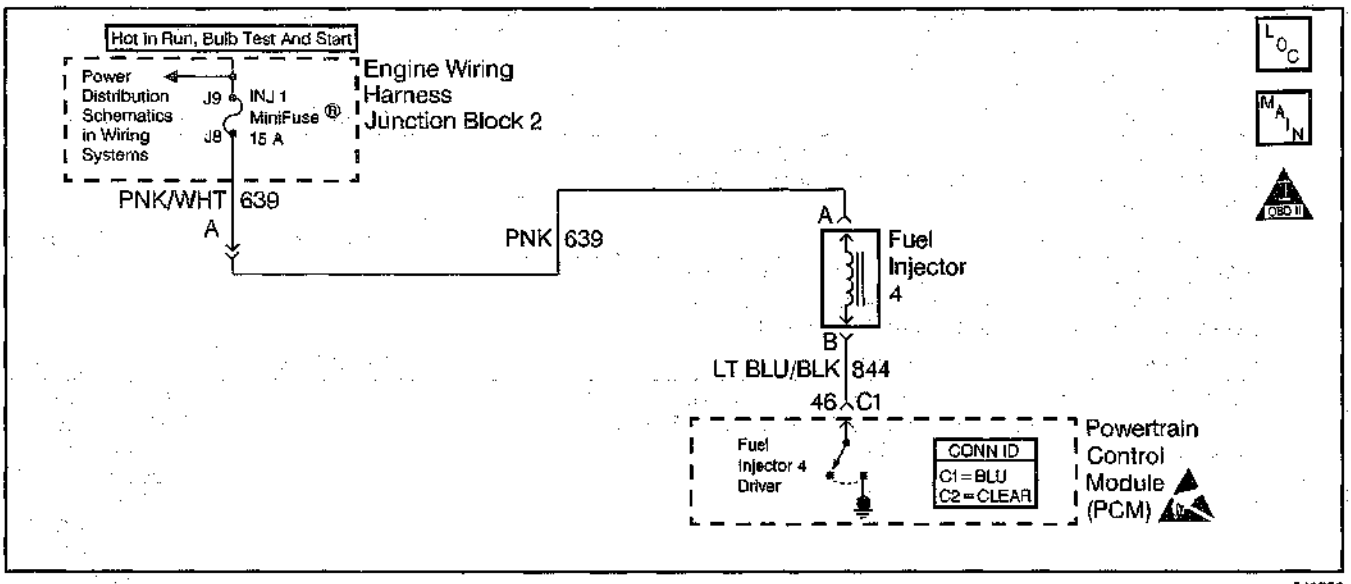
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**DTC P0203 Injector 3 Control Circuit (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 11 | 1. Leave the test lamp connected.<br>2. Crank the engine.<br>Does the test lamp flash? | — | *Go to Step 13* | *Go to Step 12* |
| 12 | Test for an open in the injector control circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 15* |
| 13 | Test for an open or poor connection in the fuel injector feed circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 14* |
| 14 | Inspect the injector control circuit for a poor connection at the fuel injector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* |
| 15 | Inspect the injector control circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 16 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 17 | 1. Turn ON the ignition, with the engine OFF.<br>2. Use the scan tool in order to clear the DTCs.<br>3. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0204 Injector 4 Control Circuit




### Circuit Description

The PCM controls the fuel injector control circuit using a Multi Function Driver (MFD). The MFD has the ability to detect an electrical malfunction. If an electrical malfunction is detected, the MFD signals the PCM to set this DTC.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An incorrect voltage level is being detected on the injector driver circuit.
- Above condition for over 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Monitor the injector fault parameter in the scan tool. Move the electrical harnesses for the effected electrical circuit. If the status changes on the scan tool, that may be an indicator where an intermittent fault may be located.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

4. If the scan tool indicates STUCK HIGH there is a short to battery positive voltage on the fuel injector control circuit.
5. If the scan tool indicates STUCK LOW there is an open or a short to ground on the fuel injector control circuit.
6. If the scan tool indicates a STUCK HIGH while cranking, the short to battery positive voltage is between the injector connector and the PCM. If the scan tool indicates STUCK LOW while cranking the problem is within the injector.
9. This step is testing for a short to ground in the circuit.
10. The fuel injector in this circuit will need to be tested after the short to ground is repaired or after the PCM is replaced.
11. This step is testing the function of the PCM. If the test lamp flashes then the PCM is able to supply the ground.
13. This step will find a open between the splice and the injector.
16. This vehicle is equipped with a PCM which utilizes an Electronically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0204 Injector 4 Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Start and idle the engine.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate the vehicle within Fail Record conditions.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Start the engine.<br>2. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector.<br>Does scan tool indicate this parameter STUCK HIGH? | — | *Go to Step 6* | *Go to Step 5* |
| 5 | Does the scan tool indicate this parameter STUCK LOW? | — | *Go to Step 9* | Go to Diagnostic Aids |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the fuel injector connector.<br>3. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector while cranking the engine.<br>Does the scan tool indicate this parameter STUCK HIGH when the engine is cranking? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | Test for a short to voltage on the control circuit for this injector. Refer to *Circuit Testing* and *Wiring Repairs.*<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 8 | Does the scan tool indicate this parameter STUCK LOW while cranking the engine? | — | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* | — |
| 9 | 1. Disconnect the fuel injector connector.<br>2. Probe the control circuit using a test lamp that is connected to battery positive voltage.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 11* |
| 10 | Test for a short to ground on this injector control circuit. Refer to *Circuit Testing* and *Wiring Repairs*<br>Did you find and correct the conditions? | — | *Go to Step 17* | *Go to Step 16* |

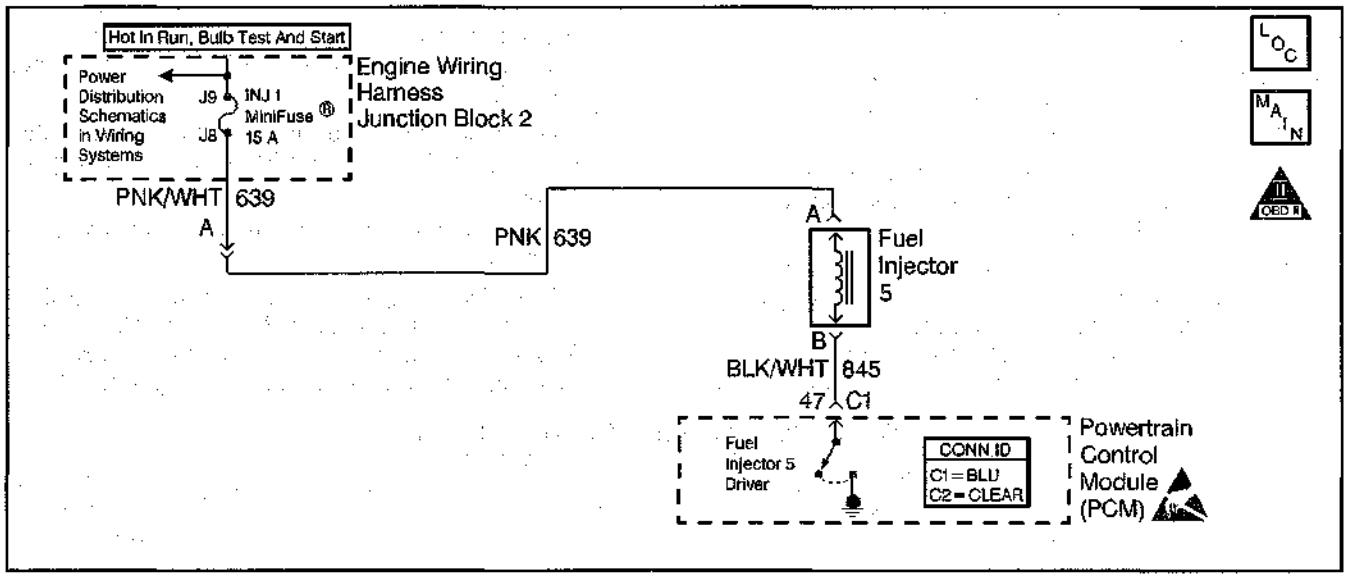
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**DTC P0204 Injector 4 Control Circuit (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 11 | 1. Leave the test lamp connected.<br>2. Crank the engine.<br>Does the test lamp flash? | — | *Go to Step 13* | *Go to Step 12* |
| 12 | Test for an open in the injector control circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 15* |
| 13 | Test for an open or poor connection in the fuel injector feed circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 14* |
| 14 | Inspect the injector control circuit for a poor connection at the fuel injector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* |
| 15 | Inspect the injector control circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 16 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 17 | 1. Turn ON the ignition, with the engine OFF.<br>2. Use the scan tool in order to clear the DTCs.<br>3. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0205 Injector 5 Control Circuit




548560

### Circuit Description

The PCM controls the fuel injector control circuit using a Multi Function Driver (MFD). The MFD has the ability to detect an electrical malfunction. If an electrical malfunction is detected, the MFD signals the PCM to set this DTC.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An incorrect voltage level is being detected on the injector driver circuit.
- Above condition for over 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Monitor the injector fault parameter in the scan tool. Move the electrical harnesses for the effected electrical circuit. If the status changes on the scan tool, that may be an indicator where an intermittent fault may be located.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

4. If the scan tool indicates STUCK HIGH there is a short to battery positive voltage on the fuel injector control circuit.
5. If the scan tool indicates STUCK LOW there is an open or a short to ground on the fuel injector control circuit.
6. If the scan tool indicates a STUCK HIGH while cranking, the short to battery positive voltage is between the injector connector and the PCM. If the scan tool indicates STUCK LOW while cranking the problem is within the injector.
9. This step is testing for a short to ground in the circuit.
10. The fuel injector in this circuit will need to be tested after the short to ground is repaired or after the PCM is replaced.
11. This step is testing the function of the PCM. If the test lamp flashes then the PCM is able to supply the ground.
13. This step will find a open between the splice and the injector.
16. This vehicle is equipped with a PCM which utilizes an Electronically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0205 Injector 5 Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Start and idle the engine.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate the vehicle within Fail Record conditions.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Start the engine.<br>2. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector.<br>Does scan tool indicate this parameter STUCK HIGH? | — | *Go to Step 6* | *Go to Step 5* |
| 5 | Does the scan tool indicate this parameter STUCK LOW? | — | *Go to Step 9* | Go to Diagnostic Aids |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the fuel injector connector.<br>3. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector while cranking the engine.<br>Does the scan tool indicate this parameter STUCK HIGH when the engine is cranking? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | Test for a short to voltage on the control circuit for this injector. Refer to *Circuit Testing* and *Wiring Repairs.*<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 8 | Does the scan tool indicate this parameter STUCK LOW while cranking the engine? | — | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* | — |
| 9 | 1. Disconnect the fuel injector connector.<br>2. Probe the control circuit using a test lamp that is connected to battery positive voltage.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 11* |
| 10 | Test for a short to ground on this injector control circuit. Refer to *Circuit Testing* and *Wiring Repairs*<br>Did you find and correct the conditions? | — | *Go to Step 17* | *Go to Step 16* |

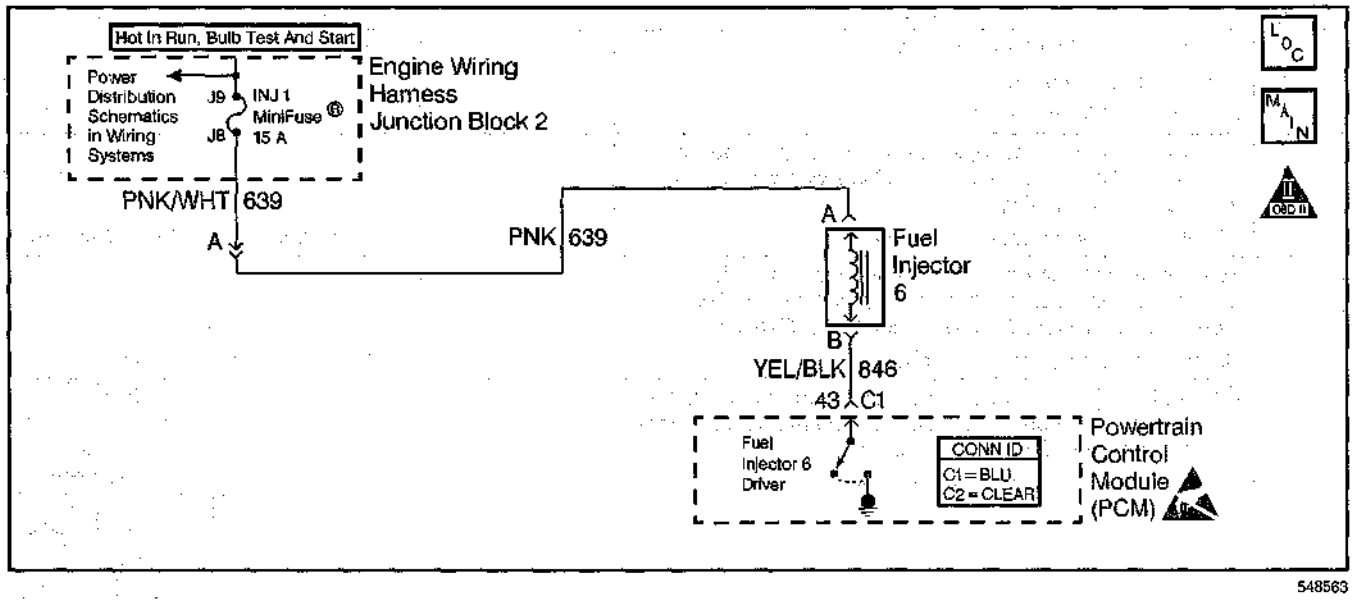
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## DTC P0205 Injector 5 Control Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 11 | 1. Leave the test lamp connected.<br>2. Crank the engine.<br>Does the test lamp flash? | — | Go to Step 13 | Go to Step 12 |
| 12 | Test for an open in the injector control circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | Go to Step 17 | Go to Step 15 |
| 13 | Test for an open or poor connection in the fuel injector feed circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | Go to Step 17 | Go to Step 14 |
| 14 | Inspect the injector control circuit for a poor connection at the fuel injector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | Go to Step 17 | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* |
| 15 | Inspect the injector control circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs*.<br>Did you find and correct the condition? | — | Go to Step 17 | Go to Step 16 |
| 16 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | Go to Step 17 | — |
| 17 | 1. Turn ON the ignition, with the engine OFF.<br>2. Use the scan tool in order to clear the DTCs.<br>3. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | Go to Step 2 | System OK |

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## DTC P0206 Injector 6 Control Circuit




548563

### Circuit Description

The PCM controls the fuel injector control circuit using a Multi Function Driver (MFD). The MFD has the ability to detect an electrical malfunction. If an electrical malfunction is detected, the MFD signals the PCM to set this DTC.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An incorrect voltage level is being detected on the injector driver circuit.
- Above condition for over 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Monitor the injector fault parameter in the scan tool. Move the electrical harnesses for the effected electrical circuit. If the status changes on the scan tool, that may be an indicator where an intermittent fault may be located.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

4. If the scan tool indicates STUCK HIGH there is a short to battery positive voltage on the fuel injector control circuit.
5. If the scan tool indicates STUCK LOW there is an open or a short to ground on the fuel injector control circuit.
6. If the scan tool indicates a STUCK HIGH while cranking, the short to battery positive voltage is between the injector connector and the PCM. If the scan tool indicates STUCK LOW while cranking the problem is within the injector.
9. This step is testing for a short to ground in the circuit.
10. The fuel injector in this circuit will need to be tested after the short to ground is repaired or after the PCM is replaced.
11. This step is testing the function of the PCM. If the test lamp flashes then the PCM is able to supply the ground.
13. This step will find a open between the splice and the injector.
16. This vehicle is equipped with a PCM which utilizes an Electronically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0206 Injector 6 Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Start and idle the engine.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate the vehicle within Fail Record conditions.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Start the engine.<br>2. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector.<br>Does scan tool indicate this parameter STUCK HIGH? | — | *Go to Step 6* | *Go to Step 5* |
| 5 | Does the scan tool indicate this parameter STUCK LOW? | — | *Go to Step 9* | Go to Diagnostic Aids |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the fuel injector connector.<br>3. With a scan tool, observe the Cylinder Injector Ckt. Status parameter for this injector while cranking the engine.<br>Does the scan tool indicate this parameter STUCK HIGH when the engine is cranking? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | Test for a short to voltage on the control circuit for this injector. Refer to *Circuit Testing* and *Wiring Repairs*.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 8 | Does the scan tool indicate this parameter STUCK LOW while cranking the engine? | — | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* | — |
| 9 | 1. Disconnect the fuel injector connector.<br>2. Probe the control circuit using a test lamp that is connected to battery positive voltage.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 11* |
| 10 | Test for a short to ground on this injector control circuit. Refer to *Circuit Testing* and *Wiring Repairs*<br>Did you find and correct the conditions? | — | *Go to Step 17* | *Go to Step 16* |

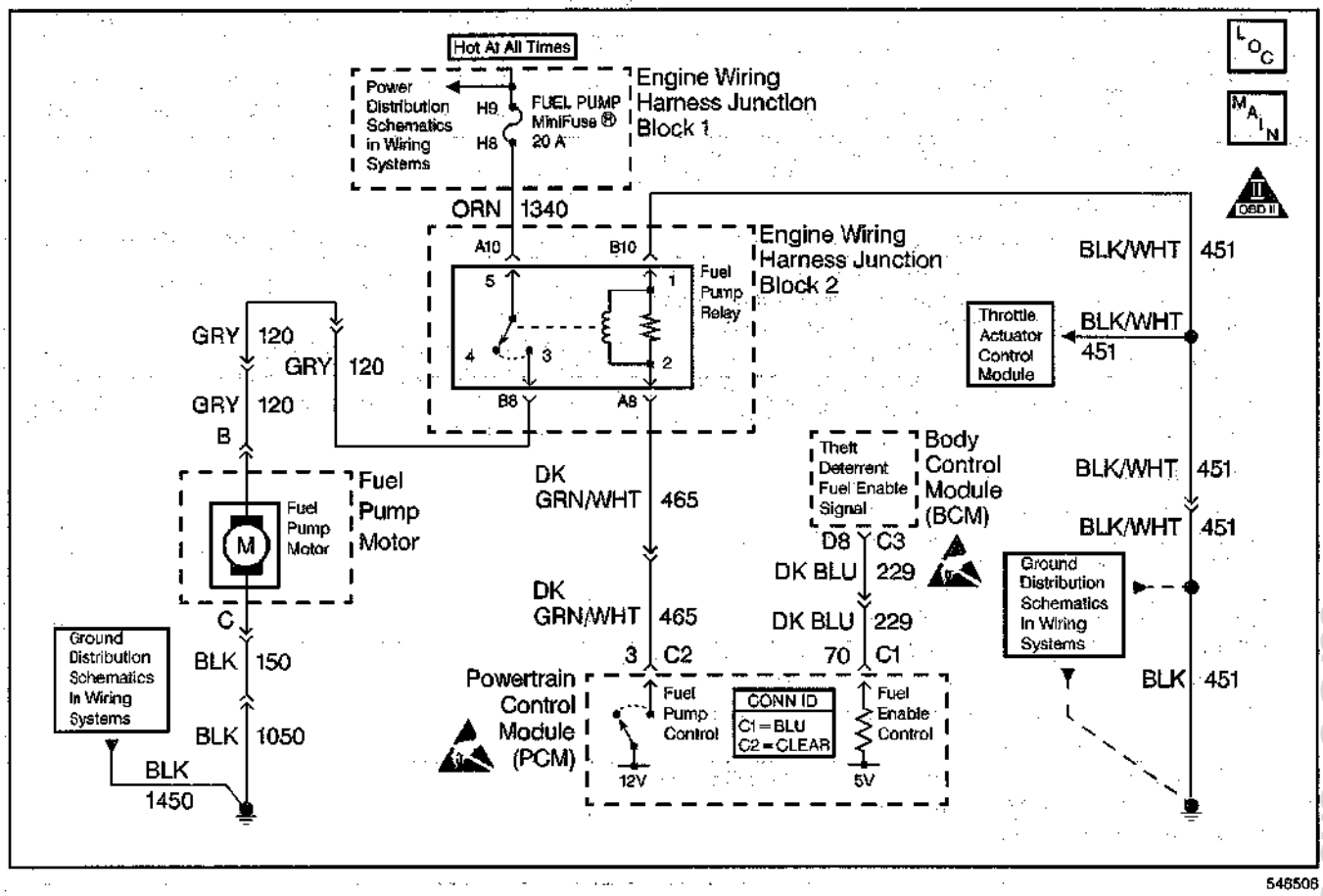
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**DTC P0206 Injector 6 Control Circuit (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 11 | 1. Leave the test lamp connected.<br>2. Crank the engine.<br>Does the test lamp flash? | — | *Go to Step 13* | *Go to Step 12* |
| 12 | Test for an open in the injector control circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs.*<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 15* |
| 13 | Test for an open or poor connection in the fuel injector feed circuit. Refer to *Testing for Intermittent and Poor Connections* or *Circuit Testing* and *Wiring Repairs.*<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 14* |
| 14 | Inspect the injector control circuit for a poor connection at the fuel injector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs.*<br>Did you find and correct the condition? | — | *Go to Step 17* | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* |
| 15 | Inspect the injector control circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs.*<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 16 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 17 | 1. Turn ON the ignition, with the engine OFF.<br>2. Use the scan tool in order to clear the DTCs.<br>3. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0230 Fuel Pump Relay Control Circuit




548508

### Circuit Description

The PCM provides ignition positive voltage to control the fuel pump relay. The PCM has the ability to detect an electrical malfunction on the relay control circuit. When the ignition switch is first turned ON, the PCM energizes the fuel pump relay which applies power to the fuel pump. The fuel pump relay will remain ON as long as the engine is running or cranking and the PCM is receiving reference pulses. If no reference pulses are present, the PCM de-energizes the fuel pump relay within 2 seconds after the ignition is turned ON or the engine is stopped. With the engine stopped, the fuel pump can be turned ON by using the scan tool output controls function. If an electrical malfunction is detected, the PCM will set DTC P0230.

### Conditions for Running the DTC

- The ignition is ON.
- System voltage is between 9 and 18 volts.

### Conditions for Setting the DTC

- The PCM detects an electrical malfunction on the fuel pump relay control circuit.
- The condition is present for more than 30 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and th engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. Listen for an audible click when the relay operates. Command both the ON and OFF states. Repeat the commands as necessary.
3. Verifies that the PCM is providing voltage to the relay.
4. Tests for an open in the ground circuit to the relay.
5. Tests if voltage is constantly being applied to the relay.
12. The PCM utilizes Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

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## DTC P0230 Fuel Pump Relay Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the On-Board (OBD) Diagnostic System Check? | — | Go to *Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, command the fuel pump relay ON and OFF.<br>Does the relay turn ON and OFF with each command? | — | Go to Diagnostic Aids | Go to *Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the relay.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Probe the control circuit of the relay with a test lamp connected to a good ground.<br>5. With a scan tool, command the relay ON and OFF.<br>Does the test lamp turn ON and OFF with each command? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | 1. Connect a test lamp between the control circuit of the relay and the ground circuit of the relay.<br>2. With a scan tool, command the relay ON and OFF.<br>Does the test lamp turn ON and OFF with each command? | — | Go to *Step 8* | Go to *Step 10* |
| 5 | Does the test lamp remain illuminated with each command? | — | Go to *Step 7* | Go to *Step 6* |
| 6 | Test the control circuit of the relay for a short to ground or an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 7 | Test the control circuit of the relay for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 8 | Inspect for poor connections at the relay. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 11* |
| 9 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 12* |
| 10 | Repair the ground circuit of the relay. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Step 13* | — |
| 11 | Replace the relay.<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 12 | **Important:** Perform the set up procedure for the PCM.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 13 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | Go to *Step 2* | System OK |

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## DTC P0300 Engine Misfire Detected

### Circuit Description

The PCM has the ability to detect a misfire by monitoring the 3X reference and camshaft position input signals from the ignition control module. The PCM monitors crankshaft speed variations (reference period differences) to determine if a misfire is occurring. If 2 percent or more of all cylinder firing events are misfires, emission levels may exceed mandated standards. The PCM determines misfire level based on the number of misfire events monitored during a 200 engine revolution test sample. The PCM continuously tracks 16 consecutive 200 revolution test samples. If 11 or more misfires are detected during any 10 of the 16 samples, DTC P0300 will set. If the misfire is large enough to cause possible three-way catalytic converter damage, DTC P0300 may set during the first 200 revolution sample in which the misfire was detected. In the case of a catalyst damaging misfire, the MIL will flash to alert the vehicle operator of the potential of catalyst damage.

### Conditions for Running the DTC

- No VSS, CKP, TP, MAP, ECT, CAM or MAF DTCs are set.
- Engine has been running for more than 5 seconds.
- Engine speed between 550 and 5800 RPM.
- System voltage between 9 and 18 volts.
- The ECT sensor indicates a temperature between -6°C (21°F) and 120°C (248°F).
- Fuel cutoff is not active.
- Fuel level is more than 10 percent.
- Throttle angle is steady.

### Conditions for Setting the DTC

The PCM detects a crankshaft RPM variation indicating a misfire sufficient to cause three-way catalytic converter damage or emissions levels that exceed the mandated standard.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the second consecutive trip in which the diagnostic has been run and failed unless three way converter damage is possible in which case the light will illuminate after the first failure.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control, and the EBTCM will illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

The scan tool provides information that can be useful in identifying the misfiring cylinder. If the DTC P0300 is currently stored as DTC status Failed Since Code Clear, the misfire history counters (Misfire History Cyl #1 - #6) will still contain a value that represents the level of misfire detected on each cylinder. The scan tool displayed misfire counter values (Misfire History Cyl. #1 through #6) can be useful in determining whether the misfire affects a single cylinder, a cylinder pair (cylinders that share an ignition coil - 1/4, 2/5, 3/6), or is random. If the largest amount of activity is isolated to a cylinder pair, inspect for the following:

- Secondary ignition wires.

  Inspect the secondary wires associated with the affected cylinder pair for disconnected ignition wires or for excessive resistance. The wires should measure less than 30,000 ohms (30K ohms).
- Damaged or malfunctioning ignition coil.

  Inspect for cracks, carbon tracking or other damage. Also test coil secondary resistance. Secondary resistance should be between 5000 ohms and 8000 ohms (5K ohms and 8K ohms).
- Substitute a known good coil.

  Switch ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

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If the misfire is random, inspect for the following conditions:

- Crankshaft Position System Variation.

  Refer to *CKP System Variation Learn Procedure.*

  The crankshaft position system variation compensating values are stored in the PCM non-volatile memory after a learn procedure has been performed. If the actual crankshaft position variation is not within the crankshaft position system variation compensating values stored in the PCM, DTC P0300 may set. The crankshaft position system variation learn procedure is required when any of the following service procedures have been performed:
  - PCM replacement or reprogramming
  - Engine replacement
  - Crankshaft replacement
  - Crankshaft balancer replacement
  - Crankshaft position sensor replacement
  - Any engine repairs which disturbs crankshaft/harmonic balancer to crankshaft position sensor relationship.
- System grounds.

  Ensure all connections are clean and properly tightened.
- Mass air flow sensor.

  A Mass air flow (MAF) sensor output that causes the PCM to sense a lower than normal air flow will cause a lean condition. Try operating the vehicle within the fail records conditions with the MAF sensor disconnected. If the lean or misfiring condition is not present with the MAF sensor disconnected, replace the MAF sensor.
- Loss of EBCM/EBTCM Serial Data.

  If the PCM stops receiving data from the EBCM/EBTCM, DTC P0300 can set due to a loss of rough road data. Check for stored ABS/TCS DTCs, especially DTCs related to a serial data malfunction. Refer to *Self-Diagnostics* in ABS/TCS.
- Air Induction System.

  Vacuum leaks that cause intake air to bypass the MAF sensor will cause a lean condition. Inspect for disconnected or damaged vacuum hoses, incorrectly installed or malfunctioning crankcase ventilation valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel Pressure.

  Perform a fuel system pressure test. A malfunctioning fuel pump, plugged filter, or malfunctioning fuel system pressure regulator will contribute to a lean condition.

  Refer to *Fuel System Pressure Test.*
- Fuel injectors

  Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F).*

  Refer to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F).*
- Contaminated Fuel.

  Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*
- EGR System.

  Inspect for leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.
- Extended Idle.

  Excessive open loop operation caused by extended idling or short trip driving may leave deposits on the heated oxygen sensors. The deposits cause oxygen sensors to respond slowly to exhaust oxygen content, affecting fuel control and causing a misfire to be indicated at idle. This condition is not permanent. To determine if this condition is causing the DTC P0300 to be set, review the freeze frame and fail records data for DTC P0300. If the DTC P0300 occurs at high engine speeds, the condition described above did not cause the DTC P0300 to set. If the DTC P0300 occurs at idle or very low engine speeds and at engine coolant temperatures less than 80°C (176°F), the condition described above is very likely the cause of the DTC P0300 being set. The deposits on the heated oxygen sensors can be eliminated by operating the vehicle fully warm at mass air flows more than 15 gm/s.

**Important:** If the level of misfire was sufficient to cause possible catalyst damage (if the MIL was flashing), ensure that the DTC P0420 test is completed and passed after verifying the misfire repair.

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

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. A condition that sets a DTC other than P0300 may also cause a misfire. If any of the indicated DTCs are set with DTC P0300, diagnose and repair the other DTC before using the DTC P0300 table.
3. The Misfire Current Cyl # parameter may normally indicate a small amount of activity (0 – 10 counts) but should not steadily increment during an entire 200 revolution test sample period.
4. Depending on the cause of the misfire, the Misfire History Cyl # counter will indicate a very large number for the misfiring cylinders; values for the non–misfiring cylinders will be less than 1/2 as great as the misfiring cylinders. When investigating a misfire, always start with the components associated with the cylinders that has the largest number of counts stored in the Misfire History Cyl # counter.
5. Steps 5 through 12 test for conditions that can cause a random cylinder misfire.

13. Steps 13 through 22 test for conditions that can cause a non–random or single cylinder misfire.

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## DTC P0300 Engine Misfire Detected

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Is DTC P1380 also set? | — | Go to *DTC P1380 Misfire Detected - Rough Road Data Not Available* | *Go to Step 3* |
| 3 | 1. Start and idle the engine.<br>2. Operate the vehicle within Fail Records conditions.<br>3. With a scan tool, observe the Misfire Current Cyl # parameter for each cylinder.<br>Does the scan tool indicate a current misfire? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | With a scan tool, observe the Misfire History Cyl # parameter.<br>Does the scan tool indicate a large value for more than one cylinder? | — | *Go to Step 5* | *Go to Step 13* |
| 5 | Visually and physically inspect the vacuum hoses/lines for splits, kinks, and improper connections. Refer to *Emission Hose Routing Diagram.*<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 6* |
| 6 | Visually and physically inspect the PCV valve for improper installation and for damaged O–rings. Refer to *Crankcase Ventilation System Inspection.*<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 7* |
| 7 | Inspect the throttle body inlet screen for damage or for the presence of foreign objects that may partially block the air flow sample through the MAF sensor. Refer to *Throttle Body Assembly Replacement* or *Throttle Body Air Inlet Screen Replacement.*<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 8* |
| 8 | Test the fuel pressure. Refer to *Fuel System Pressure Test.*<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 9* |
| 9 | Test the fuel for excessive water, alcohol, or other contaminants. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 10* |
| 10 | Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. Refer to *Ground Distribution Schematics* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 11* |
| 11 | Visually and physically inspect the following areas for vacuum leaks:<br>• Intake manifold<br>• Injector O–rings<br>• EGR adapter<br>• EGR valve<br>• EGR feed pipes<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 12* |

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## DTC P0300 Engine Misfire Detected (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 12 | 1. Remove the EGR valve. Refer to *EGR Valve Replacement.*<br>2. Visually/physically inspect the valve to ensure that the pintle is not sticking partially open. Also, inspect the EGR valve pintle and seat for carbon deposits or burrs that may interfere with the pintle closing completely.<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 13* |
| 13 | Test for proper fuel injector operation. Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F).*<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 14* |
| 14 | Visually and physically inspect the spark plug wires associated with the cylinders which were misfiring to ensure that they are not damaged and are connected to the proper cylinders at the coils and at the spark plugs.<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 15* |
| 15 | 1. Install a *J 26792* spark tester at the spark plug end of the spark plug wire for the cylinder that is indicated by the Misfire Current Cyl # counters or Misfire History Cyl # counters as having the most severe misfire (largest number of counts).<br>2. Jumper the spark plug end of the companion cylinder spark plug wire to engine ground. The companion cylinder is the cylinder that shares the same ignition coil (i.e., 1/4; 2/5; 3/6).<br>3. Crank the engine while observing the spark tester. Spark should be observed.<br>Is spark present? | — | *Go to Step 20* | *Go to Step 16* |
| 16 | **Important:** If carbon tracking or terminal discoloration is apparent at the ignition coil end of any of the spark plug wires, replace the affected ignition wire and the associated ignition coil. Refer to *Ignition Coil(s) Replacement.*<br>1. Remove and visually/physically inspect the spark plug wires associated with the cylinders that were indicated as misfiring. Ensure that the wires and boots are free of carbon tracking and the insulation is not damaged.<br>2. If a problem is found, replace malfunctioning spark plug wires as necessary. Refer to *Spark Plug Wire Harness Replacement (3.8 L Right Bank)* or *Spark Plug Wire Harness Replacement (3.8 L Left Bank)* in Engine Electrical.<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 17* |
| 17 | 1. Measure the resistance of the spark plug wires associated with the cylinders that were indicated as misfiring.<br>2. Replace any spark plug wires that measure more than the specified value. Refer to *Spark Plug Wire Harness Replacement (3.8 L Right Bank)* or *Spark Plug Wire Harness Replacement (3.8 L Left Bank)* in Engine Electrical.<br>Did you find and correct the condition? | 3280-4921 ohms/meter (1000-1500 ohms/ft.) | *Go to Step 25* | *Go to Step 18* |

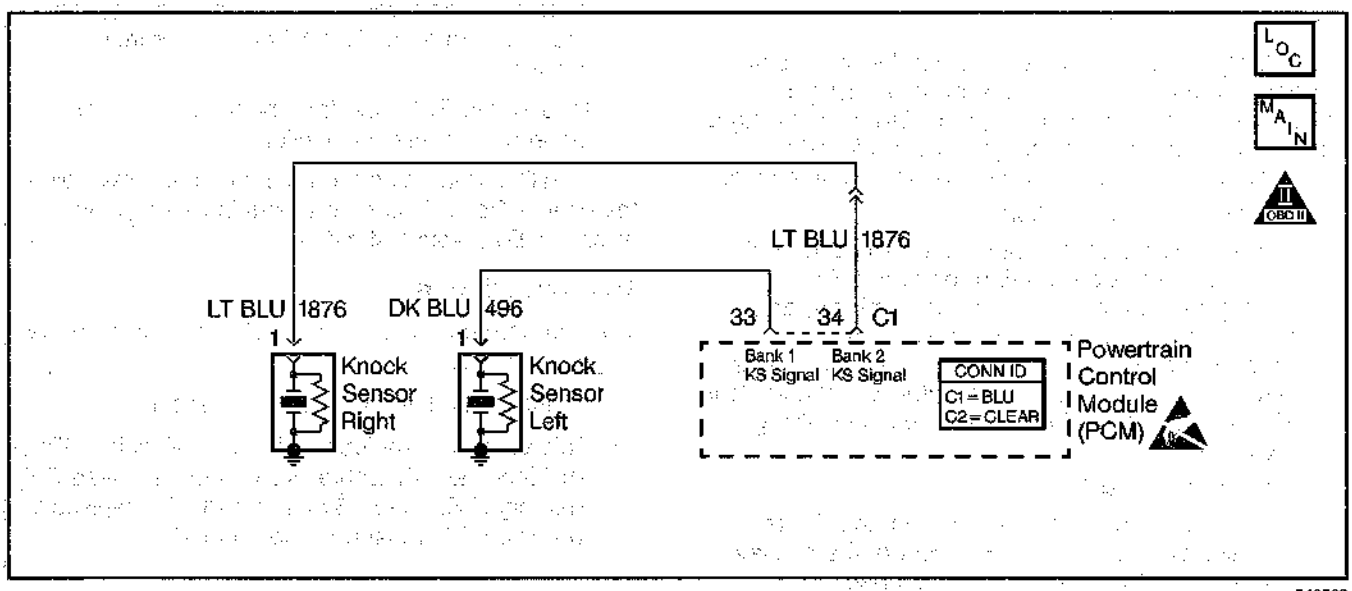
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**DTC P0300 Engine Misfire Detected (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 18 | 1. Remove and visually/physically inspect the ignition coils associated with the cylinders that were indicated as misfiring. Ensure that the coils and coil towers are free of cracks and carbon tracking.<br>2. If a problem is found, replace damaged ignition coils as necessary. Refer to *Ignition Coil(s) Replacement.*<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 19* |
| 19 | 1. Measure the ignition coil secondary resistance.<br>2. If resistance is not between the specified values, replace the faulty ignition coils as necessary. Refer to *Ignition Coil(s) Replacement.*<br>Did you find and correct the condition? | 5K–8K ohms (5000–8000 ohms) | *Go to Step 25* | *Go to Step 24* |
| 20 | 1. Remove the spark plugs from the cylinders that were indicated as misfire.<br>2. Visually inspect the spark plug electrodes for excessive fouling. Refer to *Spark Plug Replacement* in Engine Electrical.<br>Was a problem found? | — | Go to *Base Engine Misfire Diagnosis* in Engine Mechanical | *Go to Step 21* |
| 21 | 1. Visually inspect spark plug insulators for cracks, carbon tracking, or other damage. Also, inspect electrodes for incorrect gap. Refer to *Spark Plug Visual Diagnosis* in Engine Electrical.<br>2. If a problem is found, replace affected spark plugs as necessary. Refer to *Spark Plug Replacement* in Engine Electrical.<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 22* |
| 22 | Inspect for an engine mechanical problem.. Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical.<br>1. Damaged accessory drive belt or pulley.<br>2. Damaged driven accessory (generator, water pump, drive belt tensioner, etc.).<br>3. Loose or broken motor mount.<br>Did you find and correct the condition? | — | *Go to Step 25* | *Go to Step 23* |
| 23 | Test for a transmission TCC problem. Refer to *Diagnostic Trouble Code (DTC) List/Type* in Transmission/Transaxle.<br>Did you find and correct the condition? | — | *Go to Step 25* | Go to Diagnostic Aids |
| 24 | Replace the ignition control module. Refer to *Ignition Control Module Replacement.*<br>Did you complete the replacement? | — | *Go to Step 25* | — |
| 25 | 1. Use the scan tool in order to clear DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>3. With a scan tool, observe the Misfire Current Cylinder # parameter for each cylinder.<br>Does the scan tool indicate a current misfire? | — | *Go to Step 2* | System OK |

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## DTC P0325 Knock Sensor (KS) Circuit




548568

### Circuit Description

The PCM contains integrated knock sensor (KS) diagnostic circuitry. The PCM uses the circuitry to diagnose the KS sensors and related wiring. The PCM calculates an average voltage of each knock sensors signals and takes instantaneous signal voltage readings. The PCM uses the instantaneous signal voltage readings to determine the state of the knock sensor circuitry. If the knock sensor system is operating normally, the PCM should monitor instantaneous KS signal voltage readings varying outside a voltage range is more than and less than the calculated average voltage. If the PCM malfunctions in a manner which will not allow proper diagnosis of the KS circuit DTC P0325 will set.

### Conditions for Running the DTC

- No TP, VSS, CKP sensor, CMP sensor, MAF sensor, or ECT sensor DTCs are set.
- Engine speed is between 1000 and 2500 RPM.
- Throttle angle is more than 10 percent.
- Engine load is more than 45 percent.
- Engine coolant temperature is more than 60°C (140°F).
- Maximum spark retard is less than 15 degrees.
- System voltage is more than 9 volts.

### Conditions for Setting the DTC

- The PCM detects a malfunction in the integrated knock sensor diagnostic circuitry which will not allow proper diagnosis of the knock sensor circuits.
- The condition is present for 300 3X reference periods (100 crankshaft revolutions).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

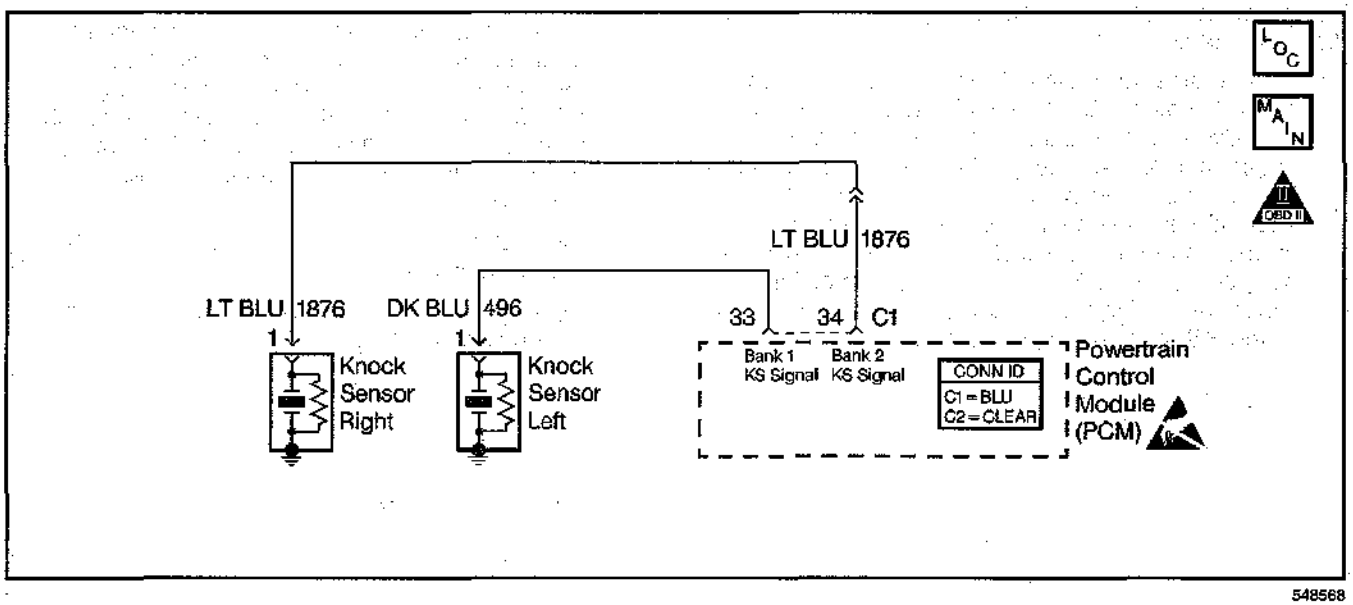
2. Ensures that the malfunction is present.
4. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

**DTC P0325 Knock Sensor (KS) Circuit**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If an engine knock can be heard repair the engine mechanical problem before proceeding with this diagnostic. Refer to *Engine Noise Diagnosis (Base Engine)* in Engine Mechanical.<br>1. Operate the vehicle within Conditions for Setting the DTC.<br>2. With a scan tool, observe Specific DTC info for this DTC until the test runs.<br>Does scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | *Go to Step 3* |
| 3 | 1. Turn ON the ignition, with the engine OFF.<br>2. Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 5* | — |
| 5 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0327 Knock Sensor (KS) Circuit Bank 1




548568

### Circuit Description

The PCM contains integrated knock sensor (KS) diagnostic circuitry. The PCM uses the circuitry to diagnose the KS sensors and related wiring. The PCM calculates an average voltage of each knock sensors signals and takes instantaneous signal voltage readings. The PCM uses the instantaneous signal voltage readings to determine the state of the knock sensor circuitry. If the knock sensor system is operating normally, the PCM should monitor instantaneous KS signal voltage readings varying outside a voltage range above and below the calculated average voltage. If the PCM detects a knock sensor 1 signal voltage within the calculated average voltage range, DTC P0327 will set.

### Conditions for Running the DTC

- No TP, VSS, CKP sensor, CMP sensor, MAF sensor, or ECT sensor DTCs are set.
- Engine speed is between 1000 and 2500 RPM:
- Throttle angle is more than 10 percent.
- Engine load is more than 45 percent.
- Engine coolant temperature is more than 60°C (140°F).
- Maximum spark retard is less than 15 degrees.
- System voltage is more than 9 volts.

### Conditions for Setting the DTC

- The PCM detects a knock sensor 1 signal voltage within the calculated average voltage range.
- The condition is present for 300 3X reference periods (100 crankshaft revolutions).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This verifies the malfunction is present. The scan tool will indicate DTC Ran=Yes and Pass=Int if the failure is intermittent. This indicates the diagnostic passed this ignition cycle and failed this ignition cycle. At this point the resistance of the knock sensors should be verified to be in the correct range. If the knock sensor resistances are correct, test the KS system wiring connections. When inspecting the KS system connections, start at the KS system jumper harness connector located behind the intake manifold. Then inspect the connections at the PCM. Refer to the wiring schematic for the correct connector and terminal. Then inspect the connections at the appropriate knock sensor. Failure Records data does not include the parameter KS Activity, however other parameters may aid in locating the conditions under which an intermittent occurred.
3. This test will isolate the knock sensor from the rest of the circuit.
4. Tap on the engine block in the location of the appropriate knock sensor.

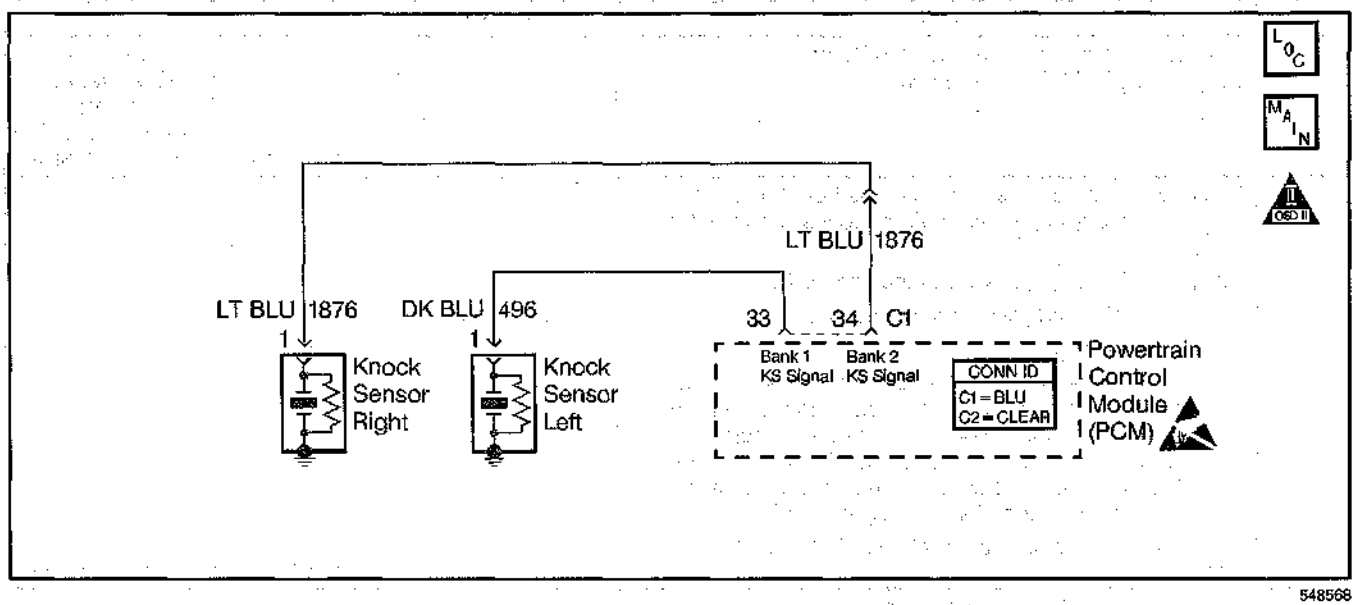
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## DTC P0327 Knock Sensor (KS) Circuit Bank 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If an engine knock can be heard, repair the engine mechanical problem before proceeding with this diagnostic.<br>1. Turn ON the ignition, with the engine OFF.<br>2. Turn OFF the ignition for 15 seconds.<br>3. Start the engine.<br>4. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Fail Records as possible. Special operating conditions that you need to meet before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC.<br>Does the scan tool indicate that this DTC failed this ignition? | — | *Go to Step 3* | Go to Diagnostic Aids |
| 3 | 1. Disconnect the knock sensor.<br>2. Measure the resistance of the appropriate knock sensor by connecting a DMM between the knock sensor signal circuit on the sensor side and the engine block.<br>3. Set the DMM to the 400K ohm scale.<br>Does the resistance measure within the specified range? | 93–107KΩ | *Go to Step 4* | *Go to Step 6* |
| 4 | 1. Connect a DMM between the appropriate knock sensor signal circuit on the sensor side and the engine block.<br>2. Set the DMM to the AC voltage scale.<br>3. Tap on the engine in the area of the appropriate knock sensor while observing the DMM.<br>Does the scan tool indicate a signal while tapping on the engine near the knock sensor? | — | *Go to Step 5* | *Go to Step 6* |
| 5 | Test the KS signal circuit for an open, a short to voltage or a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 7* |
| 6 | Replace the knock sensor. Refer to *Knock Sensor (KS) Replacement.*<br>Did you complete the replacement? | — | *Go to Step 9* | — |
| 7 | Inspect the KS signal circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 8* |
| 8 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/ Programming.*<br>Did you complete the replacement? | — | *Go to Step 9* | — |
| 9 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 10* |
| 10 | Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0332 Knock Sensor (KS) Circuit Bank 2




### Circuit Description

The PCM contains integrated knock sensor (KS) diagnostic circuitry. The PCM uses the circuitry to diagnose the KS sensors and related wiring. The PCM calculates an average voltage of each knock sensors signals and takes instantaneous signal voltage readings. The PCM uses the instantaneous signal voltage readings to determine the state of the knock sensor circuitry. If the knock sensor system is operating normally, the PCM should monitor instantaneous KS signal voltage readings varying outside a voltage range above and below the calculated average voltage. If the PCM detects a knock sensor 2 signal voltage within the calculated average voltage range, DTC P0332 will set.

### Conditions for Running the DTC

- No TP, VSS, CKP sensor, CMP sensor, MAF sensor, or ECT sensor DTCs are set.
- Engine speed is between 1000 and 2500 RPM:
- Throttle angle is more than 10 percent.
- Engine load is more than 45 percent.
- Engine coolant temperature is more than 60°C (140°F).
- Maximum spark retard is less than 15 degrees.
- System voltage is more than 9 volts.

### Conditions for Setting the DTC

- The PCM detects a knock sensor 2 signal voltage within the calculated average voltage range.
- The conditions is present for 300 3X reference periods (100 crankshaft revolutions).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This verifies the malfunction is present. The scan tool will indicate DTC Ran=Yes and Pass=Int if the failure is intermittent. This indicates the diagnostic passed this ignition cycle and failed this ignition cycle. At this point the resistance of the knock sensors should be verified to be in the correct range. If the knock sensor resistances are correct, test the KS system wiring connections. When inspecting the KS system connections, start at the KS system jumper harness connector located behind the intake manifold. Then inspect the connections at the PCM. Refer to the wiring schematic for the correct connector and terminal. Then inspect the connections at the appropriate knock sensor. Failure Records data does not include the parameter KS Activity, however other parameters may aid in locating the conditions under which an intermittent occurred.
3. This test will isolate the knock sensor from the rest of the circuit.
4. Tap on the engine block in the location of the appropriate knock sensor.

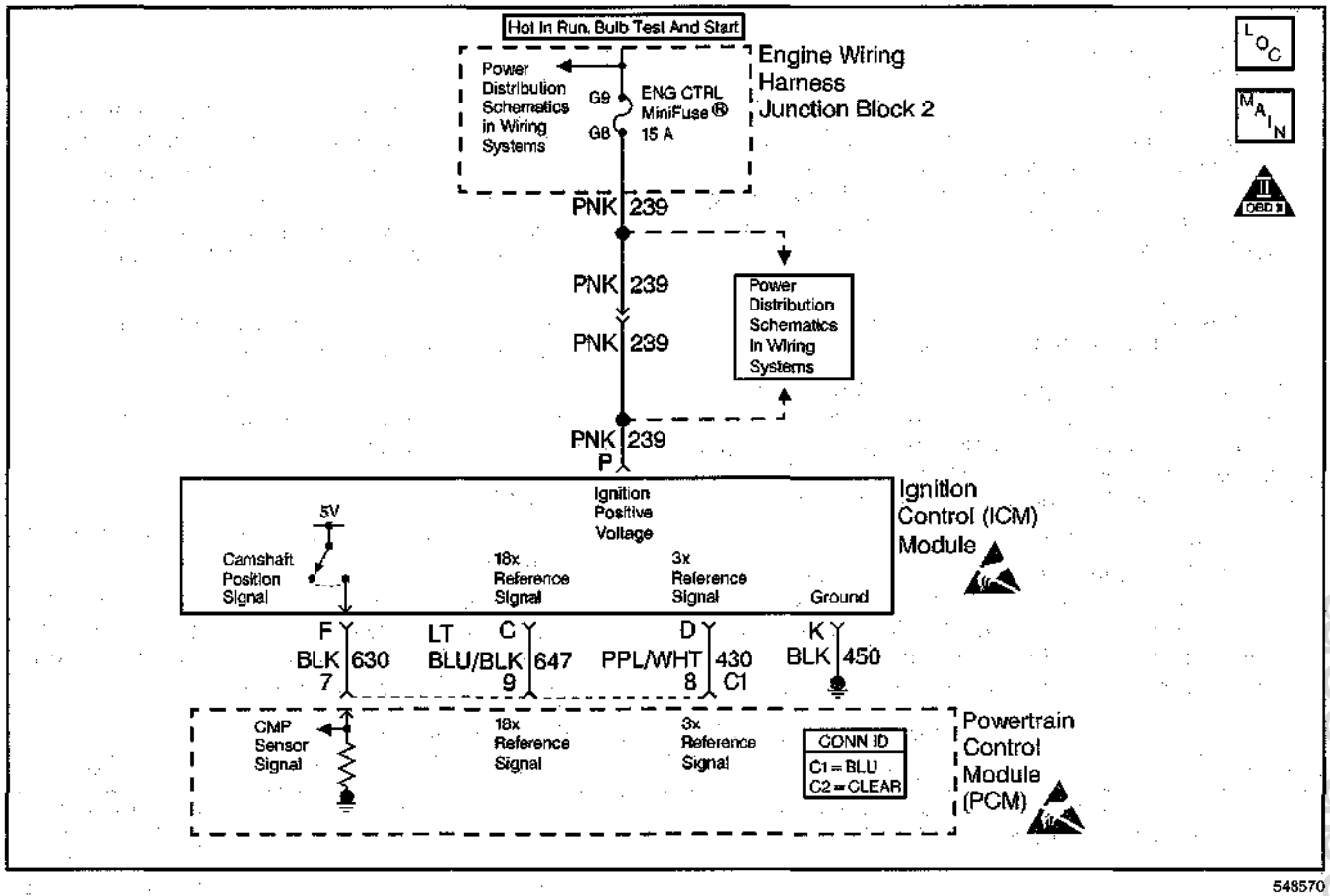
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## DTC P0332 Knock Sensor (KS) Circuit Bank 2

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If an engine knock can be heard, repair the engine mechanical problem before proceeding with this diagnostic.<br>1. Turn ON the ignition, with the engine OFF.<br>2. Turn OFF the ignition for 15 seconds.<br>3. Start the engine.<br>4. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Fail Records as possible. Special operating conditions that you need to meet before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC.<br>Does the scan tool indicate that this DTC failed this ignition? | — | *Go to Step 3* | Go to Diagnostic Aids |
| 3 | 1. Disconnect the knock sensor.<br>2. Measure the resistance of the appropriate knock sensor by connecting a DMM between the knock sensor signal circuit on the sensor side and the engine block.<br>3. Set the DMM to the 400K ohm scale.<br>Does the resistance measure within the specified range? | 93–107KΩ | *Go to Step 4* | *Go to Step 6* |
| 4 | 1. Connect a DMM between the appropriate knock sensor signal circuit on the sensor side and the engine block.<br>2. Set the DMM to the AC voltage scale.<br>3. Tap on the engine in the area of the appropriate knock sensor while observing the DMM.<br>Does the scan tool indicate a signal while tapping on the engine near the knock sensor? | — | *Go to Step 5* | *Go to Step 6* |
| 5 | Test the KS signal circuit for an open, a short to voltage or a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 7* |
| 6 | Replace the knock sensor. Refer to *Knock Sensor (KS) Replacement.*<br>Did you complete the replacement? | — | *Go to Step 9* | — |
| 7 | Inspect the KS signal circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 8* |
| 8 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 9* | — |
| 9 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 10* |
| 10 | Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0336 Crankshaft Position (CKP) Sensor Circuit




### Circuit Description

The 18X reference signal is produced by the ignition control module. The ICM calculates the 18X reference signal by filtering the crankshaft position (CKP) sensor 18X pulses when the engine is running and CKP sync pulses are also being received. The PCM uses the 18X reference signal to calculate engine RPM and crankshaft position at engine speeds less than 1200 RPM. The PCM constantly monitors the number of pulses on the 18X reference circuit and compares the number of 18X reference pulses to the number of 3 X reference pulses and CAM signal pulses being received. If the PCM receives an incorrect number of pulses on the 18X reference circuit, DTC P0336 will set and the PCM will use the 3X reference signal circuit for fuel and ignition control. The engine will continue to start and run using the 3X reference and CAM signals only.

### Conditions for Running the DTC

The engine is running (3X reference pulses are being received).

### Conditions for Setting the DTC

No 18X reference pulses are not received in one engine cycle (720 degrees of crankshaft rotation).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic has been run and failed.
- If equipped with traction control, the PCM will command the electronic brake and traction control module (EBTCM) via the serial data circuit to turn OFF traction control, and the EBTCM will illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

- Incorrect harness routing near secondary ignition components.
- Faulty Ignition Coil - Remove the ignition coils and inspect the ignition control module and coils for cracks, carbon tracking, or other signs that indicate that the coil secondary circuit is arcing to the ICM or ICM wiring harness. Refer to *Ignition Coil(s) Replacement*
- Secondary ignition wires arcing to wiring harness - Inspect secondary ignition wires for carbon tracking or other signs of damage.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

10. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

**DTC P0336 Crankshaft Position (CKP) Sensor Circuit**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Attempt to start the engine.<br>Does the engine start? | — | *Go to Step 3* | Go to *Engine Cranks but Does Not Run* |
| 3 | 1. Clear the DTCs.<br>2. Start the engine and idle for 1 minute.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Test for an open, a short to voltage, or a short to ground in the 18X reference circuit between the ICM and the PCM. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 5* |
| 5 | 1. Turn OFF the ignition.<br>2. Reconnect the ICM.<br>3. Disconnect the crank sensor.<br>4. Connect a test lamp to a good ground.<br>5. Connect a DMM between the 18X reference circuit at the PCM connector and a good ground.<br>6. Turn ON the ignition, with the engine OFF.<br>7. Repeatedly touch the test lamp to the 18X signal circuit at the crank sensor connector while observing the DMM.<br>Does the measured voltage change? | — | *Go to Step 8* | *Go to Step 6* |
| 6 | Test for a short to voltage or poor connections at the ICM. Refer to *Circuit Testing* and *Wiring Repairs* or *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 7* |

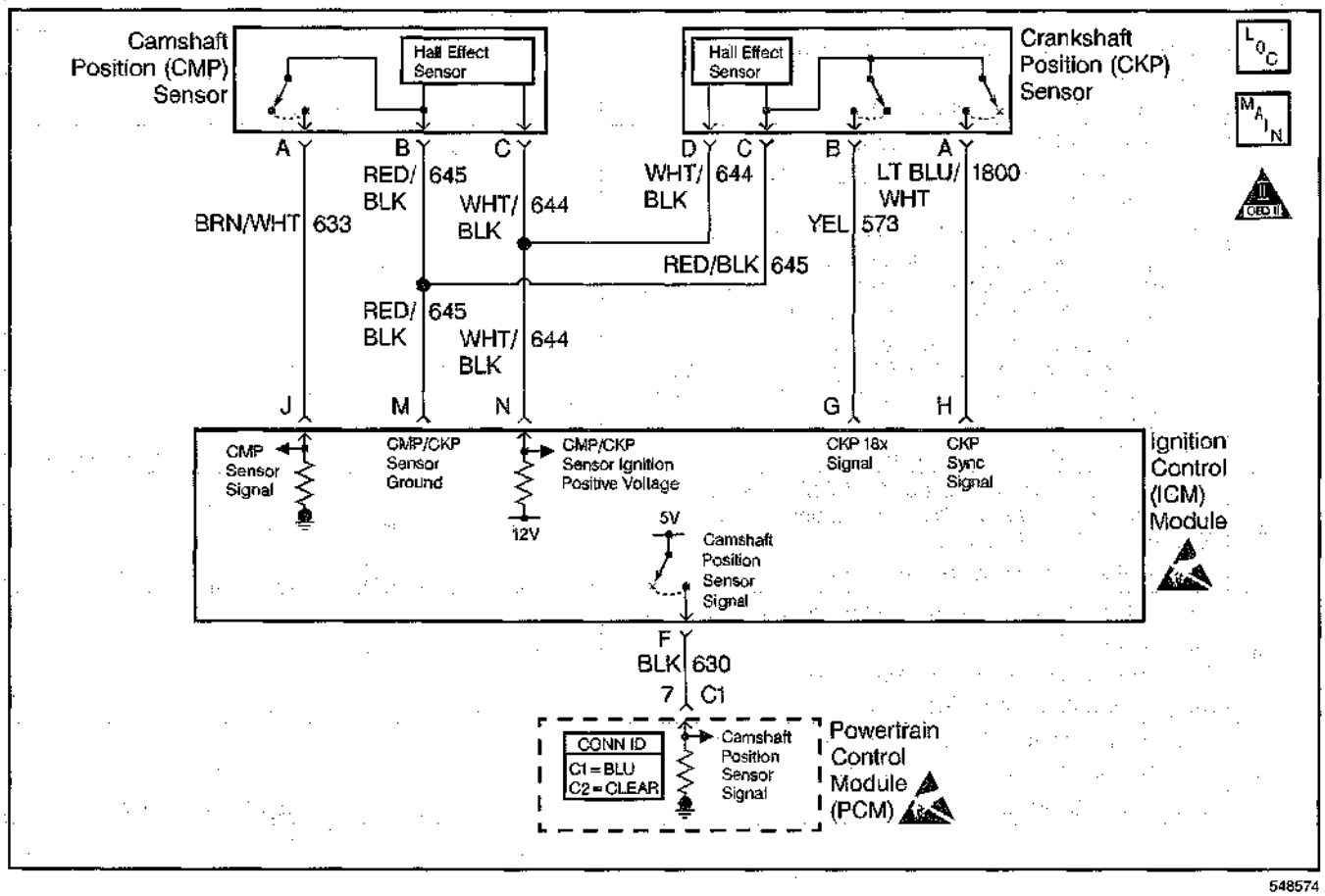
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## DTC P0336 Crankshaft Position (CKP) Sensor Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 7 | Replace the ICM. Refer to *Ignition Control Module Replacement.*<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 8 | Inspect for the following conditions:<br>1. Incorrect harness routing near secondary ignition components.<br>2. Ignition coil arcing to the wiring harness or to the ignition control module (inspect the ignition coils for cracks, carbon tracking, or other signs of damage). Refer to *Ignition Coil(s) Replacement.*<br>3. Spark plug wires arcing. Refer to *Spark Plug Wire Harness Replacement (3.8 L Right Bank)* or *Spark Plug Wire Harness Replacement (3.8 L Left Bank)* in Engine Electrical.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 9* |
| 9 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 10* |
| 10 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 11 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0341 Camshaft Position (CMP) Sensor Performance




548574

### Circuit Description

The camshaft position PCM input is produced by the ignition control module or ICM. The ICM produces the camshaft position PCM input by filtering the camshaft position (CMP) sensor pulses when the engine is running and CKP sync pulses are also being received. The PCM uses the camshaft position PCM input pulses to initiate sequential fuel injection and to determine crankshaft position for the misfire diagnostic. The PCM constantly monitors the number of pulses on the camshaft position PCM input circuit and compares the number of camshaft position PCM input pulses to the number of 18X reference pulses and the number of 3X reference pulses being received. If the PCM receives an incorrect number of pulses on the camshaft position PCM input circuit, DTC P0341 will set and the PCM will initiate injector sequence without the camshaft position PCM input with a one in six chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be disabled.

### Conditions for Running the DTC

The engine is running (3X reference pulses are being received).

### Conditions for Setting the DTC

No cam sensor reference pulses are not received in one engine cycle (720 degrees of crankshaft rotation).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

- Secondary ignition wires arcing to wiring harness - Inspect secondary ignition wires for carbon tracking or other signs of damage.
- Faulty Ignition Coil - Remove the ignition coils and inspect the ignition control module and coils for cracks, carbon tracking, or other signs that indicate that the coil secondary circuit is arcing to the ICM or ICM wiring harness. Refer to *Ignition Coil(s) Replacement*

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**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. Ensures that the fault is present.
21. Determines whether the fault is caused by a missing camshaft magnet or a faulty PCM. The voltage measured in this step should read around 4 volts, toggling to near 0 volts when the CMP sensor interfaces with the camshaft magnet.
22. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

## DTC P0341 Camshaft Position (CMP) Sensor Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | **Important:** If the engine cranks but will not run, refer to *Engine Cranks but Does Not Run.*<br>Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| *2* | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 3* | Go to Diagnostic Aids |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Probe the camshaft position input signal circuit at the PCM connector using a Digital Multimeter that is connected to a good ground.<br>4. Turn ON the ignition.<br>**Important:** If voltage measures 0, bump over engine to insure cam sensor magnet is not located under the cam sensor at the time of this test.<br>5. Observe the voltage indicated on the DMM.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 4* | *Go to Step 5* |
| 4 | 1. Turn OFF the ignition.<br>2. Without disconnecting the CMP harness connector, remove the CMP sensor from the engine front cover.<br>**Important:**<br>• The magnet used must have sufficient power and the correct polarity.<br>• If the voltage remains at 5 volts, retest using the opposite end of the magnet.<br>3. Turn ON the ignition.<br>4. Place a magnet on the CMP sensor.<br>Does the voltage toggle from 5 volts to 0 volts as the magnet is placed on the sensor? | — | *Go to Step 16* | *Go to Step 8* |
| 5 | Does the voltage on the camshaft position input signal circuit measure more than the specified value? | 5V | *Go to Step 7* | *Go to Step 6* |

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## DTC P0341 Camshaft Position (CMP) Sensor Performance (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 6 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Disconnect the ignition control module (ICM).<br>4. Turn ON the ignition.<br>5. Probe the camshaft position input signal circuit and the CMP sensor signal circuit at the ICM using a test lamp that is connected to B+.<br>6. If the test lamp is illuminates, repair the short to ground in the camshaft position input signal circuit or the CMP sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 13* |
| 7 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Disconnect the ICM.<br>4. Turn ON the ignition.<br>5. Probe the camshaft position input signal circuit using a test lamp that is connected to a good ground.<br>6. If the test lamp is illuminates, repair the short to voltage in the camshaft position input signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 18* |
| 8 | 1. Disconnect the CMP sensor.<br>2. Measure the voltage on the sensor feed circuit using a DMM that is connected to the CMP ground circuit.<br>Is the voltage at the specified value? | B+ | *Go to Step 9* | *Go to Step 12* |
| 9 | Measure the voltage on the CMP sensor signal circuit using a DMM that is connected to the CMP ground circuit.<br>Does the voltage measure within the specified range? | 5-7V | *Go to Step 10* | *Go to Step 11* |
| 10 | 1. Measure the voltage on the CMP input signal circuit at the PCM connector using a DMM that is connected to a good ground.<br>2. Observe the voltage while repeatedly touching the CMP sensor signal circuit at the CMP sensor connector using a test lamp that is connected to a good ground.<br>Does the voltage switch between 0 and 5 volts when the test lamp is repeatedly touched to the CMP signal circuit? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for the following conditions:<br>1. The CMP sensor signal circuit for an open, a short to voltage or a short to ground.<br>2. The camshaft position input signal circuit for a short to voltage.<br>Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 14* |
| 12 | Test the following circuits for an open between the ICM and the CMP sensor:<br>1. The sensor feed circuit.<br>2. The sensor ground circuit.<br>Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 14* |
| 13 | Test for an open in the camshaft position input signal circuit between the PCM and the ICM. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 14* |

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## DTC P0341 Camshaft Position (CMP) Sensor Performance (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 14 | Inspect for poor connections at the ICM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 17* |
| 15 | Inspect for poor connections at the CMP sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 19* |
| 16 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 20* |
| 17 | Inspect for the following conditions:<br>1. Incorrect harness routing near secondary ignition components.<br>2. Ignition coil arcing to the wiring harness or to the ignition control module. Inspect ignition coils for cracks, carbon tracking, or other signs of damage. Refer to *Ignition Coil(s) Replacement.*<br>3. Secondary ignition wires arcing to the wiring harness. Refer to *Spark Plug Wire Harness Replacement (3.8 L Right Bank)* in Engine Electrical.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 18* |
| 18 | Replace the ICM. Refer to *Ignition Control Module Replacement.*<br>Did you complete the replacement? | — | *Go to Step 24* | — |
| 19 | Replace the CMP sensor. Refer to *Camshaft Position (CMP) Sensor Replacement.*<br>Did you complete the replacement? | — | *Go to Step 24* | — |
| 20 | Inspect for the following conditions:<br>1. Incorrect harness routing near secondary ignition components.<br>2. Ignition coil arcing to wiring harness or ignition control module. Inspect ignition coils for cracks, carbon tracking, or other signs of damage. Refer to *Ignition Coil(s) Replacement.*<br>3. Secondary ignition wires arcing to wiring harness. Refer to *Spark Plug Wire Harness Replacement (3.8 L Right Bank)* in Engine Electrical.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 21* |
| 21 | 1. Reinstall the CMP sensor to the engine front cover.<br>2. Probe the camshaft position input signal circuit using a DMM that is connected to a good ground.<br>3. Observe the voltage while repeatedly bumping the engine with the starter.<br>Does the voltage toggle between the specified values? | 5V / 0V | *Go to Step 22* | *Go to Step 23* |
| 22 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 24* | — |
| 23 | Replace faulty or missing CMP sensor magnet.<br>Did you complete the replacement? | — | *Go to Step 24* | — |
| 24 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient

### Circuit Description

The PCM tests the EGR system during deceleration by momentarily commanding the EGR valve open while monitoring the manifold absolute pressure (MAP) sensor signal. When the EGR valve is opened, the PCM should see a proportional increase in MAP. If the expected increase in MAP is not seen, the PCM notes the amount of error that was detected and adjusts an internal fail counter towards a fail threshold level. When the fail counter exceeds the fail threshold level, the PCM will set DTC P0401. The number of test samples required to accomplish this may vary according to the amount of detected flow error.

Normally, the PCM will only allow one EGR flow test sample to be taken during an ignition cycle. To aid in verifying a repair, the PCM allows a specified number of test samples during the first ignition cycle following a scan tool Clear Info or a battery disconnect. Between nine and twelve samples should be sufficient for the PCM to determine adequate EGR flow and pass the EGR test if the system is operating correctly.

### Conditions for Running the DTC

- No Fuel Injector, CKP, TP, MAP, VSS, IAT, ECT, IAC, EGR Pintle, Misfire or MAF DTCs set.
- Engine coolant temperature is more than 75°C (167°F).
- RPM is between 900 and 1400 RPM.
- BARO is more than 70 kPa.
- Vehicle speed is more than 40 km/h (25 MPH).
- A/C clutch status is unchanged.
- Transmission status is unchanged.
- Throttle angle is less than 1 percent
- EGR position is less than 1 percent
- MAP, TP, RPM and VSS are steady.

### Conditions for Setting the DTC

MAP changes monitored during the EGR flow test indicate insufficient EGR flow.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** If the EGR valve shows signs of excessive heat, inspect the exhaust system for blockage (possibly a plugged catalytic converter). Refer to *Restricted Exhaust System Check*.

To verify a repair, clear the information with the scan tool and run the EGR flow test keeping the following items in mind:

- The PCM will only run the EGR flow test during a gradual deceleration.
- The PCM will only run the EGR test during a closed throttle condition.
- The PCM will only run the EGR test at vehicle speeds more than 40 km/h (25 mph).
- Several deceleration cycles will be necessary to run a sufficient number of EGR flow test samples (9-12).
- If the engine speed increases more than 100 RPM from the enabling RPM (refer to Conditions for Running the DTC), the PCM will reset the test.
- If the engine speed decreases more than 300 RPM from the enabling RPM (refer to Conditions for Running the DTC), the PCM will reset the test.
- When the PCM commands the EGR valve open engine speed will drop. If the engine speed drops below the following RPM values, the test will not run:
  - Manual Transaxle - 800 RPM.
  - Automatic Transaxle - 700 RPM.
- The EGR Test Counter displayed on the scan tool can be useful in determining that the EGR flow test is running and to keep track of the number of test samples taken. The counter will increment each time a test sample is taken.

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A Vacuum restriction to the MAP sensor - A restriction to the MAP sensor can cause the EGR flow test to fail due to insufficient MAP changes being monitored during the test. Inspect for objects blocking the vacuum to the MAP sensor. Also inspect for kinked or pinched MAP sensor vacuum hoses (if equipped.)

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

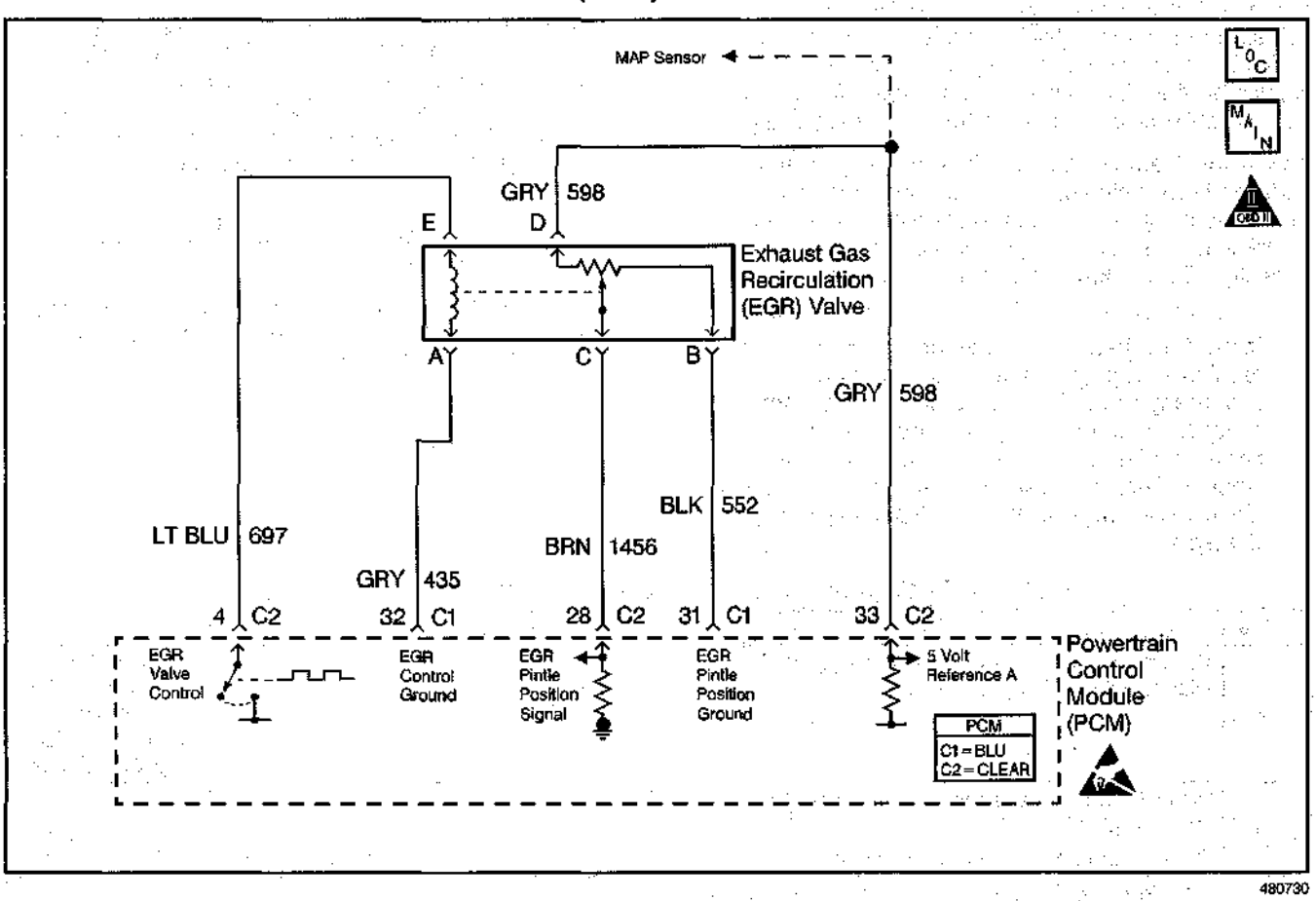
If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

**DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Inspect the exhaust system for modification of original installed parts or leaks.<br>Did you find and correct the condition? | — | *Go to Step 5* | *Go to Step 3* |
| 3 | 1. Remove the EGR valve. Refer to *EGR Valve Replacement.*<br>2. Visually and physically inspect the following items:<br>• The pintle, the valve passages and the adapter for excessive deposits or any kind of a restriction.<br>• the EGR valve gasket and pipes for leaks.<br>Did you find and correct the condition? | — | *Go to Step 5* | *Go to Step 4* |
| 4 | 1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold. Refer to *EGR Valve Replacement.*<br>2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage.<br>Did you find and correct the condition? | — | *Go to Step 5* | Go to Diagnostic Aids |
| 5 | 1. With a scan tool, observe the EGR Test Count parameter.<br>2. Operate the vehicle within the conditions specified in Diagnostic Aids.<br>3. Continue operating the vehicle until 9 -12 EGR Test Count test samples have been taken.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0403 Exhaust Gas Recirculation (EGR) Solenoid Control Circuit




### Circuit Description

The PCM monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM. The Linear EGR valve is controlled by using an ignition positive driver and ground circuit within the PCM. The driver has the ability to detect an electrical malfunction in the ignition positive or ground circuit. If an electrical malfunction occurs, the driver signals the PCM to set DTC P0403.

### Conditions for Running the DTC

The engine is cranking or running.

### Conditions for Setting the DTC

- The PCM detects an electrical malfunction in the control circuit for the EGR valve.
- The condition is present for more than 20 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. Listen for an audible click when the solenoid operates. Command the EGR between 0 percent to 10 percent. Repeat the commands as necessary.
3. Verifies that the PCM is providing voltage to the solenoid.
4. Tests for an open in the ground circuit to the solenoid.
5. Tests if voltage is constantly being applied to the solenoid.

12. The PCM utilizes Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

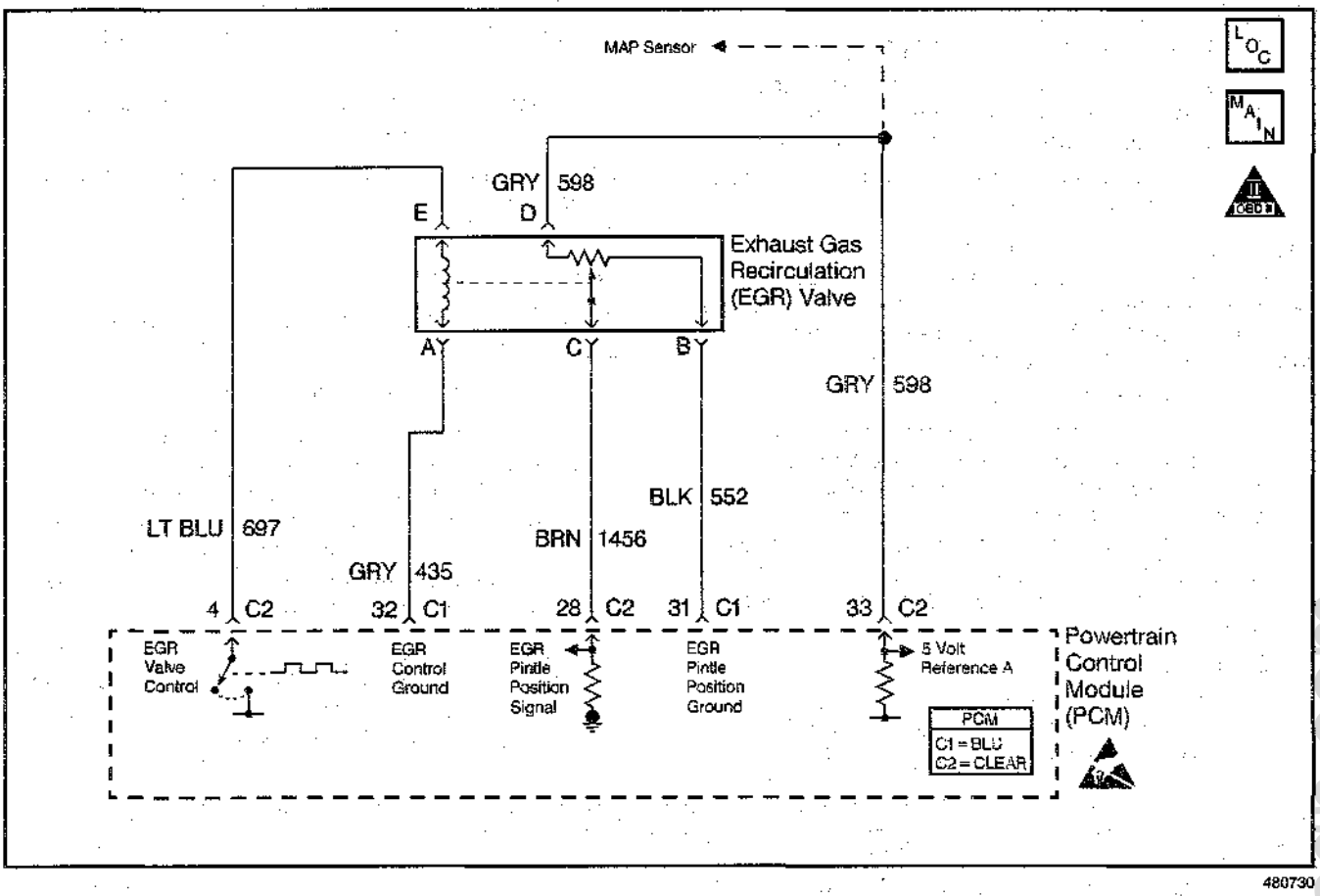
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## DTC P0403 Exhaust Gas Recirculation (EGR) Solenoid Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the On-Board Diagnostic (OBD) System Check? | — | Go to *Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, command the EGR from 0 percent to 10 percent.<br>Does the solenoid turn ON and OFF with each command? | — | Go to Diagnostic Aids | Go to *Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the EGR.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Probe the control circuit of the solenoid using a test lamp that is connected to a good ground.<br>5. With a scan tool, command the EGR between 0 percent and 10 percent.<br>Does the test lamp turn ON and OFF with each command? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | 1. Connect a test lamp between the control circuit of the solenoid and the ground circuit of the solenoid.<br>2. With a scan tool, command the EGR between 0 percent and 10 percent.<br>Does the test lamp turn ON and OFF with each command? | — | Go to *Step 8* | Go to *Step 10* |
| 5 | Does the test lamp remain illuminated with each command? | — | Go to *Step 7* | Go to *Step 6* |
| 6 | Test the control circuit of the solenoid for a short to ground or an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 7 | Test the control circuit of the solenoid for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 8 | Inspect for poor connections at the EGR. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 11* |
| 9 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 12* |
| 10 | Repair the ground circuit of the solenoid. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Step 13* | — |
| 11 | Replace the EGR. Refer to *EGR Valve Replacement.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 12 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 13 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | Go to *Step 2* | System OK |

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## DTC P0404 Exhaust Gas Recirculation (EGR) Open Position Performance




### Circuit Description

The PCM monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM. The PCM compares Actual EGR position with Desired EGR position when the valve is commanded open. If Actual EGR position varies more than 15 percent from Desired EGR position when the PCM is commanding the EGR valve opened, DTC P0404 will set.

### Conditions for Running the DTC

System Voltage is between 10 volts and 16 volts.

### Conditions for Setting the DTC

- Desired EGR does not equal 0.
- Actual EGR position varies more than 15 percent from Desired EGR position.
- The above conditions are present for more than 20 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

- Excessive deposits on the EGR Pintle or seat.

  Remove the EGR valve and inspect for deposits that may interfere with the EGR valve pintle extending completely or cause the pintle to stick.
- A EGR valve over temperature or icing condition could have caused this DTC to set.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. Verifies that the malfunction is present.
3. If DTC P0404 will only set under certain conditions, the malfunction may be intermittent; refer to Diagnostic Aids. If an intermittent wiring problem is not present, check for a poor connection at the PCM or the EGR valve. If the connections are OK and DTC P0404 continues to set, replace the EGR valve.
15. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

### DTC P0404 Exhaust Gas Recirculation (EGR) Open Position Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Was the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any of the following DTCs are set, diagnose the other DTC first.<br>• *DTC P0403 Exhaust Gas Recirculation (EGR) Solenoid Control Circuit*<br>• *DTC P0405 Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage*<br>1. Turn ON the ignition switch.<br>2. Select the scan tool EGR valve output control function.<br>3. Increment the EGR valve through all positions while comparing desired EGR position to actual EGR position.<br>Does desired EGR position remain within 15 percent of actual EGR position at all commanded positions? | — | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. Review and record scan tool Failure Records data.<br>2. Operate the vehicle within Failure Records conditions.<br>3. Using a scan tool, monitor specific DTC info for DTC P0404.<br>Does the scan tool indicate DTC P0404 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the EGR valve.<br>3. Turn ON the ignition, with the engine OFF.<br>Does the pintle position displayed on the scan tool equal the specified value? | 0% | *Go to Step 5* | *Go to Step 7* |

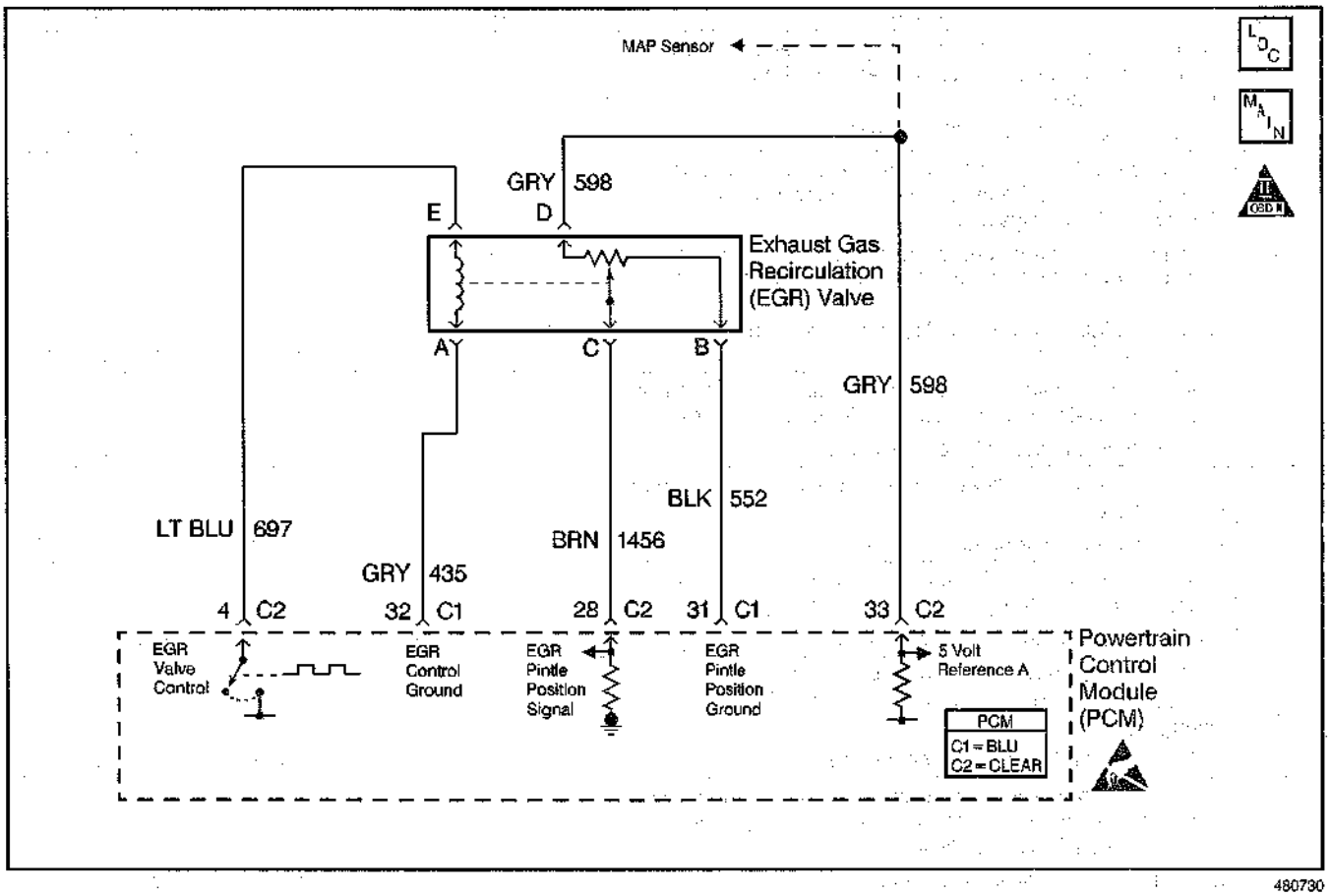
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## DTC P0404 Exhaust Gas Recirculation (EGR) Open Position Performance (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | Connect a DMM to measure voltage between the sensor ground circuit and the 5 volt reference A circuit at the harness connector.<br>Is the voltage at the specified value? | 5V | *Go to Step 6* | *Go to Step 8* |
| 6 | **Important:** If the 3 amp fuse blows, locate and repair a short to ground in the signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Install a 3 amp fused jumper between the 5 volt reference circuit and the signal circuit at the EGR valve harness connector.<br>Does the pintle position displayed on the scan tool equal the specified value? | 100% | *Go to Step 12* | *Go to Step 10* |
| 7 | Test the Signal Circuit for a short to voltage and repair as necessary. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 15* |
| 8 | Connect the DMM between the 5 V reference circuit and a good ground.<br>Is the voltage at the specified value? | 5V | *Go to Step 9* | *Go to Step 11* |
| 9 | Test the sensor ground circuit for an open or short to voltage. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 14* |
| 10 | Test the signal circuit for high resistance or a high resistance short to ground. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 14* |
| 11 | Test the 5 V reference circuit for an open, short to ground, or a short to voltage and repair as necessary. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 14* |
| 12 | 1. Check for poor terminal connections at the EGR valve.<br>2. If a problem is found, repair as necessary. Refer to *Testing for Continuity, Testing for Intermittent and Poor Connections, Repairing Connector Terminals, Connector Repairs* in Wiring Systems.<br>Was a problem found? | — | *Go to Step 16* | *Go to Step 14* |
| 13 | 1. Check the circuits related to the EGR valve for poor terminal connections at the PCM.<br>2. If a problem is found, repair as necessary. Refer to *Testing for Continuity, Testing for Intermittent and Poor Connections, Repairing Connector Terminals, Connector Repairs* in Wiring Systems.<br>Was a problem found? | — | *Go to Step 16* | *Go to Step 15* |
| 14 | Replace the EGR valve. Refer to *EGR Valve Replacement.*<br>Is action complete? | — | *Go to Step 16* | — |
| *15* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Is action complete? | — | *Go to Step 16* | — |
| 16 | 1. Review and record scan tool Failure Records data.<br>2. Clear DTCs.<br>3. Operate the vehicle within Failure Records conditions.<br>4. Using a scan tool, monitor specific DTC info for DTC P0404.<br>Does the scan tool indicate DTC P0404 failed this ignition? | — | *Go to Step 2* | System OK |

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## DTC P0405 Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage




### Circuit Description

The PCM monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM and to detect a fault if the pintle position sensor circuit is open or shorted. If the PCM detects an excessively low EGR Feedback signal voltage, DTC P0405 will set.

### Conditions for Running the DTC

System voltage is more than 10 volts.

### Conditions for Setting the DTC

- EGR Feedback is less than 0.14 volts at any time.
- The condition is present for longer than 20 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

A EGR valve icing or over temperature condition could have caused this DTC to set.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

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- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. Verifies that the malfunction is present.
3. If DTC P0405 will only set under certain conditions, the malfunction may be intermittent; refer to Diagnostic Aids. If an intermittent wiring problem is not present, inspect for a poor connection at the PCM or the EGR valve.
18. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0405 Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| *2* | 1. Turn ON the ignition.<br>2. With a scan tool, increment the EGR valve through all positions while comparing Desired EGR position to Actual EGR position.<br>Does Desired EGR position remain close to Actual EGR position at all commanded positions? | — | *Go to Step 3* | *Go to Step 4* |
| *3* | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Disconnect the EGR.<br>2. Measure the voltage between the EGR pintle position sensor ground circuit and the 5 volt reference circuit using a DMM.<br>Does the voltage measure at or near the specified value? | 5V | *Go to Step 5* | *Go to Step 9* |
| 5 | Probe the EGR valve pintle position signal circuit with a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 8* | *Go to Step 6* |
| 6 | 1. Connect a jumper between the 5 volt reference circuit and the pintle position signal circuit.<br>2. With a scan tool, observe the Actual EGR position parameter.<br>Does the scan tool indicate Actual EGR position at the specified value? | 100% | *Go to Step 13* | *Go to Step 7* |
| 7 | Test for an open in the EGR valve pintle position signal circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 19* | *Go to Step 17* |
| 8 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Probe the EGR valve pintle position signal circuit using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 12* | *Go to Step 15* |
| 9 | Probe the 5 volt reference circuit using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 11* |

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## DTC P0405 Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 10 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Probe the 5 volt reference circuit using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 16* | *Go to Step 18* |
| 11 | Test for an open in the 5 volt reference circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 19* | *Go to Step 17* |
| 12 | Repair the short to ground in the EGR valve pintle position signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 19* | — |
| 13 | Inspect for the following conditions:<br>1. Poor connections at the EGR valve.<br>2. The EGR pintle position signal circuit shorted to the EGR valve control circuit.<br>If a problem is found, repair as necessary. Refer to *Wiring Repairs* or *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 19* | *Go to Step 14* |
| 14 | **Important:** If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged converter) using the procedure found in the *Restricted Exhaust System Check*. If the exhaust system is restricted, repair the cause; one of which might be an injector which is open due to one of the following reasons:<br>• Stuck<br>• Grounded driver circuit<br>• Possible faulty control module<br>If this condition is found, the oil should be checked for possible fuel contamination.<br>Replace the EGR valve. Refer to *EGR Valve Replacement*.<br>Did you complete the repair? | — | *Go to Step 19* | — |
| 15 | Test the EGR valve pintle position signal circuit for a short to the sensor ground circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 19* | *Go to Step 18* |
| 16 | Repair short to ground in the 5 volt reference circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 19* | — |
| 17 | Inspect the circuits related to the EGR valve for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 19* | *Go to Step 18* |
| *18* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 19* | — |
| 19 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0420 Catalyst System Low Efficiency

Refer to *Engine Controls Schematics.*

### Circuit Description

To control emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The converter also has the ability to store excess oxygen and release the stored oxygen to promote these reactions. This oxygen storage capacity (OSC) is a measurement of the catalysts ability to control emissions. The PCM monitors this process using a heated oxygen sensor (HO2S) located in the exhaust stream past the three-way converter. When the catalyst is functioning properly, the HO2S 2 is slow to respond to a large change in the HO2S1 signal. When the HO2S 2 responds quickly to a large change in the HO2S 1 signal, the OSC and efficiency of the catalyst is considered to be bad and the MIL will be illuminated if subsequent tests also indicate a failure.

### Conditions for Running the DTC

1. Meet conditions for engine warm up. Use the scan tool catalyst data list in order to verify the following:
   - No VSS, EVAP, Misfire, HO2S, EGR, ECT, MAF, ETC, IAT, MAP, CMP, CKP sensor, Fuel Trim, or Fuel Injector DTCs set.
   - Engine has been running longer than 10 minutes.
   - Engine coolant temperature (ECT) is more than 76°C (169°F) and less than 124°C(255°F).
   - Baro is more than 75 kPa.
   - Vehicle is in Closed Loop.
   - Intake air temperature (IAT) is more than -20°C (-4°F) and less than 100°C (212°F).
   - Battery voltage more than 10.7 volts.
2. Warm up the catalyst.
   - Fully open hood.
   - Transmission is in park (automatic) or neutral (manual).
   - Set the parking brake.
   - Press and hold service brake.
   - Each time the engine is started the diagnostic can run up to 18 times. After the ten minute run time, and before the diagnostic runs the first time, the engine must run an additional 5 minutes between 1500 and 2000 RPM. Any additional tests on the same key cycle, the RPM must be between 1500 and 2000 RPM for 1 minute.
   - To activate the diagnostic; Return to idle and put the vehicle in drive (automatic) or depress the clutch (manual).
3. Test the catalyst.
   - Place the transmission in drive (automatic) or neutral and depress the clutch (manual).
   - Within 60 seconds the air fuel ratio will go rich below 14.1 for up to 5 seconds, then it may go lean above 15.3 for up to 6 seconds.
   - Using the scan tool check and see if DTC P0420 has passed or failed this key cycle

### Conditions for Setting the DTC

The PCM determines that the catalysts oxygen storage capacity is less than a threshold considered acceptable.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

- The PCM WILL NOT ENABLE the catalyst test until following conditions are met:
  - Engine speed is plus or minus 250 RPM from desired idle.
  - Throttle position (TP) is less than .5 percent.
  - Short term integrator is between –20 percent and +20 percent.
- The catalyst test WILL ABORT if the vehicle falls out side the conditions listed below while the test is running:
  - Engine speed is plus or minus 250 RPM from desired idle.
  - Throttle position (TP) is less than .5 percent.
  - Short term integrator is between –20 percent and +20 percent.
- The catalyst test may abort due to a change in engine load (i.e., A/C, coolant fan). If this problem occurs use the scan tool to force the cooling fans on return to step 3 in the table then repeat the test.

**Important:** When using the scan tool to force the cooling fans on use the next list and previous list soft keys to enter the catalyst data list. If the catalyst data list is not entered this way the cooling fan control will be canceled.

- The number of attempted tests is limited to 18 per key cycle.

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- More than 6 tests may have to be attempted to get 6 completed tests. An aborted test counts as an attempted test.
- If 18 tests have been attempted, and a decision has not been made this key cycle then turn the key OFF for 30 seconds. Start the engine and perform the Conditions for Running the DTC - including the 10 minute run time.
- After returning to an idle the HO2S 1 signal may stay rich or lean for several seconds causing the test to be delayed.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

1. The powertrain OBD system check prompts the technician to complete some basic tests and store the freeze frame and failure records data on the scan tool if applicable.
2. If any other DTCs are set, diagnose those DTCs first. A fault in a component can cause the converter to appear degraded or may have caused its failure.
3. Clearing the DTCs allows the catalyst test to be attempted 18 times and completed up to 6 times this key cycle. If the A/C is ON the diagnostic may not run. The engine must be warmed-up. The converter needs to be warmed-up by raising the engine speed more than idle for the specified time prior to each attempted test. Check and see if DTC passed or failed this key cycle. If the DTC does not pass or fail look for a possible reason that would cause the test to abort.
4. This step includes tests for conditions that can cause the three-way converter to appear degraded. Repair any problems found before proceeding with this table.
9. If the three-way converter needs to be replaced, make sure that another condition is not present which could damage the converter. These conditions may include: misfire, high engine oil or coolant consumption, retarded spark timing, weak spark or a plugged/leaking injectors. Correct any possible causes of converter damage before replacing the converter.

**DTC P0420 Catalyst System Low Efficiency**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Are any other DTCs set? | — | Go to applicable DTC first | *Go to Step 3* |
| 3 | **Important:** If the A/C is left on the following diagnostic may not run.<br>1. With a scan tool, review and record Fail Records and clear DTCs.<br>2. Turn the A/C OFF.<br>3. Fully open the hood.<br>4. Operate the vehicle within the Fail Record conditions.<br>**Important:** If more than 6 tests have been attempted and the DTC has not passed or failed this key cycle the test may be aborting. Go to diagnostic aids.<br>5. The test may need to be completed up to 6 times in order to pass or fail.<br>Does the scan tool indicate the DTC ran and passed this key cycle? | — | System OK | *Go to Step 4* |

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## DTC P0420 Catalyst System Low Efficiency (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 4 | 1. Visually and physically inspect the three-way catalytic converter for damage.<br>2. Inspect for the following:<br>• Dents.<br>• Severe discoloration caused by excessive temperatures.<br>• Holes.<br>• Internal rattle caused by damaged catalyst substrate.<br>3. Also, ensure that the three-way catalytic converter is a proper original equipment manufacturer part.<br>Did you find damage? | — | *Go to step 9* | *Go to step 5* |
| 5 | Visually and physically inspect the exhaust system for leaks.<br>Did you find a problem? | — | *Go to Step 7* | *Go to Step 6* |
| 6 | Visually inspect for the following:<br>• Oxygen sensors for damage<br>• Oxygen sensors wiring harness for damage<br>Did you find a problem? | — | *Go to Step 8* | *Go to Step 9* |
| 7 | Repair the exhaust system as necessary.<br>Did you complete the repair? | — | *Go to Step 10* | — |
| 8 | Replace the oxygen sensor or repair the wiring as necessary. Refer to *Heated Oxygen Sensor (HO2S) Replacement* or *Wiring Repairs* in Wiring Systems.<br>Did you complete the replacement? | — | *Go to Step 10* | — |
| 9 | ***Notice:*** A misfiring condition may damage the replacement three-way catalytic converter. Check for a misfiring condition. If a misfire is present, repair the misfiring condition before replacing the three-way catalytic converter.<br>Replace the three way catalytic converter. Refer to *Catalytic Converter Replacement (3.8 L)* in Engine Exhaust.<br>Did you complete the replacement? | — | *Go to Step 10* | — |
| 10 | **Important:** If the A/C is left on the following diagnostic may not run.<br>1. With a scan tool, clear DTCs.<br>2. Turn OFF the A/C.<br>3. Fully open the hood.<br>4. Operate the vehicle within the Fail Record conditions.<br>**Important:** If more than 6 tests have been attempted and the DTC has not passed or failed this key cycle the test may be aborting. Go to Diagnostic Aids.<br>5. The test may need to be completed up to 6 times in order to pass or fail.<br>Does the scan tool indicate the DTC ran and passed this key cycle? | — | *Go to Step 11* | *Go to Step 4* |
| 11 | Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0440 Evaporative Emission (EVAP) System

Refer to *EVAP System Overview*.

### System Description

The EVAP LARGE LEAK TEST Is based on applying vacuum to the EVAP system and monitoring vacuum decay. The PCM monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge valve and the EVAP vent valve/solenoid are turned on, allowing engine vacuum to draw a small vacuum on the entire evaporative emission system. If a sufficient vacuum level cannot be achieved, a large leak or a faulty EVAP canister purge valve is indicated. This can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing, not completely installed or faulty fuel fill cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP canister purge valve
- Disconnected or faulty EVAP vent valve
- Open ignition feed circuit to the EVAP vent or purge valve
- Damaged EVAP canister
- Leaking fuel sender assembly O-ring
- Leaking fuel tank or fuel filler neck

Any of the above conditions can set DTC P0440.

### Conditions for Running the DTC

- No TP sensor, ODM, IAT sensor, or MAP sensor DTCs set.
- System voltage is between 9 and 16 volts.
- Startup engine coolant temperature is between 4°C and 30°C (40°F and 86°F).
- Startup engine coolant temperature is not more than 8°C (14°F) greater than startup intake air temperature.
- Startup Intake air temperature is between 4°C and 30°C (40°F and 86°F).
- Startup intake air temperature not more than 2°C (4°F) greater than start-up engine coolant temperature.
- Fuel tank level is between 15 percent and 85 percent.
- BARO is more than 75kPa.

### Conditions For Setting the DTC

The EVAP system is not able to achieve or maintain vacuum during the diagnostic test.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

**Important:** Although this diagnostic is considered type A, it acts like a type B diagnostic. Whenever the EVAP diagnostics report that a system has passed, or if the battery has been disconnected, the diagnostic must fail during 2 consecutive cold start trips before setting a DTC. The initial failure is not reported to the diagnostic executive or displayed on a scan tool. A passing system always reports to the diagnostic executive immediately.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

- Cracked or punctured EVAP canister.
- Damaged or disconnected source vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
- Poor connection at the PCM.
- Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness. Inspect the wiring harness to the EVAP vent valve, the EVAP purge valve, and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched or plugged vacuum source, EVAP purge, or fuel tank vapor line. Verify that the lines are not restricted.
- Use the following procedure to test for a carbon release condition that could plug the system.
  1. Turn off the ignition switch.
  2. Remove the EVAP canister purge valve. Refer to *EVAP Canister Purge Valve Replacement*.
  3. Lightly tap the canister purge valve on a clean work area looking for carbon particles exiting either of the vacuum ports.

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4. If no carbon release is evident, reinstall the components and continue with the DTC P0440 diagnostic table. If carbon is being released from either component, continue with this service procedure.
5. Remove the charcoal canister from the vehicle.
6. Ensure that the main cylinder valve is turned off on the *J 41413* EVAP purge/pressure diagnostic station.
7. Disconnect the black hose that connects the nitrogen cylinder to the EVAP purge/pressure diagnostic station at the pressure regulator by unscrewing the knurled nut on the regulator. No tools are required to remove the black hose from the regulator.
8. Using a section of vacuum line, connect one end over the open threaded fitting of the EVAP purge/pressure diagnostic station pressure regulator.
9. Connect the remaining end to the purge valve end of the EVAP purge line at the vehicle and turn on the main nitrogen cylinder valve. Continue to blow any debris from the purge line for 15 seconds.
10. Return the EVAP pressure/purge diagnostic station to its original condition by reinstalling the black hose that was disconnected in step 7.
11. Replace the following components:
    - The EVAP canister purge valve. Refer to *EVAP Canister Purge Valve Replacement.*
    - The EVAP canister. Refer to *EVAP Canister Replacement* EVAP Canister.
12. Proceed with the DTC P0440 diagnostic table.

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

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

1. The Powertrain On-Board Diagnostic (OBD) System Check prompts you to complete some of the basic checks and store the Freeze Frame and Failure records data on the scan tool if applicable.
2. If a vent valve or EVAP purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction that caused the additional DTC to set will very likely correct the condition that set this DTC.
3. Inspects for a fuel tank pressure sensor stuck high condition. The fuel tank pressure must be relieved by removing the canister line from the fuel tank or EVAP canister. The fuel fill cap will not relieve the fuel tank pressure due to a check valve in the filler neck. The check valve seals when pressure is applied to prevent vapors from escaping through the filler neck. The scan tool should read within 1.0 inch H2O of the specified value.
4. Inspects for a large leak in the EVAP system.
5. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes. The EVAP station is pressurizing a sensor that normally reads vacuum. The scan tool reads high pressure at 0 volts and high vacuum at 5 volts. The scan tool can only read a max pressure of 6.0 inches of H2O (0 volts), however the EVAP service station can pressurize the system to much higher pressures. The scan tool value should be within 0.5 inch H2O of the specified value.
6. Inspects for a leaking EVAP canister line, or vent valve.
8. Inspects for a stuck closed or plugged EVAP canister purge valve.
9. Inspects for a leaking or stuck open EVAP canister purge valve, the scan tool should read within 1.0 inch HG of the specified value.
12. Inspects for a leaking or stuck open EVAP canister purge valve. The valve should be within 1.0 in HG of the specified value.
14. Inspects for a plugged EVAP system.
18. Ensures that sufficient source vacuum is present at the EVAP canister purge valve.
21. The EVAP station is pressurizing a sensor that normally reads vacuum. The scan tool reads high pressure at 0 volts and high vacuum at 5 volts. The scan tool can only read a max pressure of 6.0 inches of H2O (0 volts), however the EVAP service station can pressurize the system to much higher pressures. The scan tool value should be within 0.5 inch H2O of the specified value.

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## DTC P0440 Evaporative Emission (EVAP) System

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you Perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Visually/physically inspect for the following conditions:<br>• Vacuum or purge lines disconnected. Refer to *Emission Hose Routing Diagram.*<br>• Loose or missing fuel fill cap.<br>Did the *DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit* or *DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit* also set? | — | Go to Applicable DTC | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the canister purge line from the EVAP canister purge valve.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe the fuel tank pressure parameter.<br>Does the scan tool indicate the fuel tank pressure near the specified value? | 0 in. H2O | *Go to Step 4* | *Go to Step 20* |
| 4 | **Important:** Before continuing, zero the EVAP pressure and vacuum (inches of H2O) gauges on the *J 41413* EVAP pressure/purge diagnostic station.<br>1. Turn OFF the ignition.<br>2. Reconnect all EVAP hardware that was previously disconnected.<br>3. Install the *J 41415-40* fill tank cap adaptor to the fuel fill neck and fuel fill cap.<br>4. Connect the EVAP station to the fuel tank cap adaptor.<br>5. Turn ON the ignition, with the engine OFF<br>6. With a scan tool, capture Fail Records data for DTC P0440 and clear DTCs.<br>7. With a scan tool, select Seal option to seal the EVAP System.<br>**Important:** Do not exceed the pressure in the specified value.<br>8. Attempt to pressurize the system to the specified value by slowly turning the EVAP service station rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>Did you achieve the specified value? | 5 in. H2O | *Go to Step 5* | *Go to Step 6* |
| 5 | 1. With the EVAP station, maintain the fuel tank pressure at the specified value. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>2. With a scan tool, observe the fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 5 in. H2O | *Go to Step 8* | *Go to Step 7* |

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## DTC P0440 Evaporative Emission (EVAP) System (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 6 | 1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister.<br>2. Block the canister fitting for the fuel tank vapor line.<br>3. Connect a hand vacuum pump to the canister port for the EVAP purge line.<br>4. With a scan tool, ensure that the EVAP system is still sealed.<br>5. With a hand held vacuum pump, attempt to apply vacuum to the EVAP canister. The canister is large and may take time to achieve specified level.<br>Did you maintain vacuum at the specified value? | 5 in. Hg | *Go to Step 11* | *Go to Step 10* |
| 7 | Visually/physically inspect for a restricted fuel tank vapor line.<br>Did you find and correct the condition? | — | *Go to Step 21* | Go to *DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage* |
| 8 | 1. With the EVAP station, maintain the fuel tank pressure at the first specified (higher) value. Monitor the pressure with the gauge an the cart with the rotary switch in the OFF/HOLD position.<br>2. With a scan tool, increase the purge to 100 percent, this should relieve the system pressure.<br>Does the EVAP pressure decrease to near the second specified (lower) value within 15 seconds? | 5 in. H2O<br>0 in. H2O | *Go to Step 9* | *Go to Step 14* |
| 9 | 1. With the EVAP station, connect the inch Hg vacuum gauge hose to the canister side of the purge valve.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, select the seal option to seal the EVAP System.<br>4. Start the engine.<br>5. Run the engine from 1200 -1500 RPM and observe vacuum level.<br>Does the vacuum level on the EVAP Station Vacuum Gauge measure near the specified value? | 0 in. Hg | *Go to Step 18* | *Go to Step 15* |
| 10 | Visually/physically inspect for the following conditions:<br>• Disconnected or damaged fresh air vent hose.<br>• Damaged EVAP canister.<br>Did you find and correct the condition? | — | *Go to Step 21* | *Go to Step 17* |
| 11 | Visually/physically inspect for the following conditions:<br>• Disconnected or leaking fuel tank vapor line.<br>• Disconnected or damaged EVAP purge line.<br>Did you find and correct the condition? | — | *Go to Step 21* | *Go to Step 12* |
| 12 | 1. Disconnect the engine vacuum purge line from the EVAP canister purge valve.<br>2. With the EVAP station, connect the (Hg) vacuum gauge hose to the canister side of the purge valve.<br>3. Turn ON the ignition, with the engine OFF<br>4. With a scan tool, select the seal option to seal the EVAP system.<br>5. Start the engine.<br>6. Run the engine from 1200 -1500 RPM and observe vacuum level.<br>Does the vacuum level on the EVAP station vacuum gauge measure near the specified value? | 0 in. Hg | *Go to Step 13* | *Go to Step 15* |

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## DTC P0440 Evaporative Emission (EVAP) System (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 13 | **Important:** Do not exceed the pressure in the specified value.<br>1. Reconnect all EVAP hardware that was previously disconnected.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, EVAP purge/seal, select the seal option to seal the EVAP system.<br>4. With the EVAP station connected to the EVAP service port, continuously attempt to pressurize the EVAP system to the specified value by leaving the EVAP pressure/purge diagnostic station control knob in the pressurize position<br>5. Using the ultrasonic leak detector *J 41416* locate and repair leak in EVAP system. It may be necessary to partially lower the fuel tank to examine the tank connections.<br>Did you find and correct the condition? | 5 in H2O | *Go to Step 21* | — |
| 14 | **Important:** Inspect for carbon release into the EVAP system.<br>Disconnect the purge line from the canister side of the purge valve.<br>Does the vacuum level on the EVAP station vacuum gauge measure near the specified value? | 0 in Hg | *Go to Step 15* | Go to Diagnostic Aids |
| 15 | Replace the EVAP canister purge valve. Refer to *EVAP Canister Purge Valve Replacement.*<br>Did you complete the replacement? | — | *Go to Step 21* | — |
| 16 | Inspect for no source vacuum to the EVAP purge valve.<br>Did you find and correct the condition? | — | *Go to Step 21* | *Go to Step 15* |
| 17 | Replace the EVAP vent valve. Refer to *EVAP Vent Valve Replacement.*<br>Did you complete the replacement? | — | *Go to Step 21* | — |
| *18* | 1. With a scan tool, increase purge to 100 percent.<br>2. Run the engine from 1200-1500 RPM and observe the vacuum level.<br>Does the vacuum level on the EVAP station vacuum gauge measure above the specified value? | 15 in Hg | Go Diagnostic Aids | *Go to Step 16* |
| 19 | Inspect for a kinked or restricted canister purge line between the EVAP canister purge valve and EVAP canister.<br>Did you find and complete the repair? | 0 in. H2O | *Go to Step 21* | — |
| 20 | 1. Turn OFF the ignition.<br>2. Disconnect the EVAP canister line from the fuel tank or EVAP canister to relieve the fuel tank pressure.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 0 in. H2O | *Go to Step 19* | Go to *DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage* |
| *21* | 1. Reconnect all EVAP hardware that was previously disconnected.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, select the Seal option to seal the EVAP system.<br>**Important:** Do not exceed the pressure in the specified value.<br>4. With the EVAP station, pressurize the system to the first specified (higher) value by slowly turning the EVAP service station rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>Does the EVAP pressure decrease to less than the second specified (lower) value within 2 minutes with the rotary switch in the OFF/HOLD position? | 15 in. H2O<br>10 in. H2O | *Go to Step 3* | System OK |

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## DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected

Refer to *EVAP System Overview.*

### System Description

The EVAP SMALL LEAK TEST is based on applying vacuum to the EVAP system and monitoring vacuum decay. The PCM monitors vacuum level via the Fuel Tank Pressure sensor input. At an appropriate time, the EVAP canister purge valve and the EVAP vent valve are turned on allowing engine vacuum to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP purge valve is turned off, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

### Conditions for Running the DTC

- No TP sensor, ODM, IAT sensor, or MAP sensor DTCs set.
- The DTC P0440 diagnostic test has passed.
- Startup engine coolant temperature is not more than 4°C and 30°C (40°F and 86°F).
- Startup engine is not more than 8°C (14°F).
- Startup Intake air temperature not more than 2°C and 30°C (40°F and 86°F).
- Startup intake air temperature not more than 2°C (4°F).
- Fuel tank level is between 15 percent and 85 percent.
- BARO is more than 75kPa.

### Conditions for Setting the DTC

A vacuum decay condition indicating a small leak is detected during the diagnostic test.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

**Important:** Although this diagnostic is considered type A, it acts like a type B diagnostic. Whenever the EVAP diagnostics report that a system has passed, or if the battery has been disconnected, the diagnostic must fail during 2 consecutive cold start trips before setting a DTC. The initial failure is not reported to the diagnostic executive or displayed on a scan tool. A passing system always reports to the diagnostic executive immediately.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line.
- Poor connection at PCM.

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

  Inspect the wiring harness to the EVAP vent valve EVAP canister purge valve and the fuel tank pressure sensor for an intermittent open or short circuit.

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

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

1. The powertrain On-Board Diagnostic (OBD) System Check prompts you to complete some of the basic checks and store the Freeze Frame and Failure Records data on the scan tool if applicable.
2. If a vent valve or EVAP purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction that caused the additional DTC to set will very likely correct the condition that set this DTC.
3. Inspects for a fuel tank pressure sensor stuck high condition. The fuel tank pressure must be relieved by removing the canister line from the fuel tank or EVAP canister. The fuel fill cap will not relieve the tank due to a check valve in the filler neck. the check valve seals when pressure is applied to prevent vapors from escaping through the filler neck. The scan tool should read within 1.0 inch H2O of the specified value.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes. The EVAP station is pressurizing a sensor that normally reads vacuum. The scan tool reads high pressure at 0 volts and high vacuum at 5 volts. The scan tool can only read a max pressure of 6.0 inches of H2O (0 volts). However the EVAP service station can pressurize the system to much higher pressures. The scan tool value should be within 0.5 inch H2O of the specified value.

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5. Inspects for a small leak in the EVAP system.
6. Inspects for a leak in the canister, vent line, or a leaking EVAP vent valve.
10. Inspects for a leaking or stuck open EVAP canister purge valve. The scan tool should read within 1.0 inch HG of the specified value.
16. The EVAP station is pressurizing a sensor that normally reads vacuum. The scan tool reads high pressure at 0 volts and high vacuum at 5 volts. The scan tool can only read a max pressure of 6.0 inches of H2O (0 volts), however the EVAP service station can pressurize the system to much higher pressures. The scan tool value should be within 0.5 inch H2O of the specified value.

## DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Visually/physically inspect for the following conditions:<br>• Vacuum or purge lines disconnected. Refer to *Emission Hose Routing Diagram.*<br>• Loose or missing fuel fill cap.<br>Did the *DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit* or *DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit* also set? | — | Go to applicable DTC | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the EVAP canister line from the EVAP canister purge valve. This will relieve the fuel tank pressure.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool observe the fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 0 in. H2O | *Go to Step 4* | *Go to Step 15* |
| 4 | **Important:** Before continuing with diagnosis, zero the EVAP Pressure and Vacuum (inches of H2O) gauges on the *J 41413* EVAP pressure/purge diagnostic station.<br>1. Turn OFF the ignition.<br>2. Reconnect all hardware that was previously disconnected.<br>3. Install the *J 41415-40* Fill Tank Cap Adaptor to the fuel fill neck and fuel fill cap.<br>4. Connect the EVAP station to the fuel tank cap adaptor.<br>5. Turn ON the ignition, with the engine OFF.<br>6. Capture Fail Record data for DTC P0440 and clear DTCs.<br>7. With a scan tool, select seal option to seal the EVAP system.<br>**Important:** Do not exceed the pressure in the specified value.<br>8. Attempt to pressurize the system to the specified value by slowly turning the EVAP service station rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>9. With a scan tool observe fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 5 in. H2O | *Go to Step 5* | *Go to Step 7* |

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## DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | **Important:** Do not exceed the pressure in the specified (higher) value Increase pressure to the first specified (higher) value by slowly turning the EVAP service station rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>Does the EVAP pressure decrease to less than the second specified (lower) value within 2 minutes with the rotary switch in the OFF/HOLD position? | 15 in. H2O<br>10 in. H2O | *Go to Step 6* | Go to Diagnostic Aids |
| 6 | 1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister.<br>2. Block the canister fitting for the fuel tank vapor line.<br>3. Connect a hand vacuum pump to the canister port for the EVAP purge line.<br>4. With a scan tool, ensure that the EVAP System is still sealed.<br>5. With a hand held vacuum pump attempt to apply vacuum to the EVAP canister. The EVAP canister is large and may take time to achieve specified level.<br>Can vacuum be maintained at the specified value? | 5 in. Hg | *Go to Step 9* | *Go to Step 8* |
| 7 | 1. Visually/physically inspect for the following conditions:<br>• Restricted fuel tank vapor line<br>• Restricted EVAP purge line<br>2. If a problem is found, repair as necessary.<br>Did you find and correct the condition? | — | *Go to Step 16* | Go to *DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage* |
| 8 | 1. Visually/physically inspect for the following conditions:<br>• Damaged fresh air vent hose<br>• Damaged EVAP canister<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | *Go to Step 16* | *Go to Step 13* |
| 9 | Visually/physically inspect for the following conditions:<br>• Leaking fuel tank vapor line.<br>• Damaged EVAP purge line.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 10* |
| 10 | 1. Disconnect the engine vacuum purge line from the EVAP canister purge valve.<br>2. With the EVAP service station, connect the EVAP service station (Hg) vacuum gauge hose to the canister side of the purge valve.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, select the Seal option to seal the EVAP system.<br>5. Start the engine.<br>6. Run the engine from 1200 -1500 RPM and observe vacuum level.<br>Does vacuum level measure near the specified value? | 0 in. Hg | *Go to Step 12* | *Go to Step 11* |
| 11 | Replace the EVAP canister purge valve. Go to *EVAP Canister Purge Valve Replacement.*<br>Did you complete the replacement? | — | *Go to Step 16* | — |

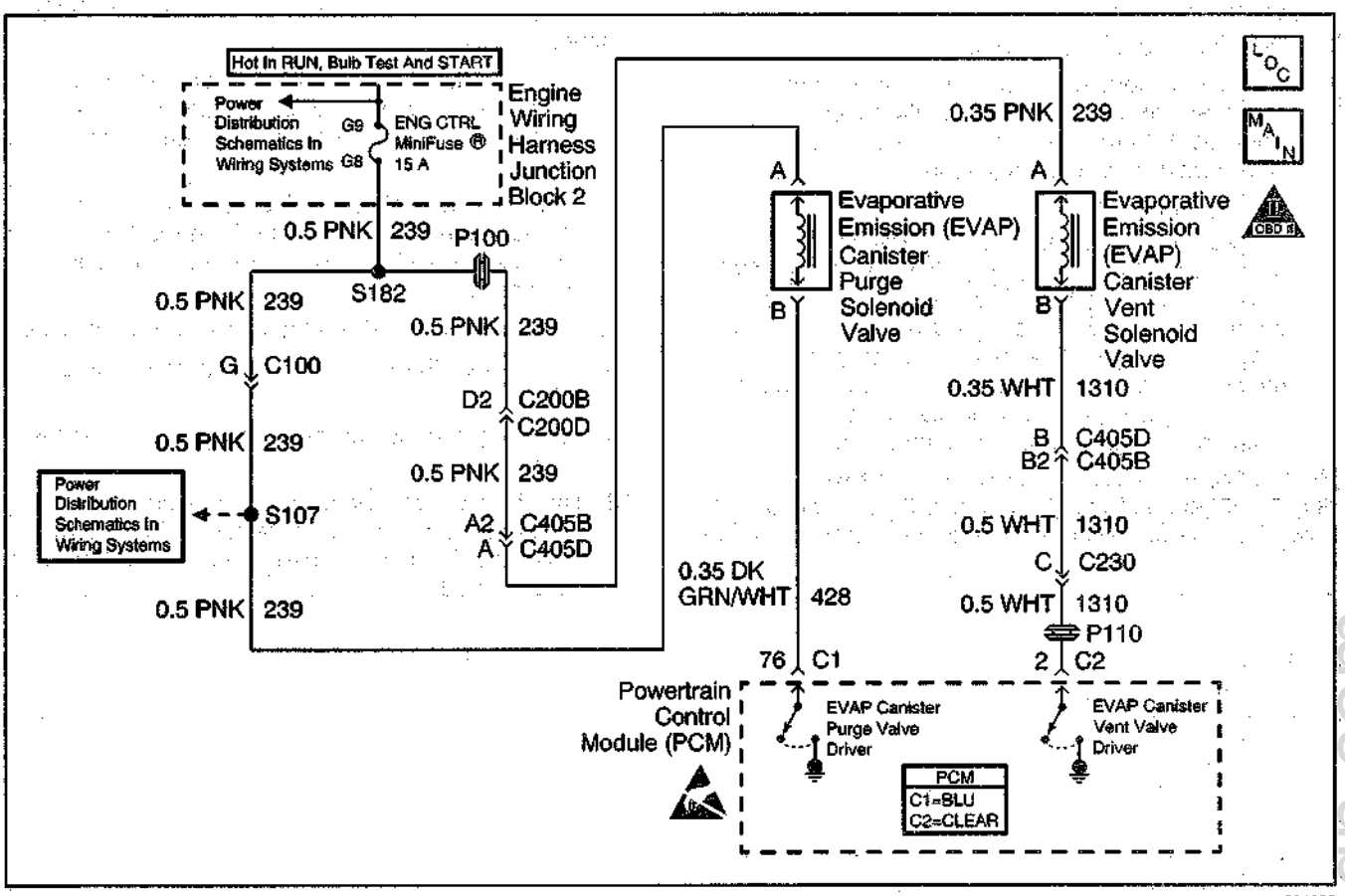
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## DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 12 | 1. Reconnect all EVAP hardware that was previously disconnected.<br>2. With a scan tool, select Seal option to seal the EVAP system.<br>**Important:** Do not exceed the 15 inches H2O pressure in the specified value.<br>3. With the EVAP station connected to the EVAP service port, continuously attempt to pressurize the EVAP system to the specified value by leaving the EVAP pressure/purge diagnostic station control knob in the pressurize position<br>4. With the ultrasonic leak detector *J 41416* locate and repair any leak in EVAP system. It may be necessary to partially lower the fuel tank to examine the top tank connections.<br>Did you find and correct the condition? | 15 in. H2O | *Go to Step 16* | — |
| 13 | Replace the EVAP vent valve. Refer to *EVAP Vent Valve Replacement*.<br>Did you complete the replacement? | — | *Go to Step 16* | — |
| 14 | Inspect for a kinked or restricted canister purge line between the EVAP canister purge valve and EVAP canister.<br>Did you find and complete the repair? | 0 in. H2O | *Go to Step 16* | — |
| 15 | 1. Turn OFF the ignition.<br>2. Remove the EVAP canister line from the fuel tank or EVAP canister. This will relieve the fuel tank pressure.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 0 in. H2O | *Go to Step 14* | Go to *DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage* |
| *16* | 1. Reconnect all EVAP hardware that was previously disconnected.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, select the Seal option to seal the EVAP system.<br>**Important:** Do not exceed the pressure in the specified value.<br>4. Pressurize the system to the first specified (higher) value by slowly turning the EVAP Service station rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>Does the EVAP pressure decrease to less than the second specified (lower) value within 2 minutes with the rotary switch in the 'Off/Hold' position? | 15 in. H2O<br>10 in. H2O | *Go to Step 3* | System OK |

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## DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit




### Circuit Description

Output driver modules (ODMs) are used by the PCM to turn on many of the current-driven devices that are needed to control various engine and Transmission functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding ON. Unlike the quad driver modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P0443 set indicates an improper voltage level has been detected on the output circuit which controls the EVAP canister purge solenoid valve.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An improper voltage level has been detected on the output circuit which controls the EVAP canister purge solenoid valve.
- The above conditions are present for at least 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

- Poor connection at the PCM.

  Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness.
- Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition ON and observe a voltmeter connected between the solenoid control circuit and ground at the PCM harness connector while moving connectors and wiring harnesses related to the solenoid. A change in voltage will indicate the location of the malfunction.

Review the Fail Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.

## Test Description

The numbers below refer to the step numbers on the diagnostic table.

1. The powertrain OBD System Check prompts you to complete some basic checks and store the freeze frame and failure records data on the scan tool.
2. Listen for an audible clicking when the purge solenoid operates. Command both the Increase and Decrease states. Repeat the commands as necessary.
3. Tests for voltage at the feed side of the solenoid.
4. Verifies that the PCM is providing ground to the solenoid.
5. Tests if ground is constantly being applied to the solenoid.
12. The PCM utilizes Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

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## DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | Go to *Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, Increase and Decrease the purge solenoid up and down.<br>Does the solenoid respond with each command? | — | Go to Diagnostic Aids | Go to *Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the solenoid.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Probe the feed circuit of the solenoid with a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | Go to *Step 4* | Go to *Step 10* |
| 4 | 1. Connect a test lamp between the control circuit of the solenoid and the feed circuit of the solenoid.<br>2. With a scan tool, command the purge solenoid ON and OFF.<br>Does the test lamp turn ON and OFF with each command? | — | Go to *Step 8* | Go to *Step 5* |
| 5 | Does the test lamp remain illuminated with each command? | — | Go to *Step 7* | Go to *Step 6* |
| 6 | Test the control circuit of the solenoid for a short to voltage or an open. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 7 | Test the control circuit of the solenoid for a short to ground. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 8 | Inspect for poor connections at the solenoid. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 11* |
| 9 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 12* |
| 10 | Repair the feed circuit of the solenoid. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Step 13* | — |
| 11 | Replace the solenoid. Refer to *EVAP Canister Purge Valve Replacement.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 12 | **Important:** Perform the set up procedure for the PCM.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 13 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | Go to *Step 2* | System OK |

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## DTC P0446 Evaporative Emission (EVAP) Vent System Performance

Refer to *EVAP System Overview*.

### System Description

A RESTRICTED or BLOCKED EVAP VENT PATH is detected by monitoring fuel tank pressure during normal operation (EVAP vent valve/solenoid open, EVAP canister purge valve normal). With the EVAP vent valve open, vacuum level in the system should be very low unless the vent path is blocked. A blockage can be caused by the following conditions:

- Faulty EVAP vent valve (stuck closed)
- Plugged kinked or pinched vent hose
- Shorted EVAP vent valve driver circuit
- Plugged EVAP canister

If any of the conditions described above are present, DTC P0446 will set.

### Conditions for Running the DTC

- No TP sensor, ODM, IAT sensor, or MAP sensor DTCs set.
- All conditions for P0440 and P0442 have been met and passed.
- Startup engine coolant temperature is not more than 4°C and 30°C (40°F and 86°F).
- Startup engine is not more than 8°C (14°F).
- Startup Intake air temperature not more than 2°C and 30°C (40°F and 86°F).
- Startup intake air temperature not more than 2°C (4°F).
- Fuel tank level is between 15 percent and 85 percent.
- BARO is more than 75kPa.

### Conditions for Setting the DTC

- Fuel tank pressure is less than -10 inch H2O.
- The condition is present for at least 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

**Important:** Although this diagnostic is considered type A, it acts like a type B diagnostic. Whenever the EVAP diagnostics report that a system has passed, or if the battery has been disconnected, the diagnostic must fail during 2 consecutive cold start trips before setting a DTC. The initial failure is not reported to the diagnostic executive or displayed on a scan tool. A passing system always reports to the diagnostic executive immediately.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

- Kinked, pinched or plugged vent hose
- Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

1. The Powertrain On-Board Diagnosis (OBD) System Check prompts you to the basic checks and store the Freeze Frame and Failure Records Data on the scan tool if applicable.
2. If a EVAP vent valve or EVAP purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction that caused the additional DTC to set will very likely correct the condition that set this DTC.
3. Inspects for a fuel tank pressure sensor stuck high condition. The fuel tank pressure must be relieved by removing the canister line from the fuel tank or EVAP canister. The fuel fill cap will not relieve the tank pressure due to a check valve in the filler neck. The check valve seals when pressure is applied to prevent vapor from escaping through the filler neck. The scan tool should read within 1.0 inch H2O of the specified value.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes. The EVAP station is pressurizing a sensor that normally reads vacuum. The scan tool reads high pressure at 0 volts and high vacuum at 5 volts. The scan tool can only read a max pressure of 6.0 inch of H2O (0 volts). However the EVAP service station can pressurize the system to much higher pressures. The scan tool value should be within 0.5 inch H2O of the specified value.
5. Inspects for a plugged or stuck closed EVAP vent valve. The value should decrease to within 1.0 inch HG of the specified value.

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## DTC P0446 Evaporative Emission (EVAP) Vent System Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Visually/Physically inspect for the following conditions:<br>• Vacuum or purge lines disconnected. Refer to *Emission Hose Routing Diagram.*<br>• Loose or missing fuel fill cap.<br>Did *DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit* or *DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit* also set? | — | Go to Applicable DTC | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the EVAP canister line from the fuel tank or EVAP canister. This will relieve the fuel tank pressure.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe the fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 0 in. H2O | *Go to Step 4* | *Go to Step 11* |
| 4 | **Important:** Before continuing with diagnosis, zero the EVAP pressure and vacuum (inches of H2O gauges on the *J 41413* EVAP pressure/purge diagnostic station.<br>1. Turn OFF the ignition.<br>2. Reconnect all EVAP hardware that was previously disconnected.<br>3. Install the *J 41415-40* fuel fill cap adaptor to the fuel fill neck and fuel fill cap.<br>4. Connect the EVAP station to the fuel tank cap adaptor.<br>5. Turn ON the ignition, with the engine OFF.<br>6. With a scan tool, capture Fail Records data for DTC P0446 and clear DTCs<br>7. With a scan tool, command the vent valve ON (closed) to seal the system.<br>**Important:** Do not exceed the pressure in the specified value.<br>8. With the EVAP station, attempt to pressurize the EVAP system to the specified value by slowly turning the rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>9. With a scan tool observe the fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure at the specified value? | 5 in. H2O | *Go to Step 5* | *Go to Step 7* |
| 5 | 1. With the EVAP station, maintain EVAP pressure at the first specified (higher) value.<br>2. With a scan tool, command the vent valve OFF (open) to relieve the pressure through the vent valve.<br>Does the EVAP pressure decrease to near the Second specified (lower) value within 2 minutes with the rotary switch in the OFF/HOLD position? | 5 in. H2O<br>0 in. H2O | Go to Diagnostic Aids | *Go to Step 6* |

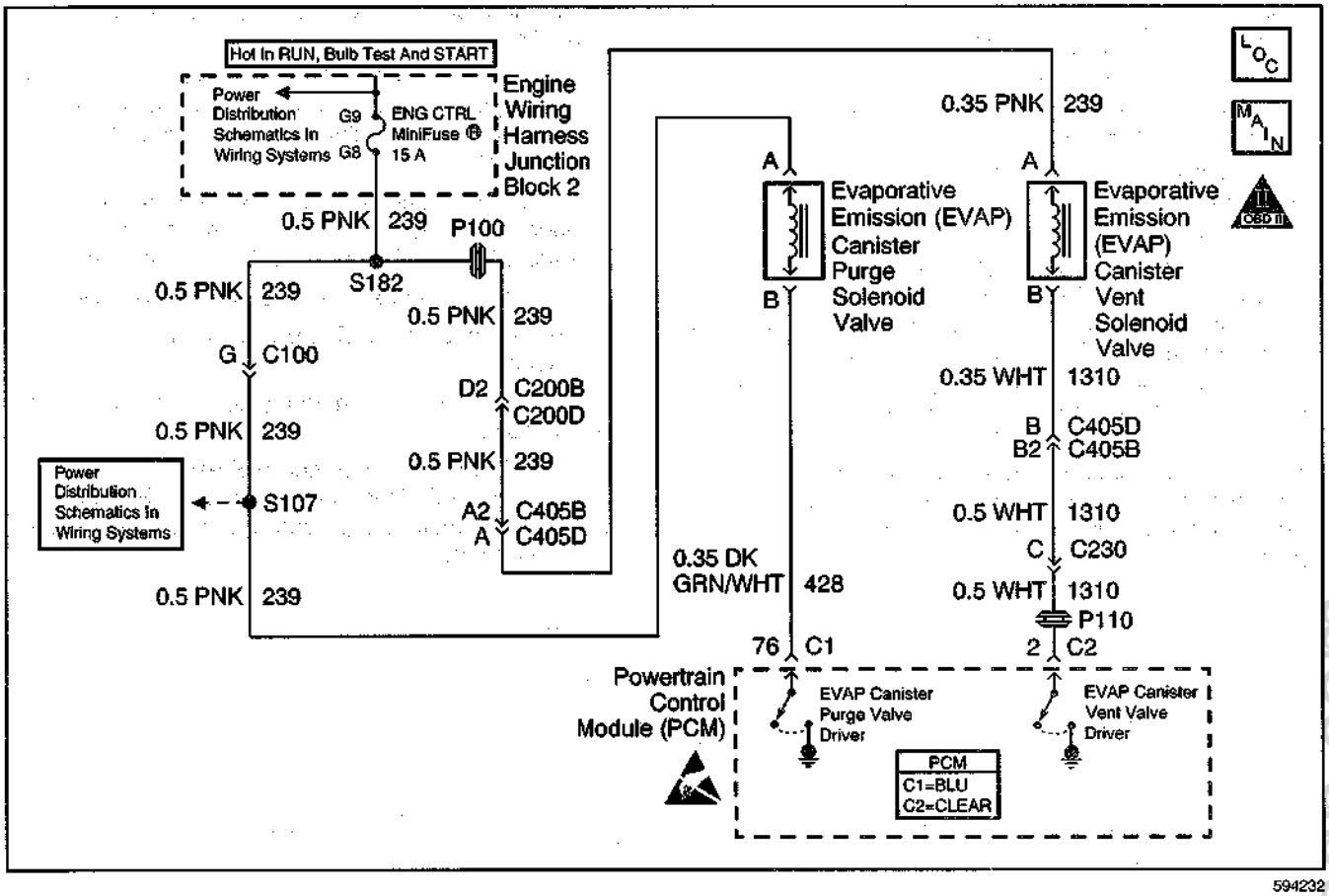
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## DTC P0446 Evaporative Emission (EVAP) Vent System Performance (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 6 | 1. Disconnect the large vent hose (marked AIR ) from the EVAP canister.<br>2. With the EVAP station, switch the rotary switch to purge.<br>3. Start the vehicle and allow to reach operating temperature<br>4. With a scan tool, increase EVAP purge to 100 percent. The scan tool will abort the test if the vacuum is above 15 inches H2O.<br>5. With the EVAP station, monitor the vacuum (inches H2O) gauge on the for 5 seconds while holding the engine speed at 2,500 RPM.<br>Does the vacuum remain less than the specified value? | 10 in. H2O | *Go to Step 7* | *Go to Step 9* |
| 7 | Inspect the vent hose between the EVAP canister and the EVAP vent valve/solenoid for being kinked, pinched, or otherwise blocked.<br>Did you find and correct the condition? | — | *Go to Step 12* | *Go to Step 8* |
| 8 | Replace the EVAP vent valve. Refer to *EVAP Vent Valve Replacement*<br>Did you complete the replacement? | — | *Go to Step 12* | — |
| 9 | Replace the EVAP canister. Refer to *EVAP Canister Replacement.*<br>Did you complete the replacement? | — | *Go to Step 12* | — |
| 10 | Inspect for a kinked or restricted canister purge line between the EVAP canister purge valve and EVAP canister.<br>Did you find and correct the condition? | 0 in. H2O | *Go to Step 12* | — |
| 11 | 1. Turn OFF the ignition.<br>2. Disconnect the EVAP canister line from the fuel tank or EVAP canister. This will relieve the fuel tank pressure.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe the fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 0 in. H2O | *Go to Step 10* | Go to *DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage* |
| 12 | 1. Reconnect all EVAP hardware that was previously disconnected.<br>2. Turn ON the ignition, With the engine OFF.<br>3. With a scan tool, command the vent valve ON (closed) to seal the system.<br>4. With the EVAP station, pressurize the EVAP system to the first specified (higher) value by slowly turning the rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>5. With a scan tool, command the EVAP vent valve OFF (open) to relieve the system pressure.<br>Does the pressure decrease to less than the second specified (lower) value within 2 minutes with the rotary switch in the OFF/HOLD position? | 5 in. H2O<br>0 in. H2O | *Go to Step 3* | System OK |

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## DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit




594232

### Circuit Description

Output driver modules (ODMs) are used by the PCM to turn on many of the current-driven devices that are needed to control various engine and Transmission functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding ON. Unlike the quad driver modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P0449 set indicates an improper voltage level has been detected on the output circuit which controls the EVAP canister vent solenoid valve.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An improper voltage level has been detected on the output circuit which controls the EVAP canister vent solenoid valve.
- The above conditions are present for at least 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

- Poor connection at the PCM.

  Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness.
- Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition ON and observe a voltmeter connected between the solenoid control circuit and ground at the PCM harness connector while moving connectors and wiring harnesses related to the solenoid. A change in voltage will indicate the location of the malfunction.

Review the Fail Records vehicle mileage since the diagnostic test last failed. This may help determine how often the condition that caused the DTC to be set occurs.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

1. The powertrain OBD System Check prompts you to complete some basic checks and store the freeze frame and failure records data on the scan tool.
2. Listen for an audible click when the vent solenoid operates. Command both the ON and OFF states. Repeat the commands as necessary.
3. Tests for voltage at the feed side of the solenoid.
4. Verifies that the PCM is providing ground to the solenoid.
5. Tests if ground is constantly being applied to the solenoid.

12. The PCM utilizes Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

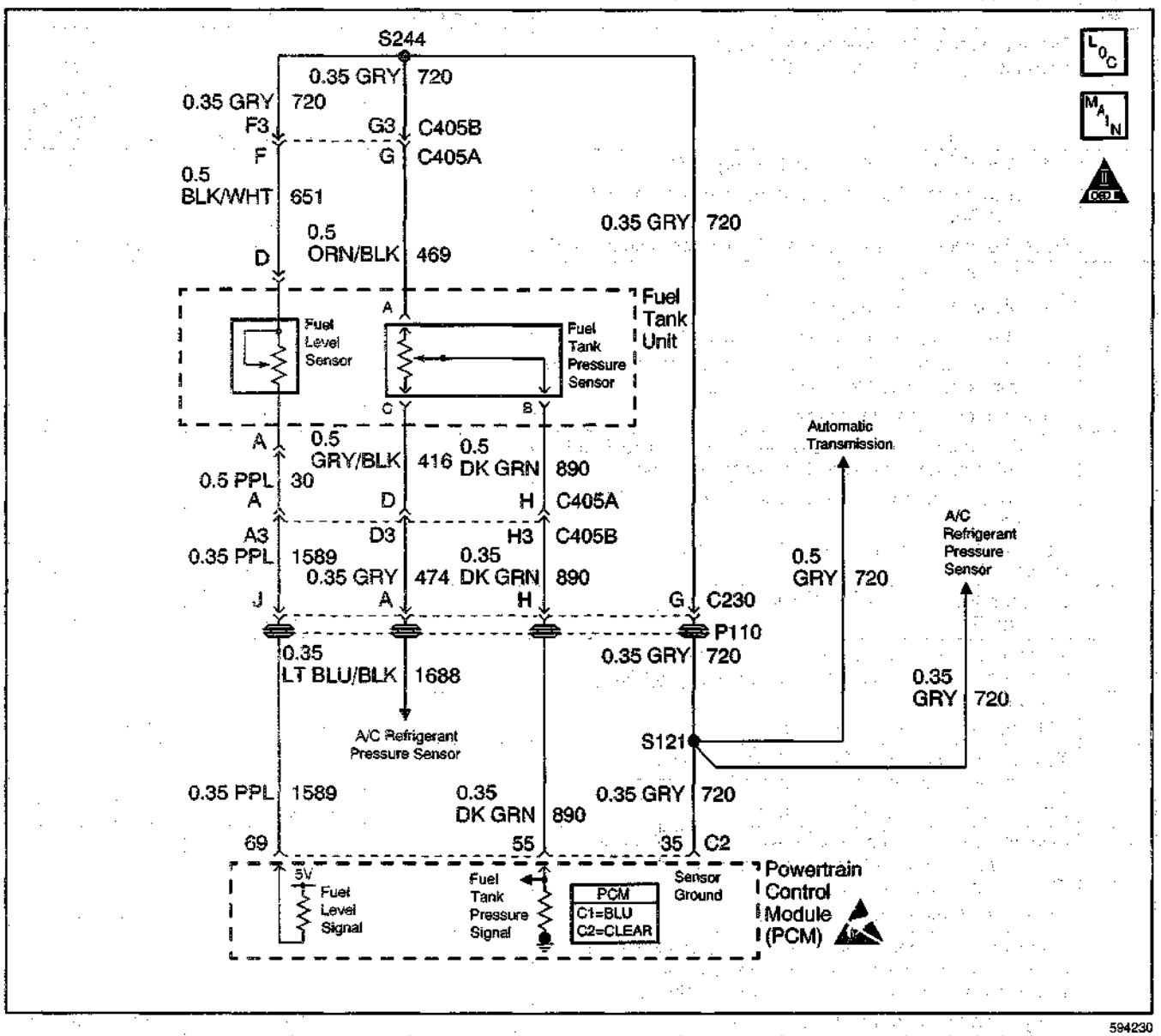
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## DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | Go to *Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, command the vent solenoid ON and OFF.<br>Does the solenoid turn ON and OFF with each command? | — | Go to Diagnostic Aids | Go to *Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the solenoid.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Probe the feed circuit of the solenoid with a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | Go to *Step 4* | Go to *Step 10* |
| 4 | 1. Connect a test lamp between the control circuit of the solenoid and the feed circuit of the solenoid.<br>2. With a scan tool, command the vent solenoid ON and OFF.<br>Does the test lamp turn ON and OFF with each command? | — | Go to *Step 8* | Go to *Step 5* |
| 5 | Does the test lamp remain illuminated with each command? | — | Go to *Step 7* | Go to *Step 6* |
| 6 | Test the control circuit of the solenoid for a short to voltage or an open. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 7 | Test the control circuit of the solenoid for a short to ground. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 8 | Inspect for poor connections at the solenoid. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 11* |
| 9 | Inspect for poor connections at the harness connector of the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 12* |
| 10 | Repair the feed circuit of the solenoid. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Step 13* | — |
| 11 | Replace the solenoid. Refer to *EVAP Vent Valve Replacement.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 12 | **Important:** Perform the set up procedure for the PCM.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 13 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | Go to *Step 2* | System OK |

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## DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage




594230

### Circuit Description

The PCM monitors the fuel tank pressure sensor signal to detect vacuum decay and excess vacuum during the enhanced EVAP diagnostic. The fuel tank pressure sensor measures the difference between the air pressure (or vacuum) in the tank and the outside air pressure. The PCM applies a 5.0 volt reference and ground to the sensor. The sensor will return a signal voltage between 0.06 and 4.9 volts. If the PCM detects a fuel tank pressure sensor signal that is excessively low, DTC P0452 will set.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- The fuel tank pressure sensor signal is less than 0.06 volts.
- The conditions is present for 5 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

- Poor connection at the PCM or fuel tank pressure sensor.

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

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel tank pressure sensor display on the scan tool while moving connectors and wiring related to the sensor. A change in the display will indicate the location of the malfunction.

## Test Description

The numbers below refer to the step numbers on the diagnostic table.

12. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

### DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If DTC P1639 is set refer to *DTC P1639 5 Volt Reference 2 Circuit.*<br>1. Turn ON the Ignition, with the engine OFF.<br>2. With a scan tool, observe fuel tank pressure sensor voltage parameter.<br>Does the scan tool indicate voltage less than the specified value? | 0.3V | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate the vehicle within Fail Record conditions.<br>Does the scan tool indicate DTC P0452 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Disconnect the fuel tank pressure sensor connector.<br>2. Connect a jumper between the signal circuit and the 5 volt reference A circuit.<br>3. With a scan tool, observe fuel tank pressure sensor voltage parameter.<br>Does the scan tool indicate voltage near the specified value? | 5V | *Go to Step 8* | *Go to Step 5* |
| 5 | Using a DMM, measure voltage between the 5 volt reference A circuit and the ground circuit.<br>Does the voltage measure at or near the specified value? | 5V | *Go to Step 9* | *Go to Step 6* |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Inspect the 5 volt reference A circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 7* |
| 7 | Test the 5 volt reference A circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 12* |
| 8 | Inspect for poor connections at the fuel tank pressure sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 11* |

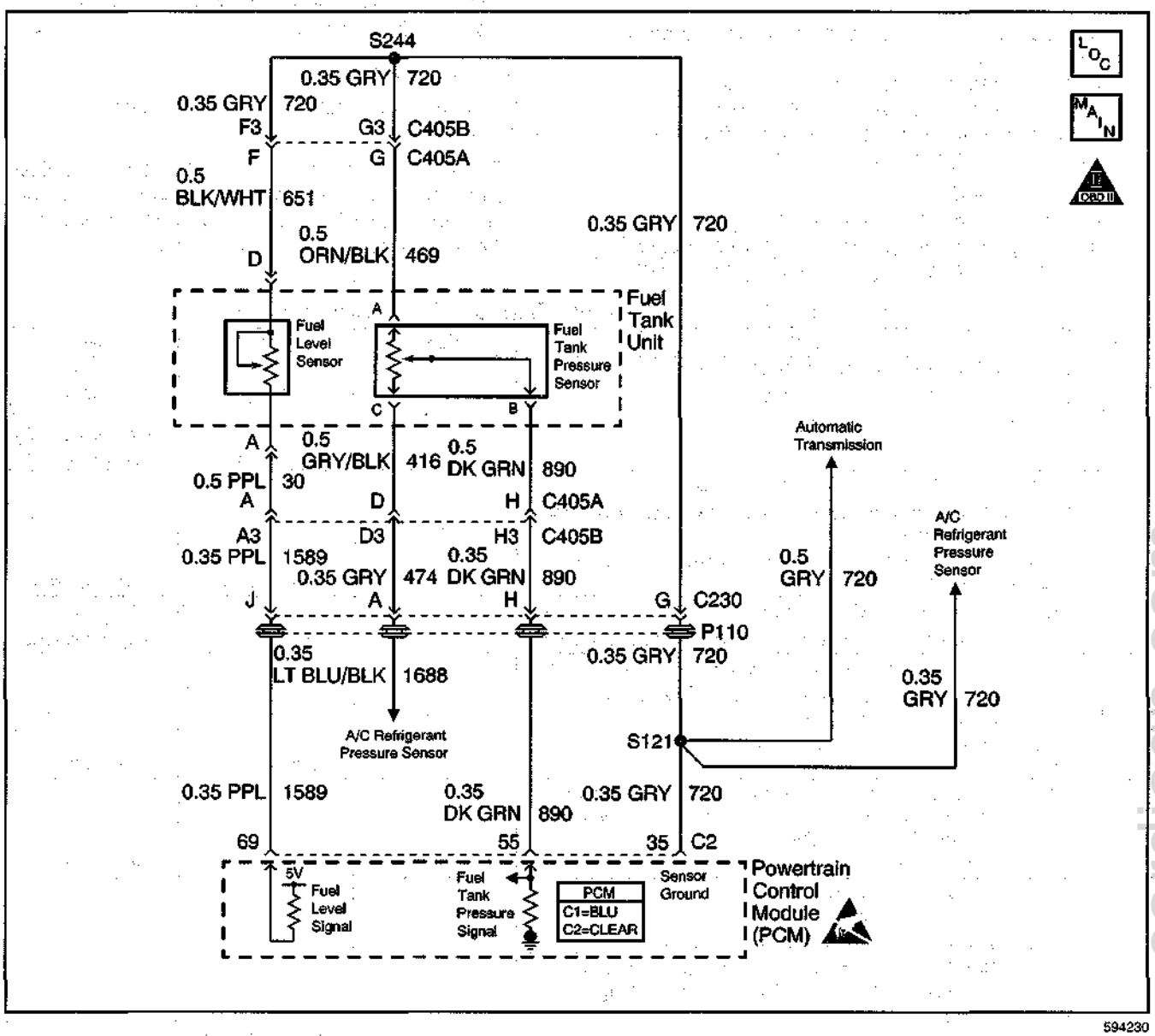
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## DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 9 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Inspect the signal circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 10* |
| 10 | Test the signal circuit for an open, short to ground, or short to the sensor ground circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 13* | *Go to Step 12* |
| 11 | Replace the fuel tank pressure sensor. Refer to *Fuel Tank Pressure Sensor Replacement.*<br>Did you complete the replacement? | — | *Go to Step 13* | — |
| 12 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 13* | — |
| 13 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage




594230

### Circuit Description

The PCM monitors the fuel tank pressure sensor signal to detect vacuum decay and excess vacuum during the enhanced EVAP diagnostic. The fuel tank pressure sensor measures the difference between the air pressure (or vacuum) in the tank and the outside air pressure. The PCM applies a 5.0 volt reference and ground to the sensor. The sensor will return a signal voltage between 0.1 and 4.9 volts. If the PCM detects a fuel tank pressure sensor signal that is excessively high, DTC P0453 will set.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- The fuel tank pressure sensor signal is more than 4.9 volts.
- The conditions is present for 5 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect fo the following:

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

## Test Description

The numbers below refer to the step numbers on the diagnostic table.

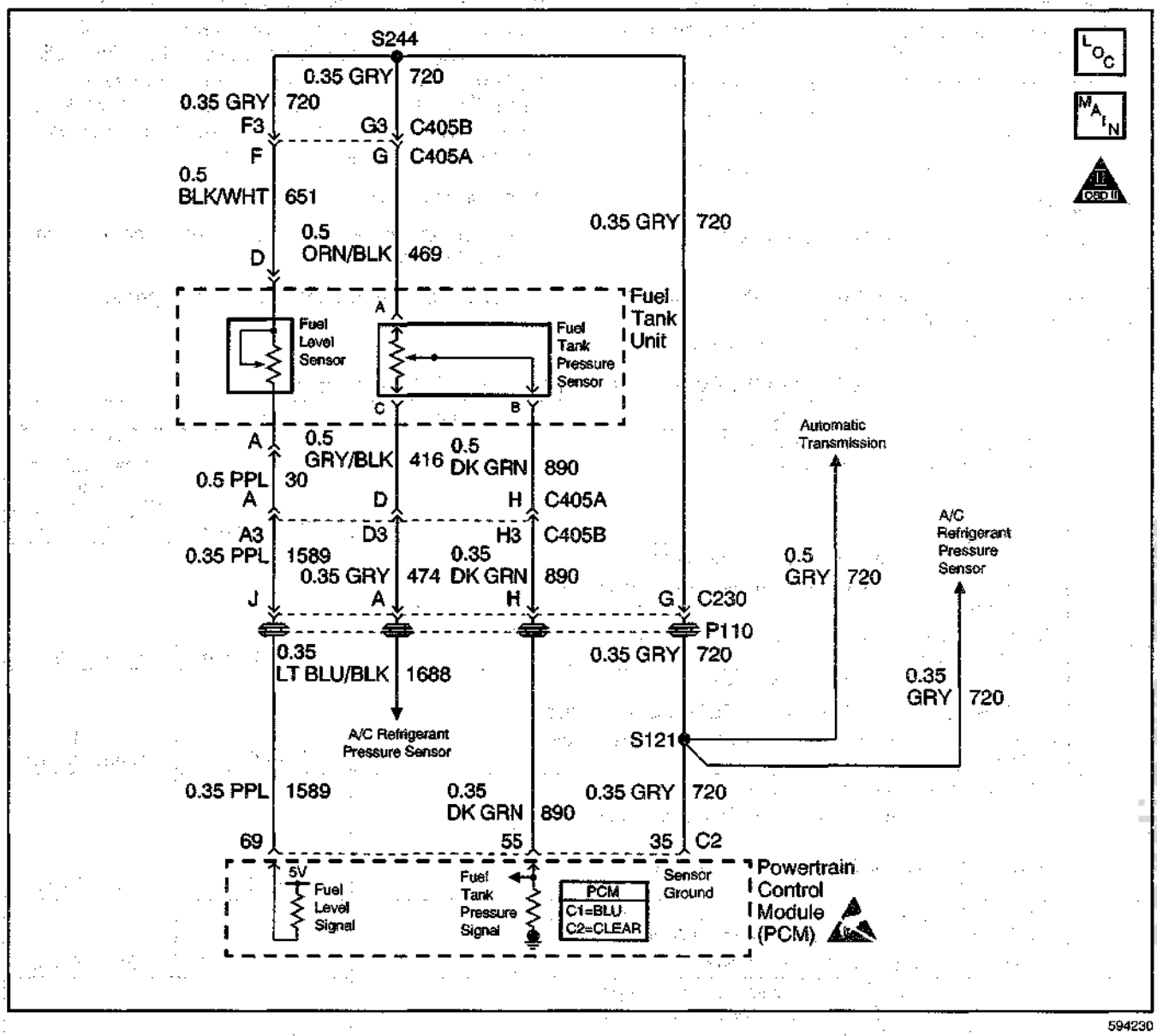
10. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe fuel tank pressure sensor voltage parameter.<br>Does the scan tool indicate voltage more than the specified value? | 4.7V | *Go to Step 4* | *Go to Step 3* |
| 3 | Operate the vehicle within the Fail Record conditions.<br>Does the scan tool indicate DTC P0453 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Disconnect the fuel tank pressure sensor. connector<br>2. With a scan tool, observe the fuel tank pressure sensor voltage parameter.<br>Does the scan tool indicate voltage at or near the specified value? | 0V | *Go to Step 6* | *Go to Step 5* |
| 5 | Test the signal circuit for a short to voltage or a short to the 5 volt reference A circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 10* |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Inspect the ground circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 7* |
| 7 | Test for an open or high resistance in the ground circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 8* |
| 8 | Inspect for poor connections at the fuel tank pressure sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 9* |
| 9 | Replace the fuel tank pressure sensor. Refer to *Fuel Tank Pressure Sensor Replacement.*<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 10 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 11 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0462 Fuel Level Sensor Circuit Low Voltage




594230

### Circuit Description

The fuel level sensor changes resistance based on fuel level. The fuel level sensor has a signal circuit and a ground circuit. The PCM applies a voltage (about 5.0 volts) on the signal circuit to the sensor. The PCM monitors changes in this voltage caused by changes in the resistance of the sensor to determine fuel level.

When the fuel tank is full, the sensor resistance is high, and the PCMs signal voltage is only pulled down a small amount through the sensor to ground. Therefore, the PCM will sense a high signal voltage (fuel tank full). When the fuel tank is empty, the sensor resistance is low, and the signal voltage is pulled down a greater amount. This causes the PCM to sense a low signal voltage (fuel tank empty).

The PCM uses inputs from the fuel level sensor to calculate the total fuel remaining in the fuel tank. This information is then sent to the fuel gauge.

This DTC sets when the PCM senses a signal voltage lower than the normal operating range of the sensor.

### Conditions for Running the DTC

The ignition switch is in the RUN position.

### Conditions for Setting the DTC

- The fuel level sensor voltage is below 0.39 volts.
- All conditions present for 6.0 minutes.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

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### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

The vehicle fuel gauge displays empty with this DTC set:

Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the DTC, the information included in the Freeze Frame and/or Failure Records data can aid in determining how many miles since the DTC set. The Fail Counter and Pass Counter can also aid determining how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

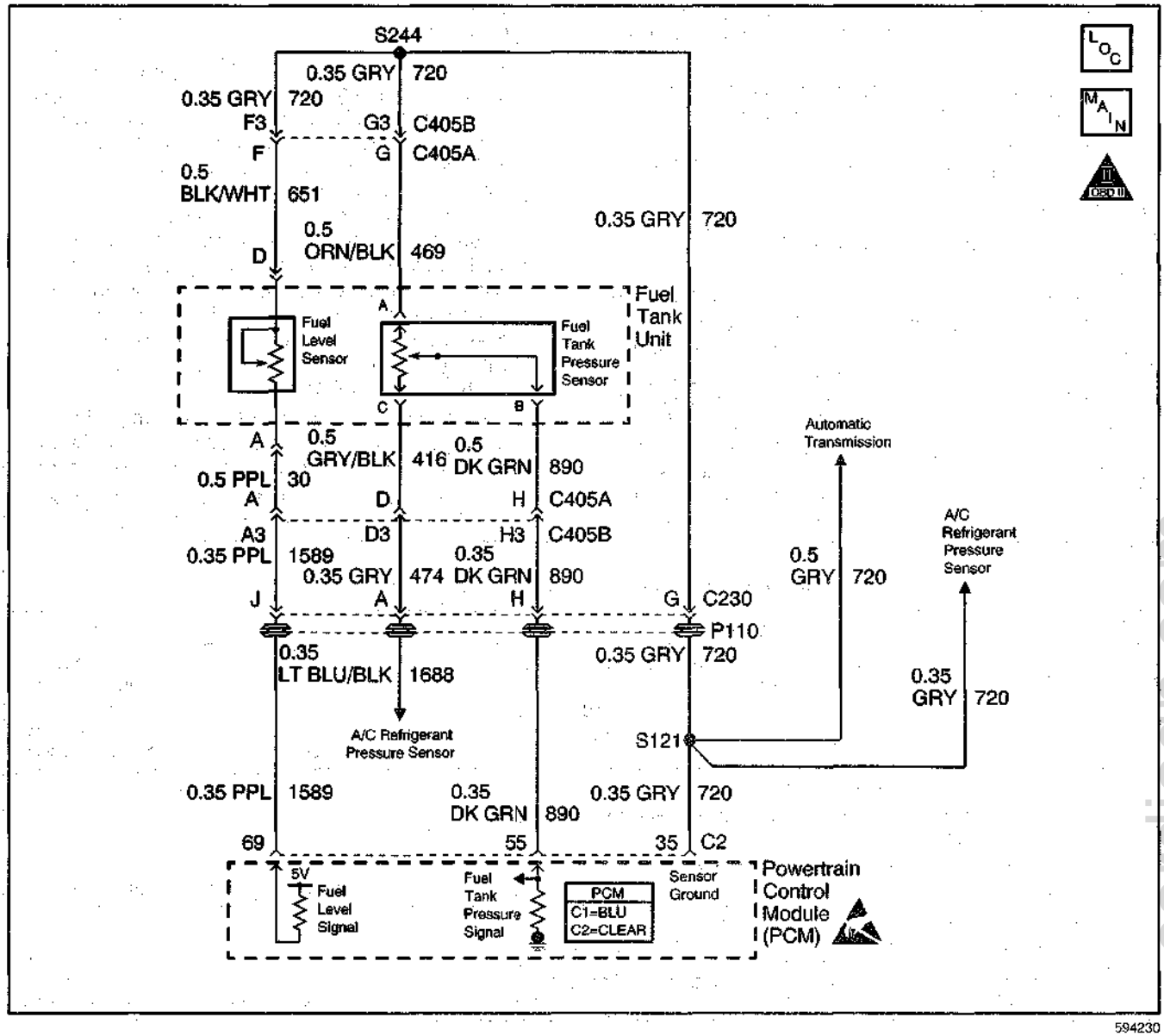
2. This step determines if the fault is present.

**DTC P0462 Fuel Level Sensor Circuit Low Voltage**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe the fuel levelsensor parameter.<br>Does the scan tool indicate fuel levelabove the specified value? | 0% | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. Turn OFF the ignition for 15 seconds.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the scan tool indicate that this diagnostic failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Disconnect the fuel levelsensor.<br>2. With a scan tool, observe the fuel levelsensor parameter.<br>Does the scan tool indicate fuel levelabove the specified value? | 0% | *Go to Step 6* | *Go to Step 5* |
| 5 | Test the signal circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 8* |
| 6 | Test the fuel sender pigtail circuits for a short together or a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 7* |
| 7 | Replace the fuel levelsensor. Refer to *Fuel Sender Assembly Replacement.*<br>Did you complete the replacement? | — | *Go to Step 10* | — |
| 8 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 9* |
| 9 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 10* | — |
| 10 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 11* |
| 11 | Does the scan tool display any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0463 Fuel Level Sensor Circuit High Voltage




594230

### Circuit Description

The fuel level sensor changes resistance based on fuel level. The fuel level sensor has a signal circuit and a ground circuit. The PCM applies a voltage (about 5.0 volts) on the signal circuit to the sensor. The PCM monitors changes in this voltage caused by changes in the resistance of the sensor to determine fuel level.

When the fuel tank is full, the sensor resistance is high, and the PCMs signal voltage is only pulled down a small amount through the sensor to ground. Therefore, the PCM will sense a high signal voltage (fuel tank full). When the fuel tank is empty, the sensor resistance is low, and the signal voltage is pulled down a greater amount. This causes the PCM to sense a low signal voltage (fuel tank empty).

The PCM uses inputs from the fuel level sensor to calculate the total fuel remaining in the fuel tank. This information is then sent to the fuel gauge.

This DTC sets when the PCM senses a signal voltage higher than the normal operating range of the sensor.

### Conditions for Running the DTC

The ignition switch is in the RUN position.

### Conditions for Setting the DTC

- The fuel level sensor voltage is above 2.9 volts.
- The condition present for 6 minutes.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

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### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

The vehicle fuel gauge displays empty with this DTC set.

Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the DTC, the information included in the Freeze Frame and/or Failure Records data can aid in determining how many miles since the DTC set. The Fail Counter and Pass Counter can also aid determining how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step determines if the fault is present.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the DTC, the information included in the Freeze Frame and/or Failure Records data can help determine how many miles since the DTC set. The Fail Counter and Pass Counter can also help determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed. For an intermittent condition.
12. Inspect the fuel sender pigtail for damage, if damage is found on the pigtail outside of the tank repair as necessary before replacing the sender.
14. Inspect for proper terminal tension/connections at the PCM harness for all connections before replacing the PCM.

### DTC P0463 Fuel Level Sensor Circuit High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| *2* | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe the fuel levelsensor parameter.<br>Does the scan tool indicate fuel levelabove the specified value? | 100% | *Go to Step 4* | *Go to Step 3* |
| *3* | 1. Turn OFF the ignition for 15 seconds.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the scan tool indicate that this diagnostic failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Disconnect the fuel level sensor.<br>2. Measure the voltage on the signal circuit using a DMM that is connected to a good ground.<br>Does the voltage measure less than the specified value? | 5.5V | *Go to Step 5* | *Go to Step 7* |
| 5 | 1. Connect a fused Jumper between the signal and ground circuits.<br>2. With a scan tool, observe the fuel levelsensor parameter.<br>Does the scan tool indicate fuel level less than the specified value? | 100% | *Go to Step 11* | *Go to Step 6* |
| 6 | 1. Disconnect the jumper from the fuel level sensor ground circuit.<br>2. Jumper the fuel levelsensor signal circuit to a known good ground.<br>Does the scan tool indicate fuel levelless than the specified value? | 100% | *Go to Step 10* | *Go to Step 8* |
| 7 | Test the signal circuit for a short to voltage. Refer to *Circuit Testing* in Wiring Systems.<br>Did you find a problem? | — | *Go to Step 9* | *Go to Step 14* |

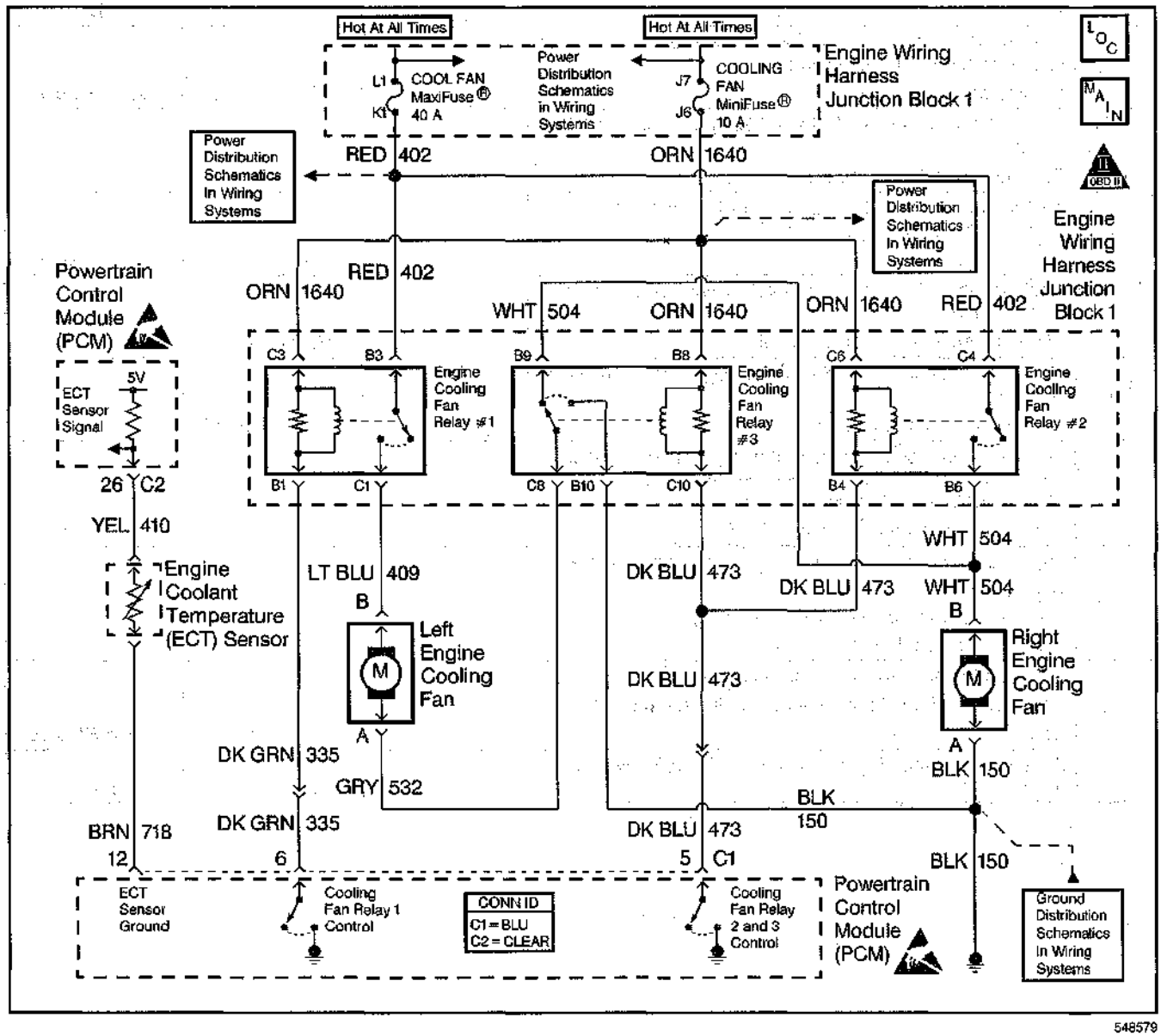
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## DTC P0463 Fuel Level Sensor Circuit High Voltage (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 8 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* in Wiring Systems.<br>Did you find a problem? | — | *Go to Step 9* | *Go to Step 13* |
| 9 | Repair the signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 10 | Test the ground circuit for an open or high resistance. Refer to *Circuit Testing* in Wiring Systems.<br>Did you find a problem? | — | *Go to Step 12* | *Go to Step 13* |
| 11 | Replace the fuel levelsensor. Refer to *Fuel Level Sensor Replacement.*<br>Did you complete the replacement? | — | *Go to Step 15* | — |
| 12 | Repair the ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Does the scan tool display any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0480 Cooling Fan Relay 1 Control Circuit




548579

### Circuit Description

Output driver modules (ODMs) are used by the PCM to turn on many of the current-driven devices that are needed to control various engine and Transaxle functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding ON. Unlike the quad driver modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P0480 set indicates an improper voltage level has been detected on the output circuit which controls the Fan 1 Relay.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An improper voltage level has been detected on the output circuit which controls the low speed fans.
- The above conditions present for at least 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

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### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

1. The powertrain OBD System Check prompts you to complete some basic tests and store the Failure Records data on the scan tool.
2. Listen for an audible click when the relay operates. Command both the ON and OFF states. Repeat the commands as necessary.
3. Tests for voltage at the coil feed side of the relay.
4. Verifies that the PCM is providing ground to the relay.
5. Tests if ground is constantly being applied to the relay.

12. The PCM utilizes Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

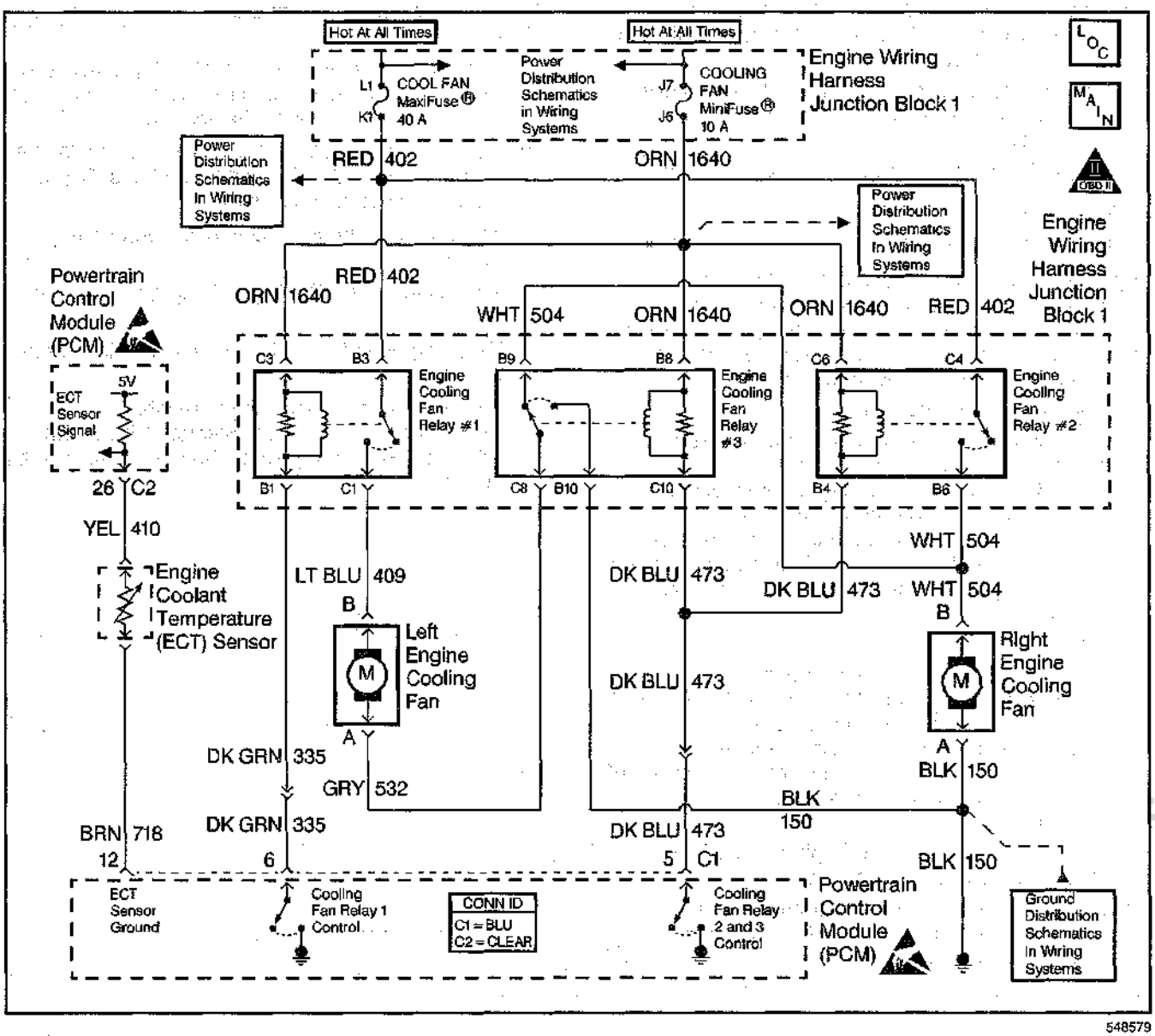
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## DTC P0480 Cooling Fan Relay 1 Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | Go to *Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, command the Low Speed Fans ON and OFF.<br>Does the relay turn ON and OFF with each command? | — | Go to Diagnostic Aids | Go to *Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the relay.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Probe the coil feed circuit of the relay using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | Go to *Step 4* | Go to *Step 10* |
| 4 | 1. Connect a test lamp between the control circuit of the relay and the coil feed circuit of the relay.<br>2. With a scan tool, command the Low Speed Fans ON and OFF.<br>Does the test lamp turn ON and OFF with each command? | — | Go to *Step 8* | Go to *Step 5* |
| 5 | Does the test lamp remain illuminated with each command? | — | Go to *Step 7* | Go to *Step 6* |
| 6 | Test the control circuit of the relay for a short to voltage or an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 7 | Test the control circuit of the relay for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 8 | Inspect for poor connections at the relay. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 11* |
| 9 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 12* |
| 10 | Repair the feed circuit of the relay. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 11 | Replace the relay.<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 12 | **Important:** Perform the set up procedure for the PCM.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 13 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | Go to *Step 2* | System OK |

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## DTC P0481 Cooling Fan Relay 2 and 3 Control Circuit




### Circuit Description

Output driver modules (ODMs) are used by the PCM to turn on many of the current-driven devices that are needed to control various engine and Transaxle functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding ON. Unlike the quad driver modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P0481 set indicates an improper voltage level has been detected on ODM B output 2, which controls the high speed and series/parallel cooling fan relays.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An improper voltage level has been detected on the output circuit which controls the high speed fans.
- The above conditions are present for at least 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

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### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

1. The powertrain OBD System Check prompts you to complete some basic tests and store the Failure Records data on the scan tool.
2. Listen for an audible click when the relay operates. Command both the ON and OFF states. Repeat the commands as necessary.
3. Tests for voltage at the coil feed side of the relays.
4. Verifies that the PCM is providing ground to the relays.
5. Tests if ground is constantly being applied to the relays.

12. The PCM utilizes Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

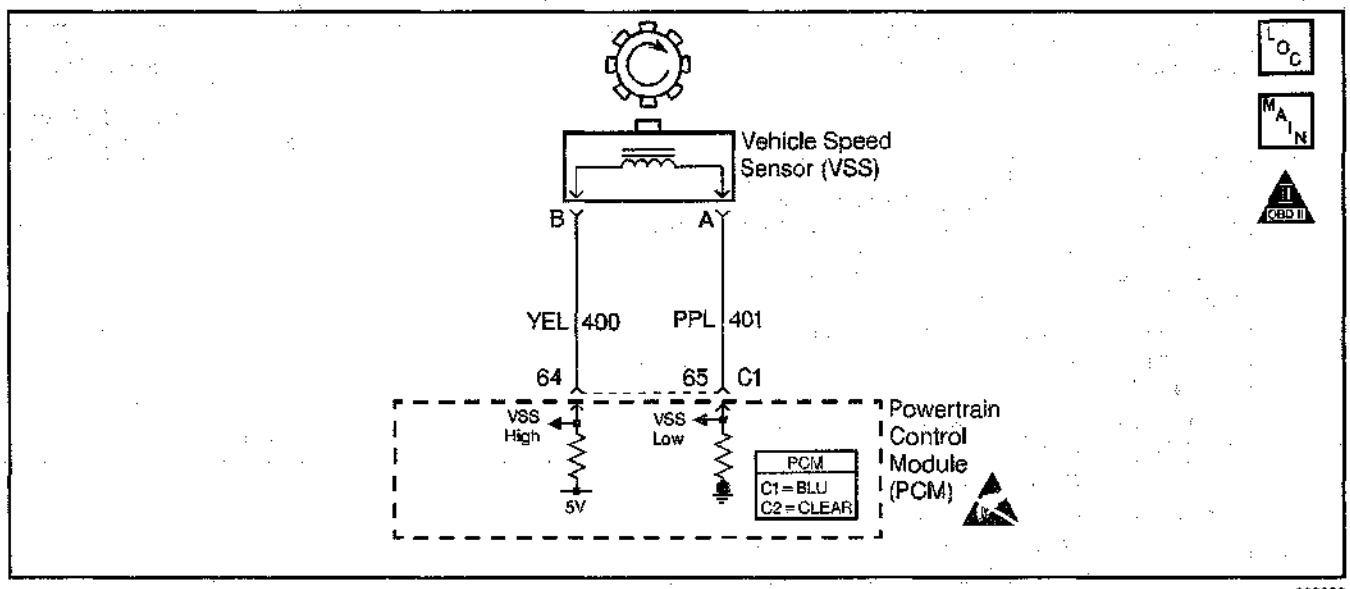
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## DTC P0481 Cooling Fan Relay 2 and 3 Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | Go to *Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If you cannot determine if the relays are responding to the command, observe the fans. When the High Speed Fans are commanded ON, Both fans should operate in low speed and after several seconds both fans should switch to high speed. If the fans are not operating properly continue with step 3 of this table.<br>1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, command the High Speed Fans ON and OFF.<br>Do both relays turn ON after several seconds and OFF with each command? | — | Go to Diagnostic Aids | Go to *Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the Fan 2 and Fan 3 relays.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Probe the coil feed circuits of each relay using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate for both circuits? | — | Go to *Step 4* | Go to *Step 10* |
| 4 | 1. Connect a test lamp between the control circuits of each relay and the coil feeds circuit of each relay.<br>2. With a scan tool, command the High Speed Fans ON and OFF.<br>Does the test lamp turn ON after several seconds and OFF with each command for both relays? | — | Go to *Step 8* | Go to *Step 5* |
| 5 | Does the test lamp remain illuminated with each command? | — | Go to *Step 7* | Go to *Step 6* |
| 6 | Test the control circuits of each relay for a short to voltage or an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 7 | Test the control circuits of each relay for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 8 | Inspect for poor connections at the relays. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 11* |
| 9 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 12* |
| 10 | Repair the feed circuit of the effected relay. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 11 | Replace the effected relay.<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 12 | **Important:** Perform the set up procedure for the PCM.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 13 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | Go to *Step 2* | System OK |

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## DTC P0500 Vehicle Speed Sensor (VSS) Circuit




### Circuit Description

Vehicle speed information is provided to the PCM by the vehicle speed sensor (VSS). The VSS consists of a magnetic pickup sensor mounted to the transmission case which interfaces with a rotor pressed onto to the transmission output shaft. The VSS produces a frequency signal that is proportional to vehicle speed. The PCM converts the VSS signal to vehicle speed, displayed on the scan tool in miles per hour and kilometers per hour. The PCM also uses the VSS signal to generate the 4000 pulses per mile vehicle speed signal used by the instrument cluster and the TAC module.

### Conditions for Running the DTC

- Engine speed is more than 1250 RPM.
- Engine load and engine speed acceleration indicate that the vehicle is in gear.

### Conditions for Setting the DTC

Vehicle speed sensor indicates a speed of less than 5 km/h (3 MPH) for more than 20 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic has been run and failed.
- If equipped with traction control, the PCM will command the electronic brake and traction control module (EBTCM) via the serial data circuit to turn OFF traction control, and the EBTCM will illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

Inspect for a Loose or damaged VSS rotor — A damaged VSS rotor may cause an erratic or incorrect vehicle speed to be displayed. Refer to Manual Transmission section for on-vehicle service.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. If the condition that caused the DTC to set cannot be duplicated, inspect the items referred to in Diagnostic Aids may isolate the cause of an intermittent fault.

### DTC P0500 Vehicle Speed Sensor (VSS) Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn OFF the ignition.<br>2. Raise the drive wheels.<br>3. Start the engine and idle in gear.<br>4. With a scan tool, observe the vehicle speed parameter.<br>Does the scan tool indicate vehicle speed more than the specified value? | 0 | Go to Diagnostic Aids | *Go to Step 3* |
| 3 | Observe the cluster speedometer with the engine still idling in gear.<br>Does the speedometer indicate vehicle speed more than the specified value? | 0 | *Go to Step 7* | *Go to Step 4* |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the VSS.<br>3. Connect *J 33431-B* signal generator and instrument panel tester to the VSS connector.<br>4. Turn ON the ignition.<br>5. Turn ON the signal generator, set signal generator to generate a VSS signal.<br>6. With a scan tool, observe the vehicle speed parameter.<br>Does the scan tool indicate vehicle speed more than the specified value? | 0 | *Go to Step 6* | *Go to Step 5* |
| 5 | Test for the following conditions:<br>1. VSS High circuit open, shorted to ground, or shorted to voltage.<br>2. VSS Low circuit open or shorted to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 7* |
| 6 | Replace the VSS. Refer to *Vehicle Speed Sensor* in Transmission/Transaxle.<br>Is the action complete? | — | *Go to Step 8* | — |
| 7 | **Important:** The Replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 8 | 1. Turn OFF the ignition.<br>2. Raise the drive wheels.<br>3. Start the engine and idle in gear.<br>4. With a scan tool, observe vehicle speed parameter.<br>Does the scan tool indicate vehicle speed more than the specified the specified value? | 0 | System OK | *Go to Step 3* |

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## DTC P0506 Idle Speed Low

### Circuit Description

The throttle actuator motor is controlled by the TAC module using various inputs from the PCM which are communicated across serial data. The DC motor located on the throttle body drives the throttle plate. In order to decrease idle speed, the TAC module commands the throttle closed reducing air flow into the engine and the idle speed decreases. In order to increase idle speed, the TAC module commands the throttle plate open allowing more air to bypass the throttle plate. If the Actual idle RPM does not match the Desired idle RPM within a calibrated time, this DTC sets.

### Conditions for Running the DTC

- No Misfire, EGR, TP, VSS, ECT, MAP, IAT, Fuel trim, Fuel injector, CKP or MAF DTCs set.
- Engine is operating for at least 2 minutes.
- ECT is more than -40°C (-40°F)
- IAT is more than –40°C (-40°F)
- BARO is more than 65 kPa
- System voltage is between 9.0 and 18.0 volts
- Vehicle speed is less than 3 mph
- APP indicated angle is less than 0.25 percent

### Conditions for Setting the DTC

- The Actual idle speed is approximately 150 RPM lower than the Desired idle speed.
- All above conditions present for 15 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This test determines whether or not the engine can achieve the commanded RPM, and if not, whether the RPM is too high or too low.

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## DTC P0506 Idle Speed Low

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Start the engine.<br>2. With a scan tool, command the engine speed up to 1500 RPM, down to 500 RPM, up to 1500 RPM.<br>3. Exit the RPM control function.<br>Does the engine speed correspond, within 100 RPM, with each command? | — | Go to Diagnostic Aids | *Go to Step 3* |
| 3 | Is the engine RPM more than 100 RPM more than or less than the Desired RPM? | — | *Go to Step 4* | *Go to Step 5* |
| 4 | Inspect for the following conditions:<br>• Excessive deposits in the throttle body.<br>• A faulty PCV valve.<br>Did you complete the repair? | — | *Go to Step 6* | — |
| 5 | Inspect for the following conditions:<br>• Excessive deposits in the throttle body.<br>• Parasitic load on the engine (i.e. transmission problem etc.).<br>Did you complete the repair? | — | *Go to Step 6* | — |
| 6 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 7* |
| 7 | Does the scan tool indicated any DTCs set that you have not diagnosed? | — | Go to applicable DTC table | System OK |

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## DTC P0507 Idle Speed High

### Circuit Description

The throttle actuator motor is controlled by the TAC module using various inputs from the PCM which are communicated across serial data. The DC motor located on the throttle body drives the throttle plate. In order to decrease idle speed, the TAC module commands the throttle closed reducing air flow into the engine and the idle speed decreases. In order to increase idle speed, the TAC module commands the throttle plate open allowing more air to bypass the throttle plate. If the Actual idle RPM does not match the Desired idle RPM within a calibrated time, this DTC sets.

### Conditions for Running the DTC

- No Misfire, EGR, TP, VSS, ECT, MAP, IAT, Fuel trim, Fuel injector, CKP or MAF DTCs set.
- Engine is operating for at least 2 minutes.
- ECT is more than -40°C (-40°F)
- IAT is more than –40°C (-40°F)
- BARO is more than 65 kPa
- System voltage is between 9.0 and 18.0 volts
- Vehicle speed is less than 3 mph
- APP indicated angle is less than 0.25 percent

### Conditions for Setting the DTC

- The Actual idle speed is approximately 175 RPM higher than the Desired idle speed.
- All above conditions present for 15 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This test determines whether or not the engine can achieve the commanded RPM, and if not, whether the RPM is too high or too low.

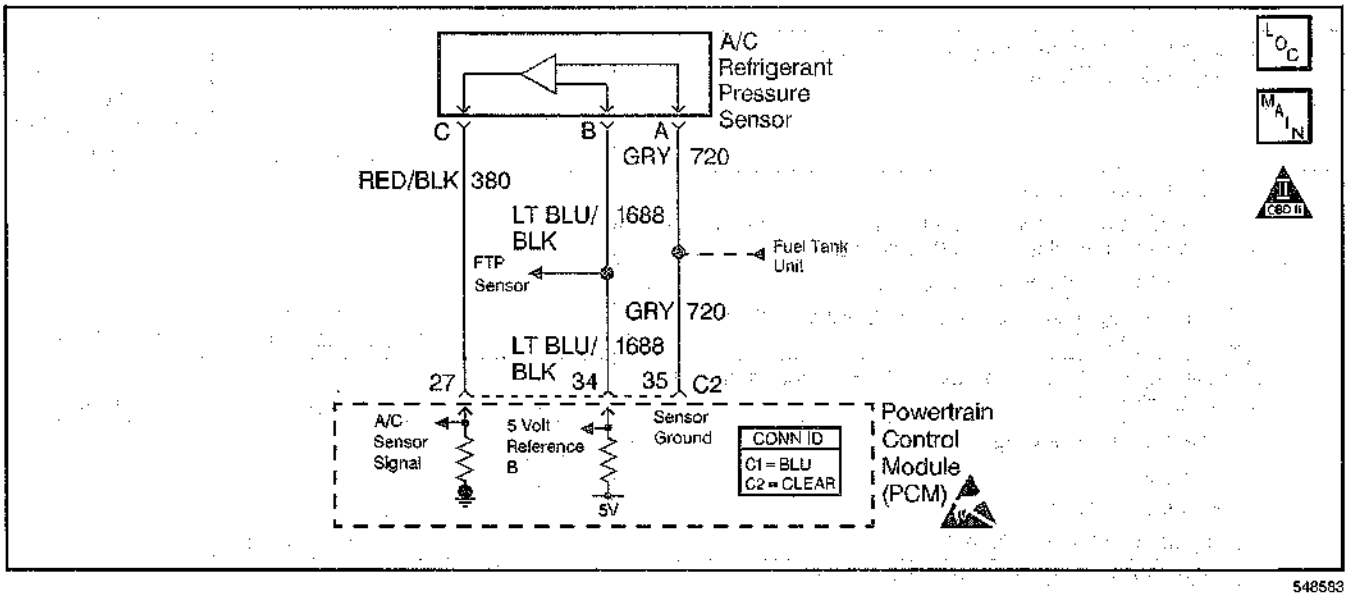
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## DTC P0507 Idle Speed High

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Start the engine.<br>2. With a scan tool, command the engine speed up to 1500 RPM, down to 500 RPM, up to 1500 RPM.<br>3. Exit the RPM control function.<br>Does the engine speed correspond, within 100 RPM, with each command? | — | Go to Diagnostic Aids | *Go to Step 3* |
| 3 | Is the engine RPM more than 100 RPM more than or less than Desired RPM? | — | *Go to Step 4* | *Go to Step 5* |
| 4 | Inspect for the following conditions:<br>• Vacuum leaks<br>• A faulty PCV valve<br>Did you complete the repair? | — | *Go to Step 6* | — |
| 5 | Inspect for the following conditions:<br>• Excessive deposits in the throttle body.<br>• Parasitic load on the engine (i.e. transmission problem etc.).<br>Did you complete the repair? | — | *Go to Step 6* | — |
| 6 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 7* |
| 7 | Does the scan tool indicated any DTCs set that you have not diagnosed? | — | Go to applicable DTC table | System OK |

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## DTC P0530 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit




548583

### Circuit Description

The A/C system uses an A/C refrigerant pressure sensor mounted in the high pressure side of the A/C refrigerant system to monitor A/C refrigerant pressure. The PCM uses this information to turn ON the engine coolant fans when the A/C refrigerant pressure is high and to keep the compressor disengaged when A/C refrigerant pressure is excessively high or low. The A/C refrigerant pressure sensor operates like other 3-wire sensors. The PCM applies a 5.0 volt reference and a sensor ground to the sensor. Changes in the A/C refrigerant pressure will cause the A/C refrigerant pressure input to the PCM to vary.
The PCM monitors the A/C refrigerant pressure signal circuit and can determine when the signal is outside of the possible range of the sensor. When the signal is out of range (high or low) for a prolonged period of time, the PCM will set DTC P0530. When DTC P0530 is set, the PCM will not allow the A/C compressor clutch to engage. This is done to protect the compressor.

### Conditions for Running the DTC

- The engine is running.
- The A/C is requested.

### Conditions for Setting the DTC

- The A/C refrigerant pressure sensor signal voltage is less than 0.1 volt (9 psi).
  OR
- The A/C refrigerant pressure sensor signal voltage is more than 4.9 volts (472 psi).
- Either of the above conditions are present for more than 20 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. If the A/C refrigerant pressure signal voltage stays high after disconnecting the A/C refrigerant pressure sensor electrical connector, the signal circuit is shorted to voltage or the PCM is faulty.
6. Tests for a high resistance or an open in the ground circuit.
15. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EPROM). When the PCM is being replaced, the new PCM must be programmed.

### DTC P0530 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) nostic System Check? | — | Go to *Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition.<br>2. With a scan tool, observe the A/C pressure sensor parameter.<br>Does the scan tool indicate the parameter is within the specified range? | 0.1V to 4.9V | Go to Diagnostic Aids | Go to *Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the A/C pressure sensor<br>3. Turn ON the ignition.<br>4. With a scan tool, observe the A/C pressure sensor parameter.<br>Does the scan tool indicate the parameter is less than the specified value? | 0.1V | Go to *Step 4* | Go to *Step 10* |
| 4 | 1. Turn OFF the ignition.<br>2. Connect a 3 amp fused jumper wire between the 5 volt reference circuit and the signal circuit.<br>3. Turn ON the ignition.<br>4. With a scan tool, observe the A/C pressure sensor parameter.<br>Does the scan tool indicate the parameter is more than the specified value? | 4.9V | Go to *Step 5* | Go to *Step 8* |
| 5 | 1. Disconnect the fused jumper wire.<br>2. Measure the voltage between the 5 volt reference circuit and the ground circuit.<br>Does the voltage measure less than the specified value? | 5.1V | Go to *Step 6* | Go to *Step 7* |
| 6 | 1. Disconnect the negetive battery cable.<br>2. Measure the resistance from the ground circuit of the A/C pressure sensor to a good ground.<br>Does the resistance measure less than the specified value? | 5 Ω | Go to *Step 12* | Go to *Step 11* |

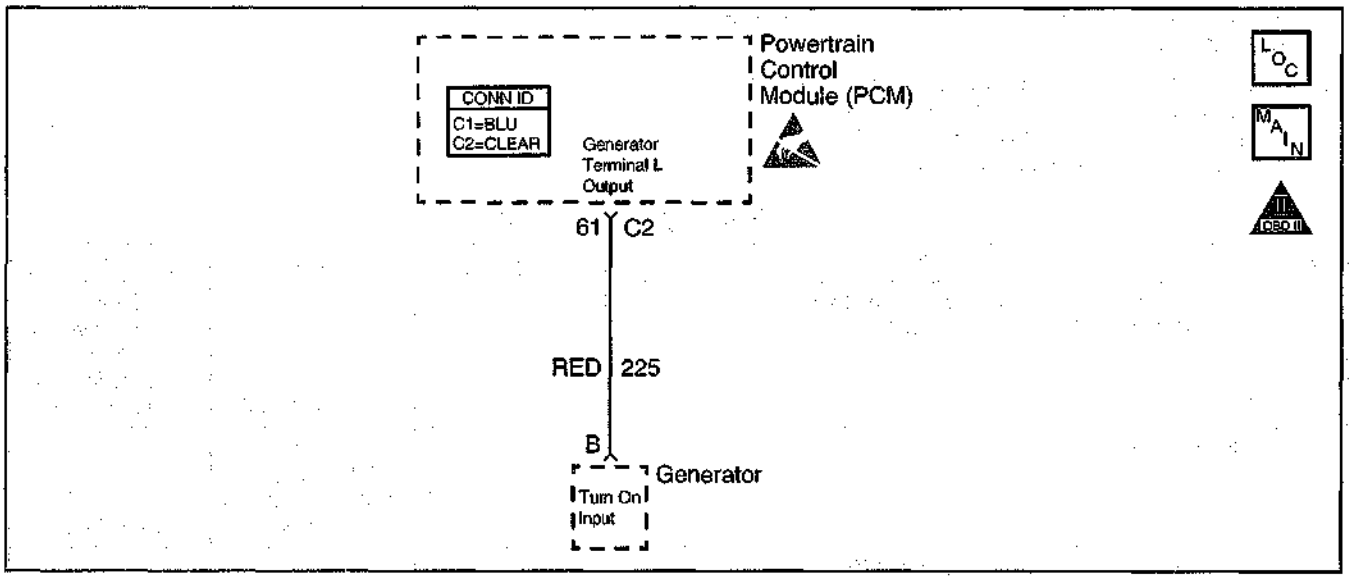
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## DTC P0530 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 7 | Test the 5 volt reference circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 16* | Go to *Step 13* |
| 8 | Test the 5 volt reference circuit for a high resistance, or an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 16* | Go to *Step 9* |
| 9 | Test the signal circuit for a short to ground, high resistance, or an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 16* | Go to *Step 13* |
| 10 | Test the signal circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 16* | Go to *Step 13* |
| 11 | Test the ground circuit for high resistance or an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 16* | Go to *Step 13* |
| 12 | Inspect for poor connections at the A/C pressure sensor Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 16* | Go to *Step 14* |
| 13 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 16* | Go to *Step 15* |
| 14 | Replace the A/C pressure sensor.<br>Did you complete the replacement? | — | Go to *Step 16* | — |
| *15* | **Important:** Perform the set up procedure for the PCM. Refer to *PCM Replacement/Programming.*<br>Replace the PCM.<br>Did you complete the replacement? | — | Go to *Step 16* | — |
| 16 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | Go to *Step 2* | System OK |

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## DTC P0560 System Voltage




369145

### Circuit Description

The PCM monitors system voltage on the PCM ignition feed circuit. If the system voltage is out of tolerance, DTC P0560 will be set. When the conditions that set DTC P0560 are present, operation of some vehicle systems and components may be affected.

### Conditions for Running the DTC

The engine is running.

### Conditions for Setting the DTC

- System voltage monitored at the PCM ignition feed circuit is less than 10 volts or more than 16 volts.
- Above conditions must be present for more than 25 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## Test Description

The numbers below refer to the step numbers on the diagnostic table.

13. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P0560 System Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Is DTC P1635 also set? | — | Go to *DTC P1635 5 Volt Reference 1 Circuit* | *Go to Step 3* |
| 3 | 1. Start and run engine above 1000 RPM.<br>2. With a scan tool, observe the ignition 1 voltage parameter.<br>Does the scan tool indicate voltage within the specified range? | 10-16V | *Go to Step 4* | *Go to Step 5* |
| 4 | 1. Turn ON the ignition, with the engine OFF.<br>2. Operate the vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 5* | Go to Diagnostic Aids |
| 5 | 1. Connect a *J 39200* DMM between the battery terminals.<br>2. Observe the voltage while running the engine above 1000 RPM.<br>Does the voltage measure within the specified range? | 10–16V | *Go to Step 6* | *Go to Step 7* |
| 6 | 1. Load the electrical system by turning ON the headlamps and the HVAC high blower.<br>2. Observe the DMM voltage while running the engine above 2000 RPM.<br>Does the voltage measure within the specified range? | 10-16V | *Go to Step 8* | *Go to Step 7* |
| 7 | 1. Turn OFF the ignition.<br>2. Disconnect the generator.<br>3. Measure the voltage on the generator control circuit using a DMM that is connected to a good ground.<br>4. Start the engine.<br>5. With a scan tool, command the Gen. L Term. ON.<br>Does the voltage measure near the specified value with the Gen. L Term. commanded ON? | 5V | *Go to Step 12* | *Go to Step 10* |
| 8 | Compare the ignition 1 voltage parameter on the scan tool with the actual battery voltage read with the DMM.<br>Do the voltages match? | — | Go to Diagnostic Aids | *Go to Step 9* |
| 9 | Inspect the PCM ignition feed circuit for a poor connection between the ignition switch and the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 13* |
| 10 | Test the generator control circuit for an open or a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 11* |

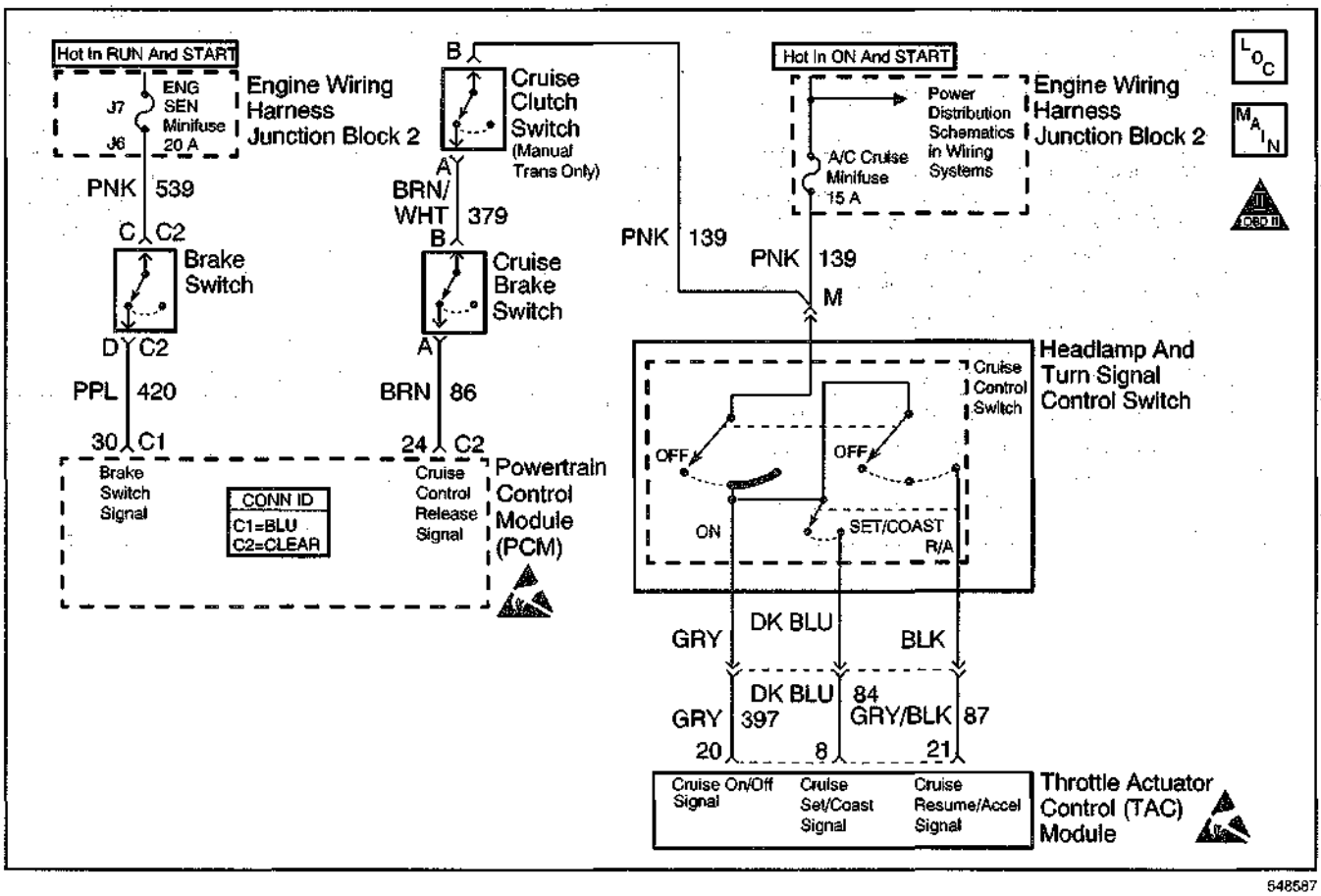
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## DTC P0560 System Voltage (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 11 | Inspect the generator control circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 13* |
| 12 | Inspect the generator control circuit for a poor connection at the generator. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | Go to *Generator Assembly Check* in Engine Electrical |
| *13* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 14* | — |
| 14 | 1. Start and run the engine above 1000 RPM.<br>2. With a scan tool, observe ignition 1 voltage parameter.<br>Does the scan tool indicate voltage within the specified range? | 10-16V | System OK | *Go to Step 5* |

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## DTC P0567 Cruise Control Resume Switch Circuit




### Circuit Description

The throttle actuator control (TAC) module is a communication link between the cruise switches and the PCM. The cruise Resume/Accel switch is an input to the TAC module. This input is then communicated from the TAC module to the PCM across serial data, allowing the PCM to control and hold a requested speed. The Cruise Resume/Accel switch sends an ignition voltage to the TAC module when the switch is closed (ON). If the PCM receives an input when the module does not expect it, this DTC sets.

### Conditions for Running the DTC

The Cruise switch is ON.

### Conditions for Setting the DTC

The Resume/Accel switch is ON for more than 90 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

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- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

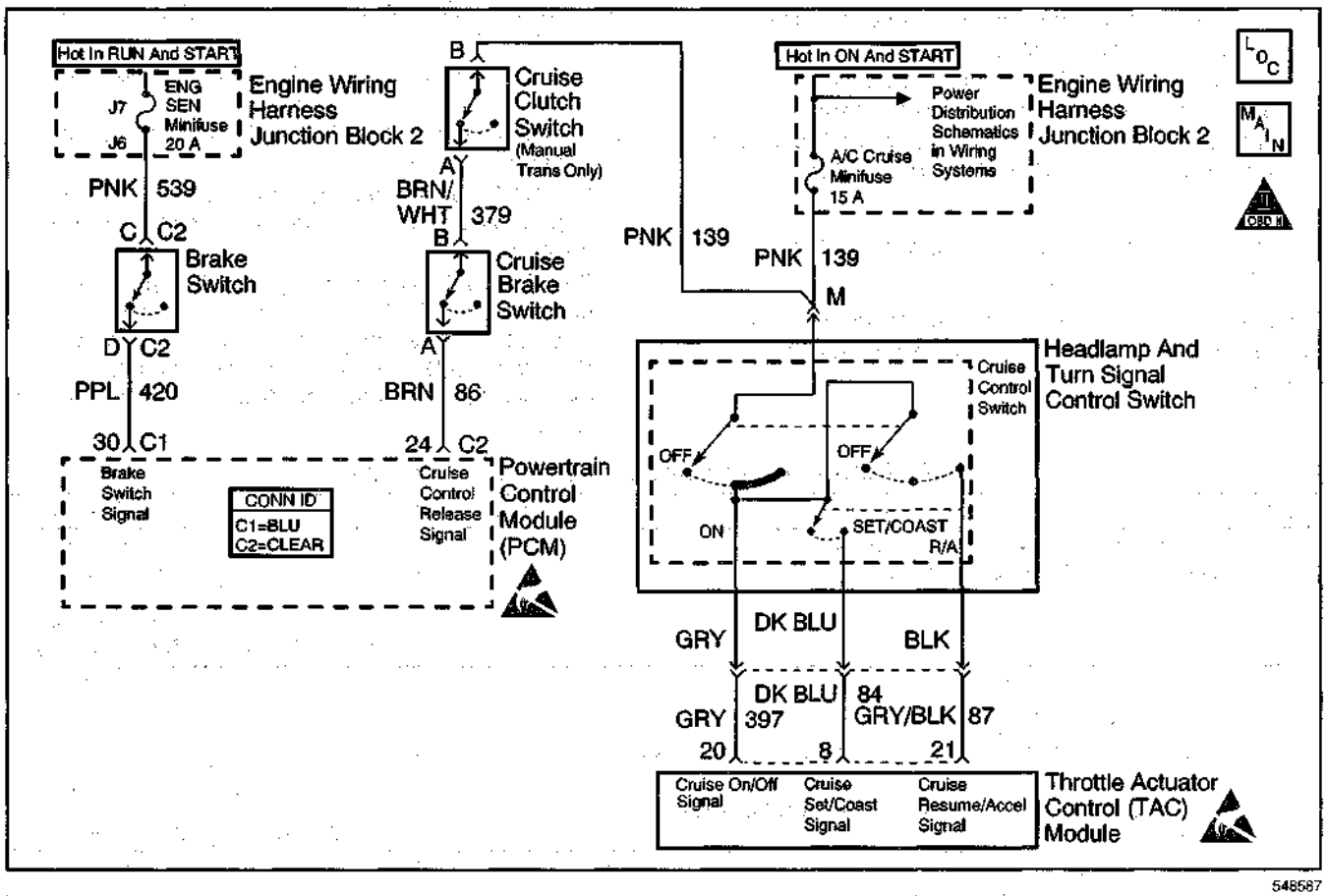
2. This step determines if the Resume/Accel signal circuit is shorted to voltage.
3. This step determines if the TAC module or the switch is at fault.
4. Inspect for a resume/accel switch stuck in the engaged position or for the signal circuit shorted to voltage.
7. This DTC will not report a pass. The scan tool status for this DTC will never report a pass. The scan tool will only indicate the DTC when the diagnostic fails. The repair is not complete if the scan tool indicates that the diagnostic ran and failed.

### DTC P0567 Cruise Control Resume Switch Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition.<br>2. Turn OFF the cruise switch.<br>3. With a scan tool, observe the Cruise Resume/Accel switch parameter.<br>Does the scan tool indicate the Cruise Resume/Accel switch ON? | — | *Go to Step 3* | Go to Diagnostic Aids |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the TAC module.<br>3. Turn ON the ignition.<br>4. Probe the Resume/Accel switch signal circuit at the TAC module harness using a *J 34142-B* test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 4* | *Go to Step 5* |
| 4 | Repair the short to voltage on the Resume/Accel switch signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 7* | *Go to Step 6* |
| 5 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 7* | — |
| 6 | Replace the multifunction lever. Refer to *Multifunction Turn Signal Lever Replacement - On Vehicle* in Steering Column.<br>Did you complete the repair? | — | *Go to Step 7* | — |
| 7 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 8* |
| 8 | Does the scan tool indicated any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0568 Cruise Control Set Switch Circuit




548587

### Circuit Description

The throttle actuator control (TAC) module is a communication link between the cruise switches and the PCM. The cruise Set/Coast switch is an input to the TAC module. This input is then communicated from the TAC module to the PCM across serial data, allowing the PCM to control and hold a requested speed. The Cruise Set/Coast switch sends an ignition voltage to the TAC module when the switch is closed (ON). If the PCM receives an input when the module does not expect it, this DTC sets.

### Conditions for Running the DTC

The Cruise switch is ON.

### Conditions for Setting the DTC

The Set/Coast switch is ON for more than 90 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

A set/coast switch stuck in the engage position or the signal circuit is shorted to voltage.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

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- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

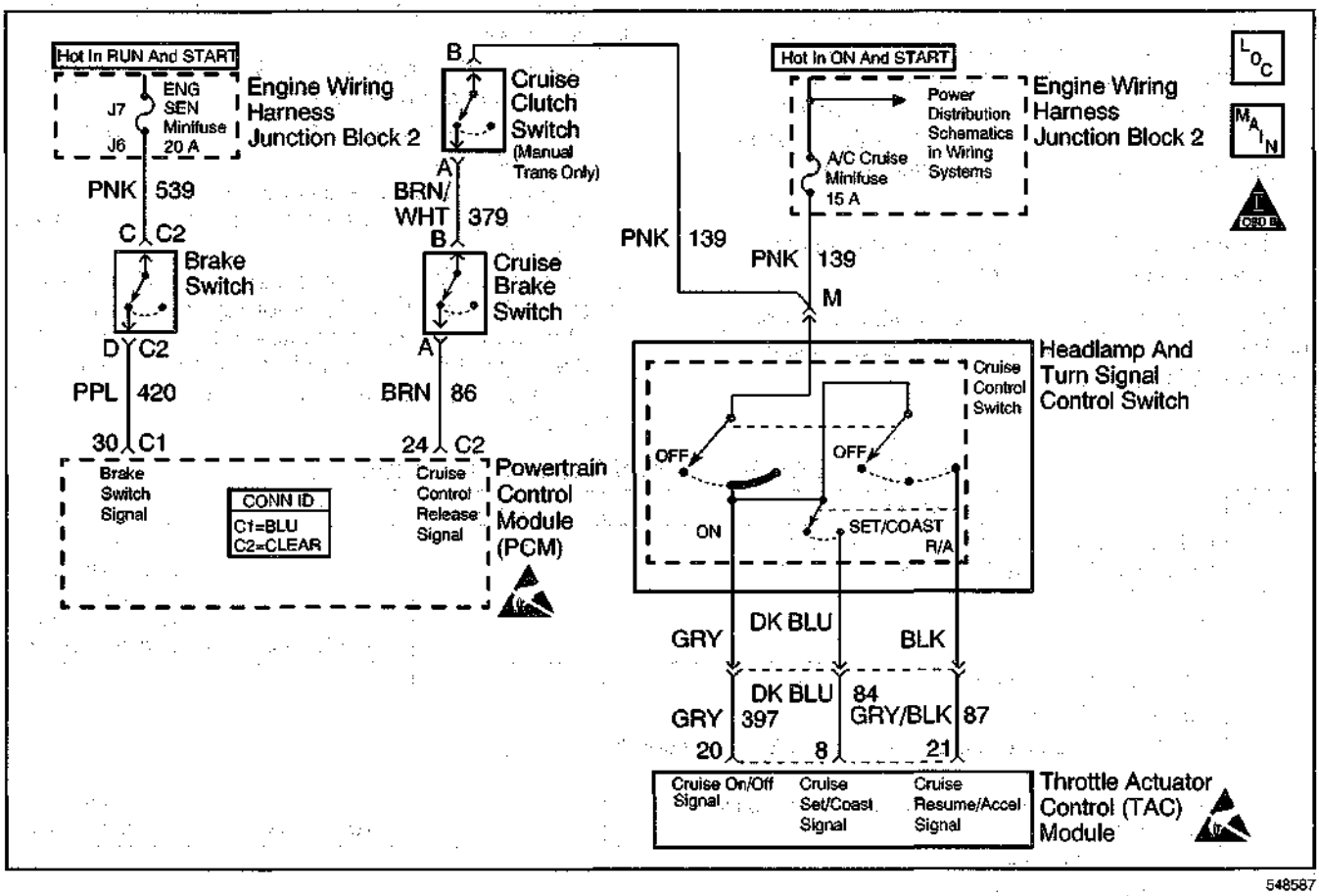
2. This step determines if the Resume/Accel signal circuit is shorted to voltage.
3. This step determines if the TAC module or the switch is at fault.
4. Inspect for a resume/accel switch stuck in the engaged position or for the signal circuit shorted to voltage.
7. This DTC will not report a pass. The scan tool status for this DTC will never report a pass. The scan tool will only indicate the DTC when the diagnostic fails. The repair is not complete if the scan tool indicates that the diagnostic ran and failed.

### DTC P0568 Cruise Control Set Switch Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition.<br>2. Turn OFF the cruise switch.<br>3. With a scan tool, observe the Cruise Set/Coast switch parameter.<br>Does the scan tool indicate the Cruise Set/Coast switch ON? | — | *Go to Step 3* | Go to Diagnostic Aids |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the TAC module.<br>3. Turn ON the ignition.<br>4. Probe the Set/Coast switch signal circuit at the TAC module harness using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 4* | *Go to Step 5* |
| 4 | Repair the short to voltage on the Set/Coast switch signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 7* | *Go to Step 6* |
| 5 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 7* | — |
| 6 | Replace the multifunction lever. Refer to *Multifunction Turn Signal Lever Replacement - On Vehicle* in Steering Column.<br>Did you complete the repair? | — | *Go to Step 7* | — |
| 7 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 8* |
| 8 | Does the scan tool indicated any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P0571 Cruise Control Brake Switch Circuit




548587

### Circuit Description

The cruise control brake switch and the cruise clutch switch are normally closed switches. When the Cruise Brake switch or the cruise clutch switch are closed, the PCM senses ignition voltage on the cruise control release signal circuit. The PCM compares this signal to the signal received from the other clutch and brake switches. If these switches do not agree this DTC will set.

### Conditions for Running the DTC

- The engine speed is more than 1000 RPM for 1 second.
- The wheel speed is more than 20 mph in order to enable the diagnostic. The diagnostic disables when the wheel speed is less than 5 mph.

### Conditions for Setting the DTC

- The vehicle speed decreases 1 MPH in 0.5 seconds without the PCM sensing a switch transition.
- The condition is present for 10 accel/decel cycles.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Perform the following in order to adjust the cruise control brake switch:

1. With the brake pedal depressed, insert the cruise control brake switch into the retainer until the switch body seats in the retainer. You can hear clicks as you push the threaded portion of the switch through the retainer.
2. Slowly pull the brake pedal fully rearward against the stop until you can no longer hear the clicks.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This step determines if the fault is present.
4. This step tests for a cruise control release circuit for a short to B+.

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## DTC P0571 Cruise Control Brake Switch Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Start the engine.<br>2. With a scan tool, observe the cruise release switch parameter.<br>3. Depress the brake pedal approximately half–way.<br>Does the scan tool parameter switch from Released to Applied? | — | Go to Diagnostic Aids | *Go to Step 3* |
| 3 | Inspect the A/C Cruise fuse.<br>Is the fuse open? | — | *Go to Step 4* | *Go to Step 6* |
| 4 | **Important:** Only do this step if the vehicle has a manual transmission. Otherwise go to step 5.<br>1. Disconnect the cruise clutch switch.<br>2. Probe the clutch switch feed circuit at the clutch switch connector using a *J 34142-B* Test Lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 17* | *Go to Step 5* |
| 5 | 1. Disconnect the cruise brake switch.<br>2. Probe the brake switch feed circuit at the brake switch connector using a test lamp that is connected to B+.<br>3. Probe the brake switch signal circuit at the brake switch connector using a test lamp that is connected to B+.<br>Does the test lamp illuminate when probing either circuit? | — | *Go to Step 26* | Go to *Cruise Control Diagnosis* |
| 6 | Test the adjustment of the cruise control brake switch. Go to Diagnostic Aids.<br>Did you find a correct the condition? | — | *Go to Step 27* | *Go to Step 7* |
| 7 | **Important:** Only do this step if the vehicle has a manual transmission. Otherwise go to step 12.<br>Test the adjustment of the cruise clutch switch. Go to Diagnostic Aids.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 8* |
| 8 | 1. Disconnect the cruise clutch switch.<br>2. Probe the cruise clutch switch feed circuit at the cruise clutch switch connector using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 9* | *Go to Step 18* |
| 9 | Probe the brake switch feed circuit at the clutch switch connector using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | 0V | *Go to Step 10* | *Go to Step 19* |
| 10 | 1. Remove the cruise clutch switch.<br>2. Measure the continuity across the switch while toggling it by hand.<br>Does the DMM toggle from open to continuity. | — | *Go to Step 11* | *Go to Step 20* |
| 11 | 1. Disconnect the cruise brake switch.<br>2. Measure the brake switch feed circuit for continuity between the clutch and the brake switch.<br>Does the DMM indicate continuity? | — | *Go to Step 13* | *Go to Step 21* |
| 12 | 1. Disconnect the cruise brake switch.<br>2. Probe the cruise brake switch feed circuit at the brake switch connector using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 13* | *Go to Step 22* |

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## DTC P0571 Cruise Control Brake Switch Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 13 | Probe the cruise control release switch signal circuit at the brake switch connector using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | 0V | *Go to Step 14* | *Go to Step 23* |
| 14 | 1. Remove the cruise brake switch.<br>2. Measure the continuity across the switch while toggling it by hand.<br>Does the DMM toggle from open to continuity? | — | *Go to Step 15* | *Go to Step 24* |
| 15 | Test for an open in the cruise control release switch signal circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 16* |
| 16 | Inspect for poor connections. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 25* |
| 17 | Repair the short to ground in the clutch switch feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | — |
| 18 | Repair the open in the clutch switch feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | — |
| 19 | Test for a short to voltage between the clutch switch and the PCM. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | *Go to Step 25* |
| 20 | Replace the cruise clutch switch.<br>Did you complete the replacement? | — | *Go to Step 27* | — |
| 21 | Repair the open in the brake switch feed circuit between the clutch and brake switch. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | — |
| 22 | Repair the open in the brake switch feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | — |
| 23 | Repair the short to voltage in the cruise control release signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | *Go to Step 25* |
| 24 | Replace the cruise brake switch.<br>Did you complete the replacement? | — | *Go to Step 27* | — |
| 25 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 27* | — |
| 26 | Repair the short to ground on the circuit which illuminated the test lamp. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | *Go to Step 25* |
| 27 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 28* |
| 28 | Does the scan tool indicated any DTCs set that you have not diagnosed? | — | Go to applicable DTC table | System OK |

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## DTC P0601Control Module Read Only Memory (ROM)

### Circuit Description

The PCM used in this vehicle utilizes an Electrically Erasable Programmable Read-Only Memory (EEPROM). The EEPROM contains program information and the calibrations required for powertrain diagnostics operation.

Unlike the PROM used in past applications, the EEPROM is not replaceable. When the PCM is replaced or a calibration update is required, the PCM must be programmed using approved Techline equipment.

### Conditions for Running the DTC

The ignition is in the crank or run position.

### Conditions for Setting the DTC

The PCM does not contain the correct program required to operate the vehicle.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Diagnostic Aids

DTC P0601 indicates that the contents of the EEPROM have changed since the PCM was programmed. The only possible repair is PCM replacement. Remember to program the replacement PCM with the correct software and calibration for the vehicle.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

**DTC P0601Control Module Read Only Memory (ROM)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |

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## DTC P0602 Control Module Not Programmed

### Circuit Description

The PCM used in this vehicle utilizes an Electrically Erasable Programmable Read-Only Memory (EEPROM). The EEPROM contains program information and the calibrations required for powertrain diagnostics operation.
Unlike the PROM used in past applications, the EEPROM is not replaceable. When the PCM is replaced or a calibration update is required, the PCM must be programmed using approved Techline equipment.

### Conditions for Setting the DTC

The ignition is in the crank or run position.

### Conditions for Setting the DTC

The PCM does not contain the correct program required to operate the vehicle.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

**DTC P0602 Control Module Not Programmed**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Program the PCM with the correct software. Refer to *PCM Replacement/Programming.*<br>2. Retest for DTC P0602.<br>Did DTC P0602 reset? | — | *Go to Step 3* | System OK |
| 3 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |

## DTC P0604 Control Module Random Access Memory (RAM)

### Circuit Description

The PCM performs an internal self-test on its Random Access Memory (RAM) or read/write memory. If this self-test fails, this DTC sets.

### Conditions for Running the DTC

- The ignition voltage is more than 10 volts.
- The ignition is ON for 5 seconds.

### Conditions for Setting the DTC

The internal RAM test fails.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. This DTC indicates an internal PCM problem.

**DTC P0604 Control Module Random Access Memory (RAM)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |

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## DTC P0606 Control Module Internal Performance

### Circuit Description

This diagnostic indicates that the PCM detects an internal microprocessor integrity fault.

### Conditions for Running the DTC

The PCM is powered-up.

### Conditions for Setting the DTC

The PCM detects an internal microprocessor integrity fault.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

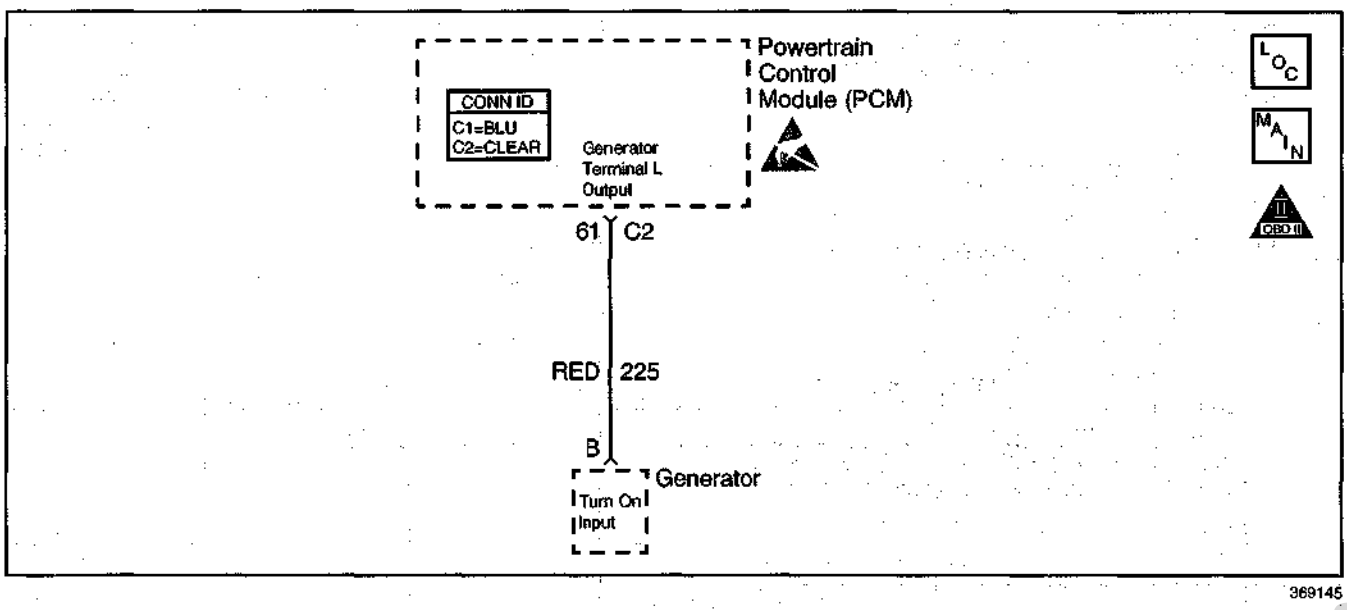
2. This DTC indicates an internal PCM problem.

**DTC P0606 Control Module Internal Performance**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | Go to *A Powertrain On Board Diagnostic (OBD) System Check* | — |

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## DTC P0620 Generator Performance




### Circuit Description

The PCM Output (L) terminal to the alternator determines when the alternator will be turned off. It is on under all normal vehicle operating conditions except during low RPM conditions. The alternator is turned off during low RPM conditions to remove excess load from the engine.

The alternator telltale lamp will illuminate any time the ignition is on and engine is not running. The telltale will go out after the engine is running and the alternator is putting out the desired amperage.

### Conditions for Running the DTC

- The engine is running.
- The voltage telltale is ON.

### Conditions for Setting the DTC

The above condition is present for more than 30 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.
  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.
  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

6. This vehicle is equipped with a PCM which utilizes and Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

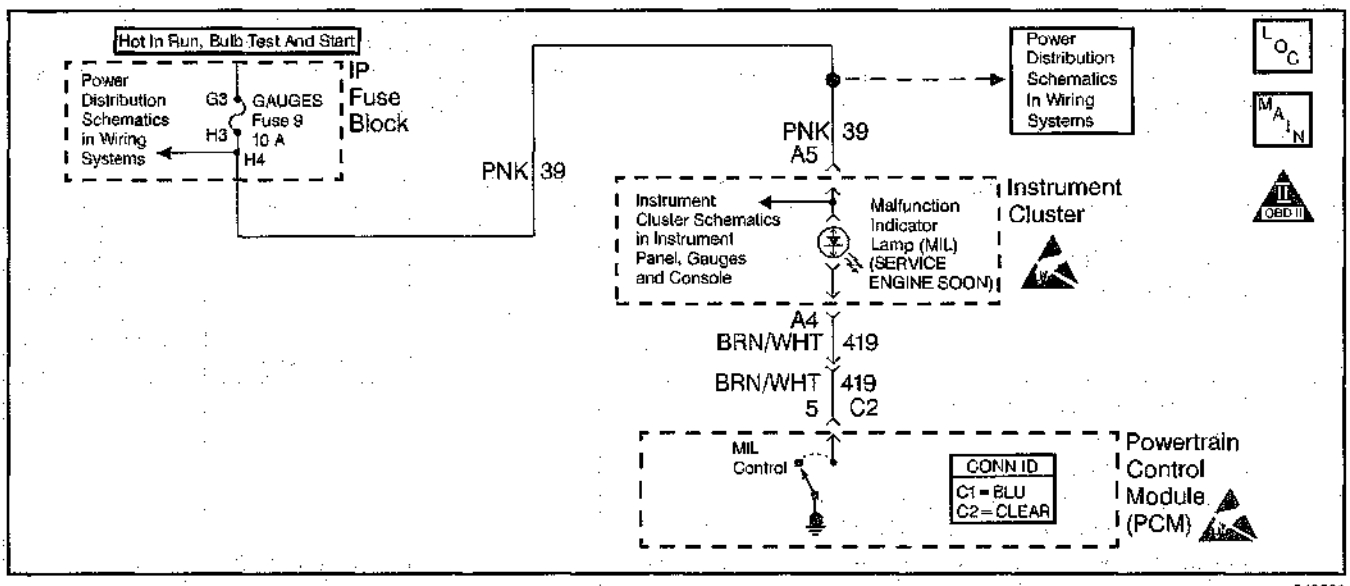
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## DTC P0620 Generator Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go To Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn OFF the ignition.<br>2. Disconnect the Generator harness connector.<br>3. Connect a *J 39200* DMM between the (L) terminal and a good ground.<br>4. Start the engine.<br>Command the Generator on with the scan tool while observing the DMM.<br>Does the voltage change from the first indicated value to the second indicated value? | 0.0V<br>5.0V | Go To Starting and Charging | *Go To Step 3* |
| 3 | Test the (L) circuit for an open or short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go To Step 7* | *Go To Step 4* |
| 4 | Test the (L) circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go To Step 7* | *Go To Step 5* |
| 5 | Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go To Step 7* | *Go To Step 6* |
| 6 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/ Programming.*<br>Did you complete the replacement? | — | *Go To Step 7* | — |
| 7 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within Fail Records conditions.<br>Does the DTC reset? | — | *Go To Step 2* | System OK |

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## DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit




### Circuit Description

Output driver modules (ODMs) are used by the PCM to turn on many of the current-driven devices that are needed to control various engine and Transaxle functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding ON. Unlike the quad driver modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P0650 set indicates an improper voltage level on the output circuit that controls the malfunction indicator lamp (MIL).

### Conditions for Running the DTC

Ignition is ON.

### Conditions for Setting the DTC

- An improper voltage level has been detected on the output circuit which controls the malfunction indicator lamp (MIL).
- Above conditions for at least 30 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. Normally, ignition feed voltage should be present on the control circuit with the PCM disconnected and the ignition turned ON.
4. Tests for a short to voltage on the control circuit.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

**DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. Measure the voltage on the MIL control circuit using a *J 39200* DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | B+ | *Go to Step 3* | *Go to Step 6* |
| 3 | Probe the MIL control circuit using a test lamp that is connected to ground.<br>Does test lamp illuminate? | — | *Go to Step 4* | *Go to Step11* |
| 4 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Disconnect the instrument panel.<br>4. Turn ON the ignition.<br>5. Measure the voltage on the MIL control circuit using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | 0 V | *Go to Step 10* | *Go to Step 5* |
| 5 | Repair short to voltage in the MIL control circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 6 | Inspect the ignition feed fuse for the instrument panel indicators.<br>Is the fuse open? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | 1. Repair the short to ground in ignition feed circuit for the instrument panel indicators. Refer to *Wiring Repairs* in Wiring Systems.<br>2. Replace the fuse.<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 8 | 1. Disconnect the instrument cluster.<br>2. Turn ON the ignition.<br>3. Measure the voltage on the ignition feed circuit for the instrument cluster indicators using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | B+ | *Go to Step 9* | *Go to Step 13* |
| 9 | Test the MIL control circuit for an open or a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 10* |
| 10 | Inspect the MIL control circuit and the instrument panel indicators ignition feed circuit for a poor connection at the instrument panel and the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | Go to *A Diagnostic System Check - Instrument Cluster* in Instrument Panel, Gauges and Console |

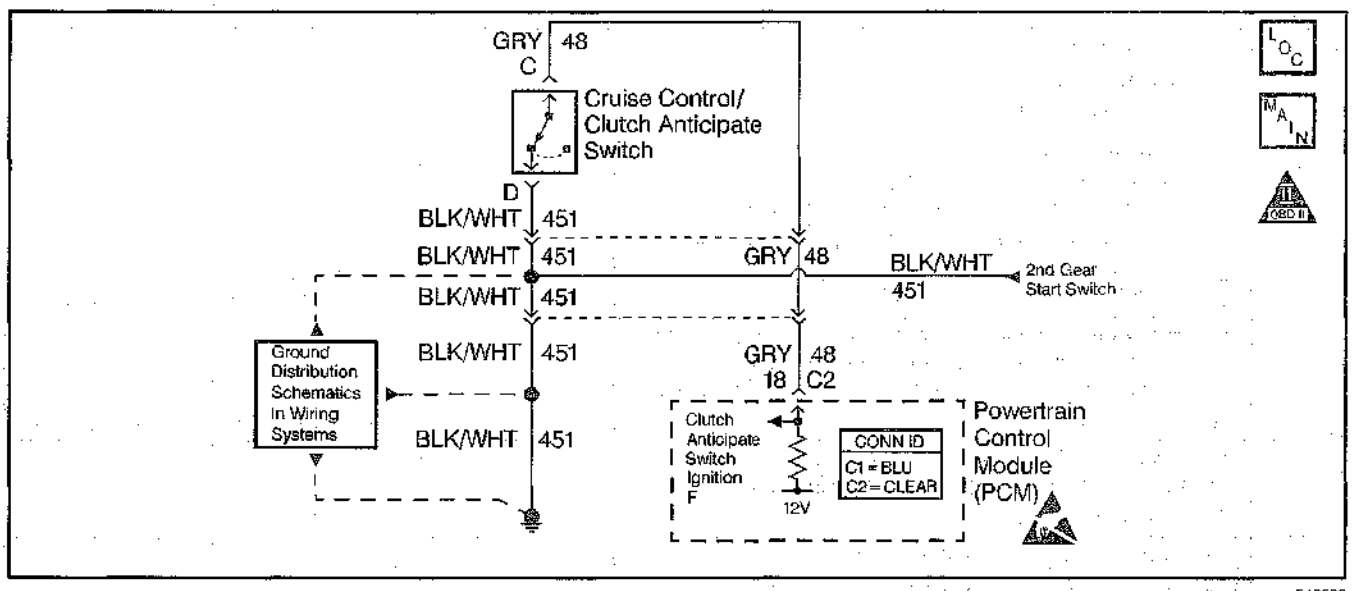
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## DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 11 | 1. Turn OFF the ignition.<br>2. Reconnect the PCM.<br>3. Disconnect the instrument cluster.<br>4. Turn ON the ignition.<br>5. Connect a *J 34142-B* test lamp between the MIL control circuit and the I/P ignition feed circuit.<br>6. With a scan tool, command the MIL ON and OFF.<br>Does the test lamp flash ON and OFF with each command? | — | Go to Diagnostic Aids | *Go to Step 12* |
| 12 | Inspect the MIL control circuit for a faulty connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 13 | Repair the open in the ignition feed circuit to the I/P indicators. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 15* | — |
| *14* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs<br>2. Operate the vehicle within Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P0704 Clutch Switch Circuit




### Circuit Description

The clutch anticipate switch input allows the PCM to adjust the idle when the manual transmission clutch is being disengaged. The PCM monitors the Clutch Anticipate Switch input; if a low voltage is monitored, the PCM considers the Clutch Anticipate Switch closed to ground (clutch engaged). When the ground at the Clutch Anticipate Switch input is interrupted (clutch being disengaged), the PCM will immediately decrease idle. This is done to avoid a possible RPM flare caused by the sudden change in engine load.

### Conditions for Running the DTC

Engine load and engine speed acceleration indicate that the vehicle is in gear and moving.

### Conditions for Setting the DTC

- The Clutch Anticipate Switch PCM input indicates that the clutch is engaged. (clutch switch closed to ground).
- Above conditions must be present for more than 3 minutes.

OR

- Changes in the vehicle speed to engine speed ratio indicate that more than 70 gear changes have occurred.
- The state of the Clutch Anticipate Switch did not change.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. This step tests the true state of the clutch pedal switch.
7. This step tests the integrity of the Clutch Anticipate Switch input circuit.
15. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

**DTC P0704 Clutch Switch Circuit**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition.<br>2. With a scan tool, observe the Clutch Anticipate Switch parameter.<br>Does the scan tool indicate Released? | — | *Go to Step 3* | *Go to Step 6* |
| 3 | Depress the clutch pedal while observing the Clutch Anticipate Switch parameter on the scan tool.<br>Does the parameter change to Applied? | — | Go to Diagnostic Aids | *Go to Step 4* |
| 4 | Disconnect the Clutch Anticipate Switch.<br>Does the scan tool indicate Applied? | — | *Go to Step 13* | *Go to Step 5* |
| 5 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM<br>3. Probe the signal circuit at the PCM harness connector using a *J 34142-B* test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 9* | *Go to Step 15* |
| 6 | 1. Disconnect the clutch pedal switch.<br>2. Probe the ground circuit using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 7* | *Go to Step 10* |
| 7 | 1. Connect a fused jumper between the signal circuit and the ground circuit.<br>2. With a scan tool, observe the clutch anticipate switch parameter.<br>Does the scan tool indicate Released? | — | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the signal circuit for an open or a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 14* |
| 9 | Repair the short to ground in the signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 16* | — |
| 10 | Repair open in the ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 16* | — |
| 11 | Test the Clutch Anticipate Switch adjustment. Refer to *Clutch Anticipate Switch Replacement* in Clutch.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 12* |
| 12 | Inspect for poor connections at the Clutch Anticipate Switch. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 13* |

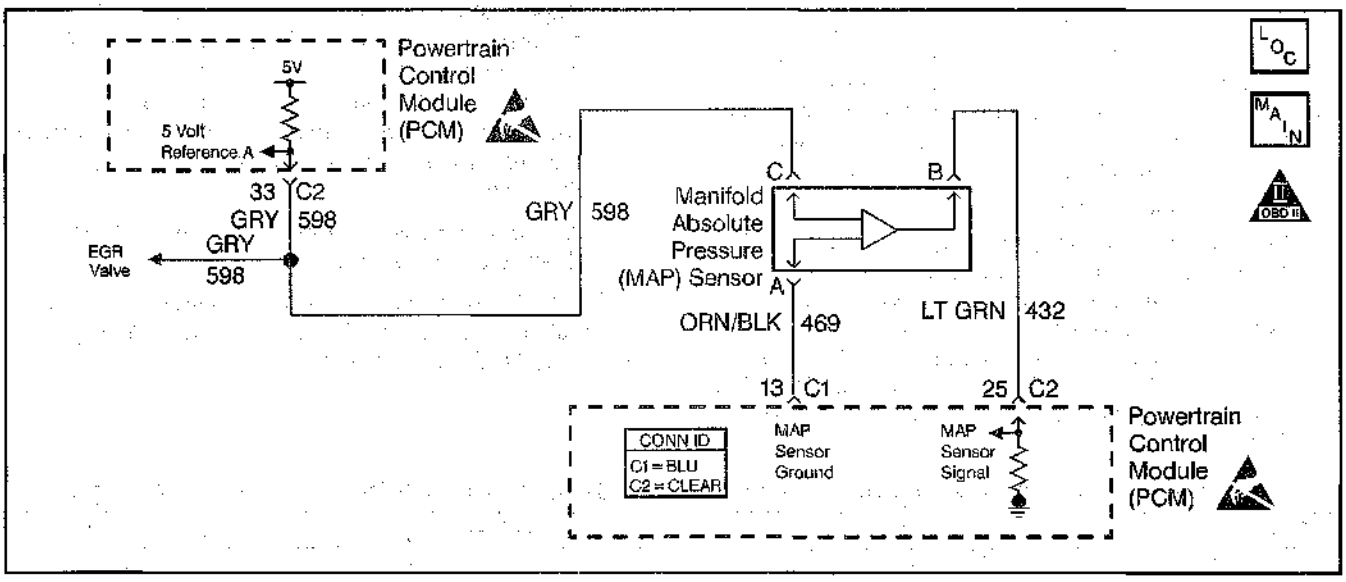
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## DTC P0704 Clutch Switch Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 13 | Replace the Clutch Anticipate Switch. Refer to *Clutch Anticipate Switch Replacement* in Clutch.<br>Did you complete the replacement? | — | *Go to Step 16* | — |
| 14 | Inspect for poor connections at PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 15* |
| *15* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 16* | — |
| 16 | 1. Turn ON the ignition.<br>2. With a scan tool, observe the clutch anticipate switch parameter.<br>Does scan tool indicate Released? | — | *Go to Step 17* | *Go to Step 6* |
| 17 | Depress the clutch pedal while observing the Clutch Anticipate Switch display on the scan tool.<br>Does the parameter change to Applied? | — | System OK | *Go to Step 4* |

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## DTC P1106 Manifold Absolute Pressure (MAP) Sensor Circuit Intermittent High Voltage




368338

### Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from less than 2 volts at idle (high vacuum) to more than 4 volts with the key ON, engine not running or at wide-open throttle (low vacuum). The MAP sensor is used to determine manifold pressure changes while the EGR flow test diagnostic is being run, refer to *DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient*. Also to update the barometric pressure reading (BARO), as an enabling factor for other diagnostics. The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is intermittently high, DTC P1106 will set.

### Conditions for Running the DTC

- No TP sensor DTCs are present.
- The engine has been running for a length of time that is determined by startup coolant temperature. The length of time ranges from 2 minutes at less than -30°C(-22°F) to 0.5 second at more than 30°C (86°F).
- The throttle position is less than 2 percent when the engine speed is less than 900 rpm.

  OR

  The throttle position is 0 percent when the engine speed is more than 900 rpm.

### Conditions for Setting the DTC

- The MAP sensor intermittently indicates a voltage more than 4.2 volts.
- The above conditions are present for more than 5 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

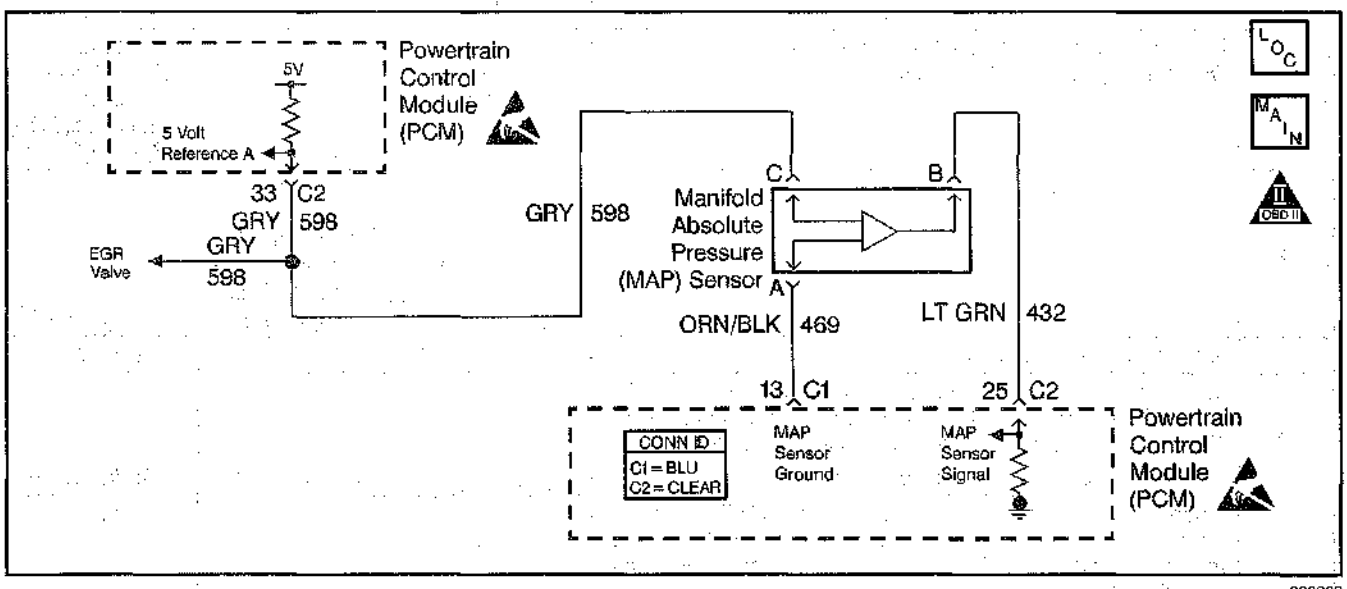
If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### DTC P1106 Manifold Absolute Pressure (MAP) Sensor Circuit Intermittent High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Is DTC P0108 also set? | — | Go to *DTC P0108 Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage* | *Go to Step 3* |
| 3 | Is DTC P1111 or P1115 also set? | — | *Go to Step 6* | *Go to Step 4* |
| 4 | Inspect the MAP ground for a poor connection at the MAP sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 5* |
| 5 | Inspect the MAP ground for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 8* |
| 6 | Test the signal circuit of the MAP sensor for an intermittent short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 7* |
| 7 | Test the 5 volt reference A circuit of the MAP for an intermittent short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 8* |
| 8 | Test the ground circuit for an intermittent open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 9* | Go to Diagnostic Aids |
| 9 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions. Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1107 Manifold Absolute Pressure (MAP) Sensor Circuit Intermittent Low Voltage




### Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from less than 2 volts at idle (high vacuum) to more than 4 volts with the key ON, engine not running or at wide-open throttle (low vacuum). The MAP sensor is used to determine manifold pressure changes while the EGR flow test diagnostic is being run, refer to *DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient*. Also to update the barometric pressure reading (BARO), as an enabling factor for other diagnostics. The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is intermittently low, DTC P1107 will set.

### Conditions for Running the DTC

- No TP sensor DTCs are present.
- The ignition is ON.
- Throttle angle is steady more than 0 percent if engine speed is less than 1000 rpm.

  OR

  Throttle angle is steady more than 10 percent if engine speed is more than 1000 rpm.

### Conditions for Setting the DTC

- The MAP sensor intermittently indicates a voltage less than 0.1 volt.
- The above conditions are present for more than 5 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

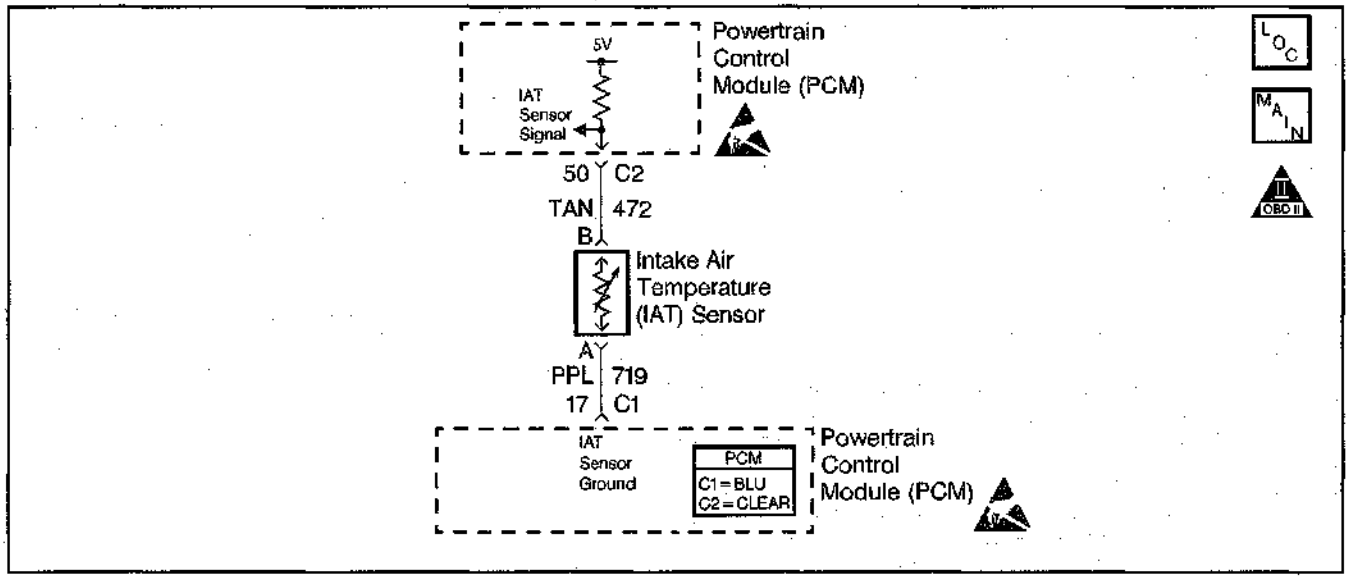
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## DTC P1107 Manifold Absolute Pressure (MAP) Sensor Circuit Intermittent Low Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Is DTC P0107 also set? | — | Go to *DTC P0107 Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage* | *Go to Step 3* |
| 3 | Are any TP DTCs also set? | — | *Go to Step 7* | *Go to Step 4* |
| 4 | Inspect for poor connections at the harness connector of the MAP sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 5* |
| 5 | Inspect the 5 volt reference A circuit of the MAP sensor for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 6* |
| 6 | Inspect the signal circuit of the MAP sensor for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 7* |
| 7 | Test the 5 volt reference A circuit of the MAP sensor for an intermittent open or short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 9* | *Go to Step 8* |
| 8 | Test the Signal circuit of the MAP sensor for an intermittent open or short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 9* | Go to Diagnostic Aids |
| 9 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1111 Intake Air Temperature (IAT) Sensor Circuit Intermittent High Voltage




221729

### Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The PCM applies 5.0 volts through a pull up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P1111 will set when the PCM detects an intermittently high signal voltage on the intake air temperature sensor signal circuit.

### Conditions for Running the DTC

- No active ECT, MAF sensor or VSS DTCs.
- The engine has been running for more than 3 minutes.
- Vehicle speed is less than 56 km/h(35 mph).
- The mass air flow is less than 12 g/s.
- The engine coolant temperature is more than 60°C (140°F).

### Conditions for Setting the DTC

- IAT signal voltage indicates an intake air temperature intermittently less than –34°C (–29°F).
- The above conditions are present for more than 5 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

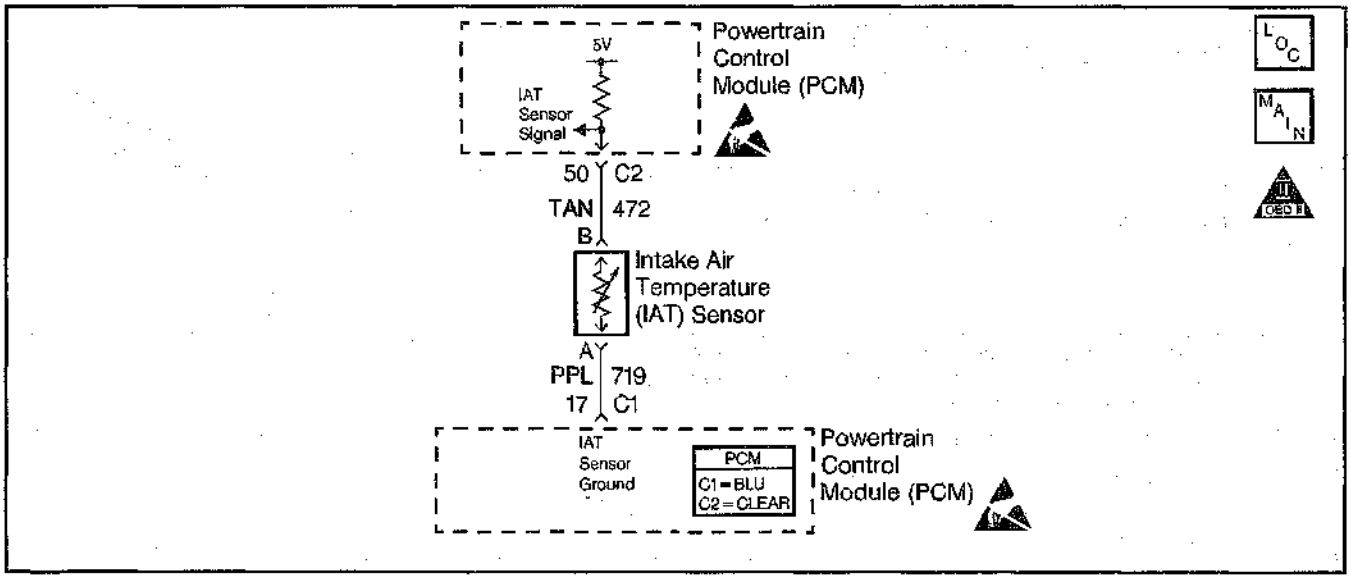
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## DTC P1111 Intake Air Temperature (IAT) Sensor Circuit Intermittent High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | With a scan tool, select Diagnostic Trouble Codes (DTC). Is DTC P0113 also set? | — | Go to *DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Voltage* | *Go to Step 3* |
| 3 | Is DTC P1106 or P1115 also set? | — | *Go to Step 6* | *Go to Step 4* |
| 4 | Inspect for a faulty ground circuit connection at the IAT sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 5* |
| 5 | Inspect for a faulty signal circuit connection at the IAT sensor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 6* |
| 6 | Test the signal circuit of the IAT sensor for an intermittent open. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 7* |
| 7 | Test the signal circuit of the IAT sensor for an intermittent short to voltage. Refer to *Testing for Intermittent and Poor Connections* and *Wiring Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 8* |
| 8 | Inspect for a faulty sensor ground circuit connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 9* |
| 9 | Test the ground circuit of the IAT sensor for an intermittent open or a faulty splice. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | Go to Diagnostic Aids |
| 10 | 1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Fail Record conditions. Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1112 Intake Air Temperature (IAT) Sensor Circuit Intermittent Low Voltage




221729

### Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The PCM applies 5.0 volts through a pull up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P1112 will set when the PCM detects an intermittently low signal voltage on the intake air temperature sensor signal circuit.

### Conditions for Running the DTC

- No active ECT, MAF sensor or VSS DTCs.
- The engine has been running for over 10 seconds.
- Vehicle speed is more than 25 mph.

### Conditions for Setting the DTC

- The IAT sensor indicates an intake air temperature intermittently more than 135°C (275°F).
- The conditions is present for up to 5 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

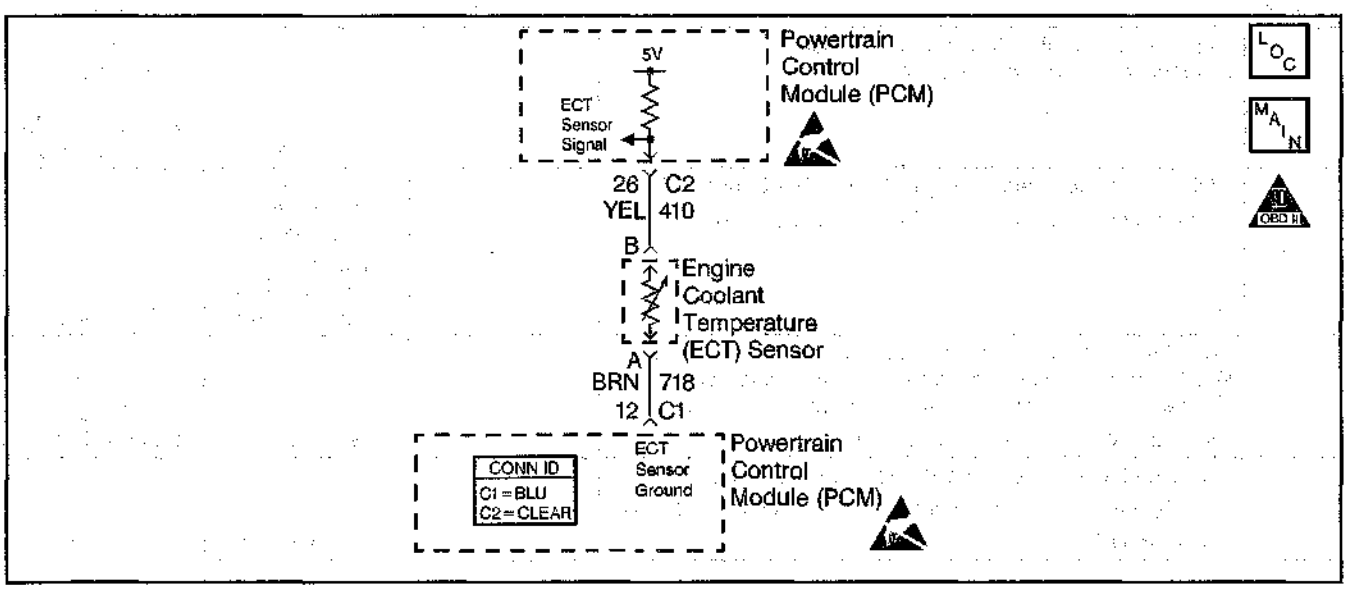
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## DTC P1112 Intake Air Temperature (IAT) Sensor Circuit Intermittent Low Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | With a scan tool, select Diagnostic Trouble Codes (DTC).<br>Does the scan tool indicate DTC P0112 also set? | — | Go to *DTC P0112 Intake Air Temperature (IAT) Sensor Circuit Low Voltage* | *Go to Step 3* |
| 3 | Test the signal circuit for an intermittent short to ground. Refer to *Testing for Intermittent and Poor Connections* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1114 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent Low Voltage




### Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The PCM applies a voltage (about 5.0 volts) through a pull up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently below the range of the ECT sensor, DTC P1114 will set.

### Conditions for Running the DTC

The engine has been running for more than 15 seconds.

### Conditions for Setting the DTC

- The ECT sensor is intermittently more than 140°C (284°F)
- The condition is present for at least 3 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

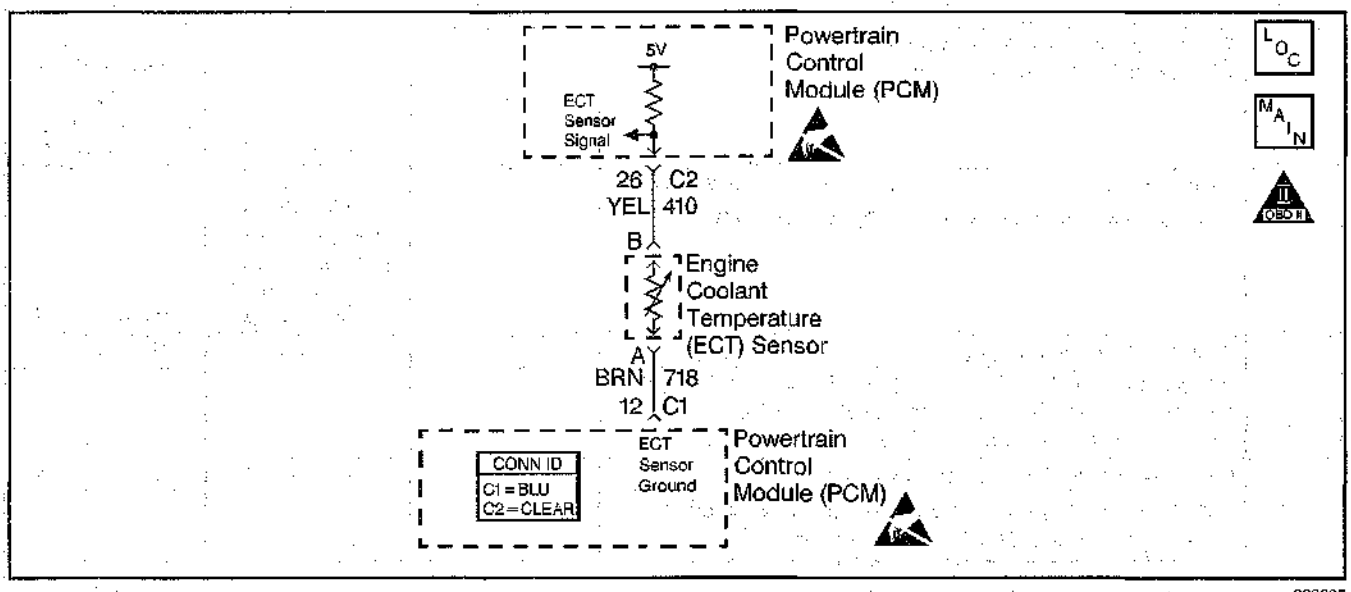
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## DTC P1114 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent Low Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | With a scan tool, select Diagnostic Trouble Codes (DTC).<br>Does the scan tool indicate DTC P0117 also set? | — | Go to *DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage* | *Go to Step 3* |
| 3 | Test the signal circuit of the ECT sensor for an intermittent short to ground. Refer to *Testing for Intermittent and Poor Connections* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1115 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent High Voltage




### Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The PCM applies a voltage (about 5.0 volts) through a pull up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high; therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently above the range of the ECT sensor, DTC P1115 will set.

### Conditions for Running the DTC

The engine has been running for more than 15 seconds.

### Conditions for Setting the DTC

- The ECT sensor is intermittently less than -34°C (-29°F)
- Above conditions present for more than 5 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

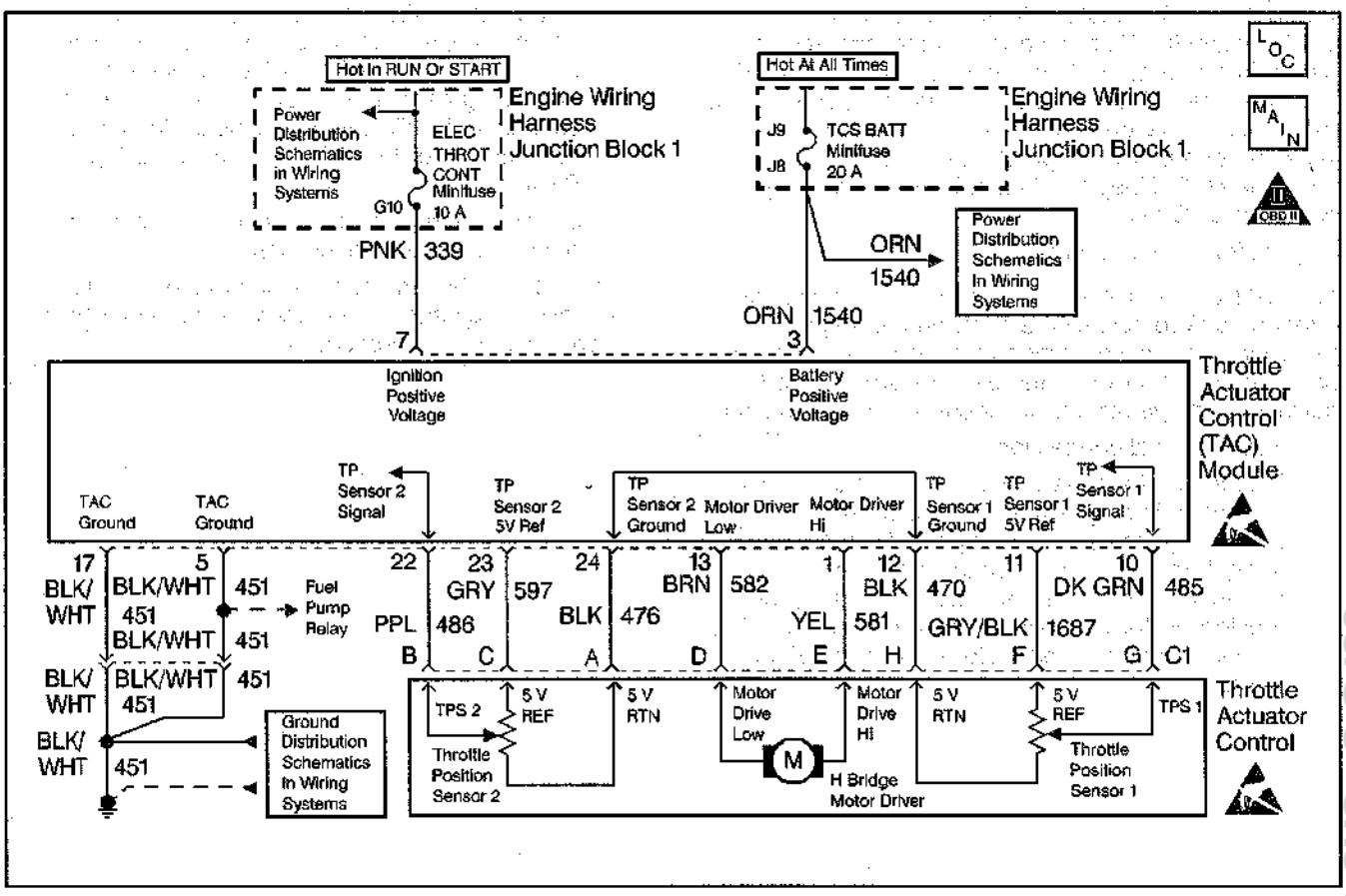
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## DTC P1115 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | With a scan tool, select Diagnostic Trouble Codes (DTC). Does the scan tool indicate DTC P0118 also set? | — | Go to *DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage* | *Go to Step 3* |
| 3 | Is DTC P1106 or P1111also set? | — | *Go to Step 8* | *Go to Step 4* |
| 4 | Inspect for a faulty ground circuit connection at the ECT sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 5* |
| 5 | Inspect for a faulty signal circuit connection at the ECT sensor. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 6* |
| 6 | Test the signal circuit of the ECT sensor for an intermittent open. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 7* |
| 7 | Test the signal circuit of the ECT sensor for an intermittent short to voltage. Refer to *Testing for Intermittent and Poor Connections* and *Wiring Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 8* |
| 8 | Inspect for a faulty sensor ground circuit connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | *Go to Step 9* |
| 9 | Test the ground circuit of the ECT sensor for an intermittent open or a faulty splice. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition? | — | *Go to Step 10* | Go to Diagnostic Aids |
| 10 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1120 Throttle Position (TP) Sensor 1 Circuit




### Circuit Description

The throttle position (TP) sensor is mounted on the throttle body/TAC assembly. The sensor is actually two individual throttle position sensors within one housing. Two separate signal, ground and reference circuits are used in order to connect the TP sensor assembly and the throttle actuator control (TAC) module. The TP sensor signal voltage increases as the throttle opens. The signal circuit for TP Sensor is pulled up to reference voltage.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are not set.
- The ignition switch is in the crank or run position.
- The ETC serial data is operational.

### Conditions for Setting the DTC

TP sensor 1 voltage is less than 0.34 volts or more than 4.4 volts as observed on the scan tool.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## DTC P1120 Throttle Position (TP) Sensor 1 Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If the code does not set this ignition, refer to Diagnostic Aids.<br>1. Turn ON the ignition.<br>2. With a scan tool, observe the TP sensors Disagree parameter.<br>Does the scan tool indicate YES? | — | *Go to Step 3* | *Go to Step 11* |
| 3 | 1. With a scan tool, observe the TP sensor voltage parameter.<br>2. Depress the throttle to wide open throttle (WOT) and release.<br>Does the scan tool indicate voltage at or near the specified value throughout throttle travel? | 1 V | *Go to Step 21* | *Go to Step 4* |
| 4 | Does scan tool indicate voltage below the specified value throughout throttle travel? | 1 V | *Go to Step 5* | *Go to Step 7* |
| 5 | 1. With a scan tool, observe the TP sensor voltage parameter.<br>2. Disconnect the TAC throttle body.<br>Does the scan tool indicate voltage at or near the specified value when the TAC is disconnected? | 5 V | *Go to Step 6* | *Go to Step 13* |
| 6 | 1. Turn OFF the ignition for 15 seconds.<br>2. Turn ON the ignition.<br>3. Measure the voltage on the reference circuit using a DMM that is connected to a good ground.<br>Does the voltage measure within the specified range? | 3.9–4.6V | *Go to Step 23* | *Go to Step 17* |
| 7 | 1. Disconnect the TAC / throttle body.<br>2. Turn ON the ignition.<br>3. With a scan tool, observe the TP sensor voltage parameter.<br>4. Connect a test lamp between the signal and return circuits.<br>Does the scan tool indicate voltage at the specified value when the test lamp is installed? | 0V | *Go to Step 10* | *Go to Step 8* |
| 8 | 1. Remove the test lamp from the return circuit.<br>2. Connect the test lamp to a good ground.<br>Does the scan tool indicate voltage at the specified value when the test lamp is installed? | 0V | *Go to Step 14* | *Go to Step 9* |
| 9 | Did the test lamp illuminate when the it was connected between the signal circuit and ground? | — | *Go to Step 15* | *Go to Step 16* |
| 10 | 1. Turn OFF the ignition for 15 seconds.<br>2. Turn ON the ignition.<br>3. Measure the voltage on the reference circuit using a DMM that is connected to a good ground.<br>Does the voltage measure within the specified range? | 3.9–4.6V | *Go to Step 23* | *Go to Step 18* |
| 11 | Inspect the ELEC THROT CONT and TCS BATT fuses.<br>Are the fuses OK? | — | *Go to Step 12* | *Go to Step 19* |

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## DTC P1120 Throttle Position (TP) Sensor 1 Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 12 | 1. Disconnect the TAC module.<br>2. Probe the feed circuits using a test lamp with a test lamp that is connected to a good ground.<br>Does the test lamp illuminate when probing the feed circuits? | — | Go to *DTC P1515 Control Module Throttle Actuator Position Performance* or *DTC P1516 Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance* | *Go to Step 20* |
| 13 | Test the signal circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 26* |
| 14 | Test the return circuit for an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 25* |
| 15 | Test the signal circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 26* |
| 16 | Test the signal circuit for an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 25* |
| 17 | Test the reference circuit for an open or short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 25* |
| 18 | Test the reference circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 26* |
| 19 | Repair the short to ground in the feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | — |
| 20 | Repair the open in the feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | — |
| 21 | Test the return circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 22* |
| 22 | Test for continuity between the reference circuit in the TAC and ground. Refer to *Circuit Testing* in Wiring Systems.<br>Is continuity indicated? | — | *Go to Step 24* | *Go to Step 26* |
| 23 | Inspect for a poor connection at the TAC. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 24* |
| 24 | Replace the throttle body/TAC assembly. Refer to *Throttle Body Assembly Replacement.*<br>Did you complete the replacement? | — | *Go to Step 27* | — |
| 25 | Inspect for a poor connection at the TAC module. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 26* |
| 26 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 27* | — |
| 27 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 28* |
| 28 | Does the scan tool display any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1125 Accelerator Pedal Position (APP) System

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual Accelerator Pedal Position sensors within one housing. Three separate signals, a ground, and reference circuits. If only one APP sensor DTC is set, the redundant APP systems allow the Electronic Throttle Control (ETC) system to continue operating normally. This DTC sets if the PCM detects a problem with more than one APP sensor. One APP sensor DTC will not cause the Reduced Engine Power message to be displayed. Two APP sensor DTCs for the same sensor also will not cause the Reduced Engine Power message to be displayed. However, if two or more DTCs are set involving more than one APP sensor, this DTC will set and the Reduced Engine Power message is displayed.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are not set.
- The ignition is ON.
- The ETC serial data is operational.

### Conditions for Setting the DTC

Two or more APP sensors are out of range or all three APP sensors disagree or one APP sensor is out of range and the other two APP sensors disagree.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

- If a repair is completed and the DTC was cleared using a scan tool on the same ignition cycle, the default action will not clear until an ignition cycle has occurred.
- When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.
  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.
  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

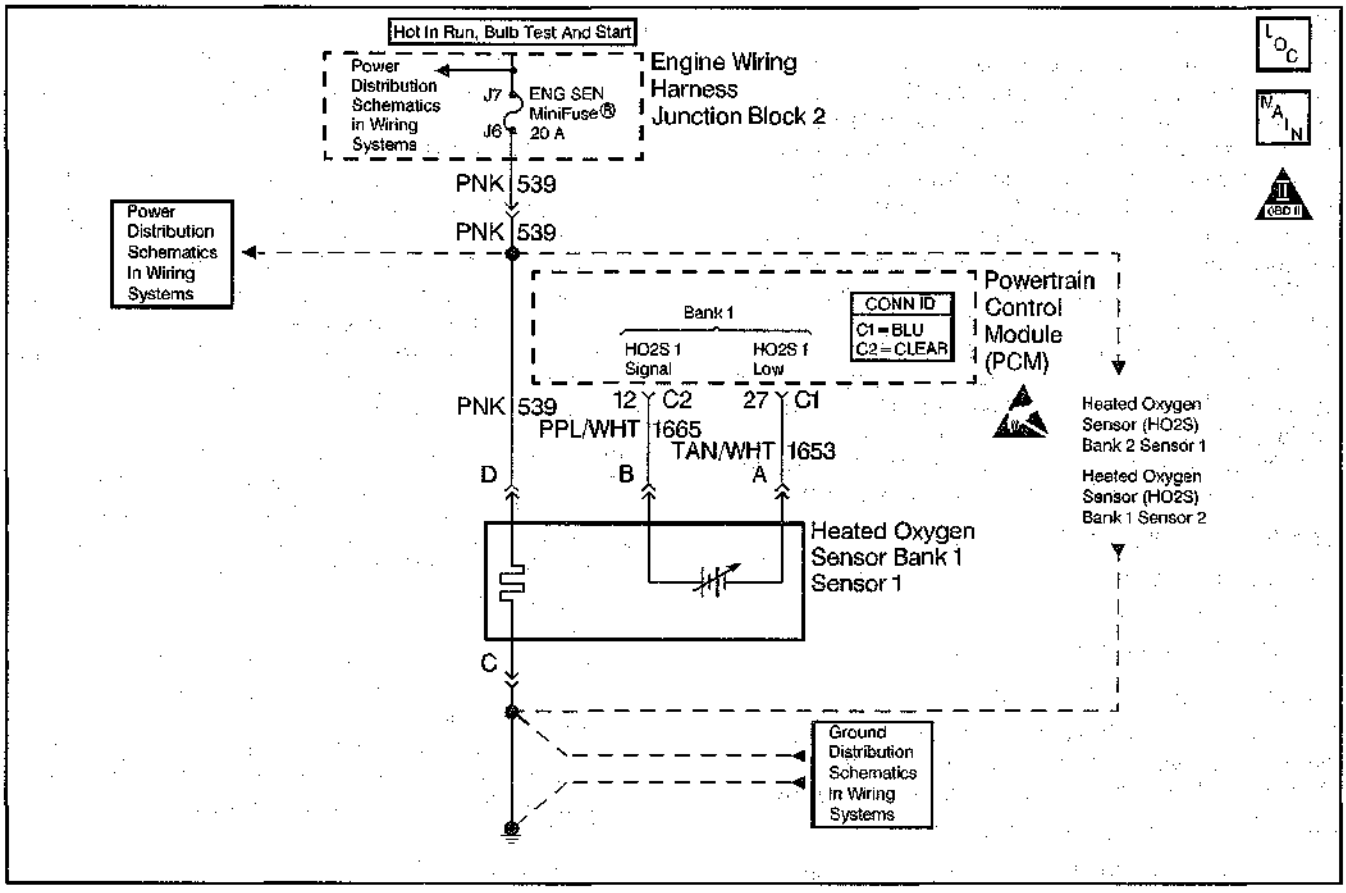
2. When the problems are corrected which are causing the APP sensor DTCs to set, the status of this DTC will change to History.

**DTC P1125 Accelerator Pedal Position (APP) System**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| *2* | This DTC indicates that two or more APP sensor DTCs are also set.<br>Review the DTCs.<br>Go to the APP sensor DTCs that are set and perform those diagnostic tables. | — | — | — |

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## DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1




### Circuit Description

The PCM monitors the heated oxygen sensor (HO2S) activity. The PCM counts the number of times that the HO2S signal voltage crosses the rich to lean and lean to rich thresholds during a 100 second test period. If the PCM determines that the HO2S did not switch enough times, DTC P1133 will be set. A lean to rich switch is determined when the HO2S voltage changes from less than 300 mV to more than 600 mV. A rich to lean switch is determined when the HO2S voltage changes from more than 600 mV to less than 300 mV.

### Conditions for Running the DTC

- No Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are set.
- DTC P0135 is not set.

### Conditions for Setting the DTC

- The PCM monitors less than 55 lean to rich and rich to lean switches for this HO2S.
- The HO2S voltage remains between 300 and 600 millivolts.
- The conditions are present for a 2 minute after closed loop enable.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. When the system is operating correctly the HO2S voltage should toggle above and below the specified values.
5. If the low circuit is shorted to ground the HO2S voltage will be less than 400 mV when the signal circuit is jumped to ground.
6. The specified value is what is measured on a correctly operating system.
7. The specified value is what is measured on a correctly operating system.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set (except HO2S DTCs), refer to other DTCs first before proceeding with this table.<br>1. Engine at operating temperature.<br>2. Operate engine above 1200 RPM for two minutes.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does scan tool indicate HO2S voltage varying outside the specified values? | 400-500 mV | *Go to Step 3* | *Go to Step 4* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect and test for the following:<br>• Exhaust leak. Refer to *Exhaust System Inspection* and *Exhaust Leakage* in Engine Exhaust.<br>• The HO2S is installed correctly.<br>• Damaged wiring. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |

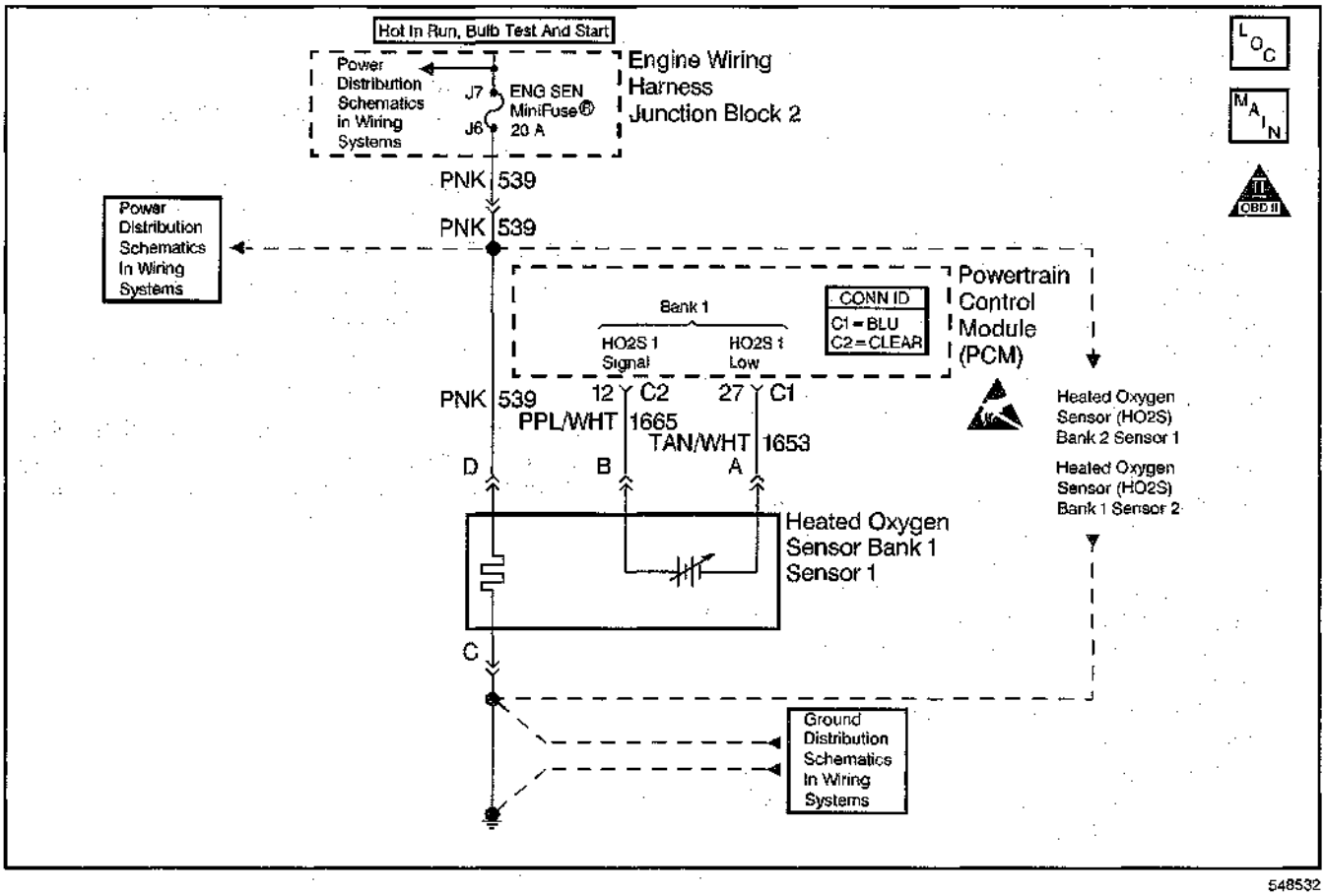
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**DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1 (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Disconnect the HO2S.<br>3. Jumper the signal circuit (PCM side) to a good ground.<br>4. With a scan tool, observe HO2S voltage parameter.<br>Does the scan tool indicate HO2S voltage more than the specified value? | 400 mV | *Go to Step 6* | *Go to Step 10* |
| 6 | 1. Remove the jumper wire.<br>2. Measure the voltage on the HO2S signal circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 4.5V | *Go to Step 7* | *Go to Step 9* |
| 7 | Measure the voltage on the HO2S low circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the low circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Test the low circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 12 | **Important:** Determine the cause of contamination before replacing the sensor.<br>Inspect and test for the following:<br>• Fuel Contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*<br>Engine oil or coolant consumption. Refer to *Oil Consumption Diagnosis* in Engine Mechanical.<br>• Use of improper RTV sealant. Refer to *Silicon Contamination of Heated Oxygen Sensors Notice* in Cautions and Notices.<br>Replace the effected HO2S sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Test for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Use the scan tool in order to check for DTCs.<br>Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1




### Circuit Description

The PCM continuously monitors the heated oxygen sensor (HO2S) activity. The PCM counts the number of times that the HO2S responds from rich to lean and from lean to rich and adds the amount of time it took to complete all transitions during the 100 second test period. With this information, an average time for all transitions can be determined. The PCM then divides the rich to lean average by the lean to rich average to obtain a ratio. If the HO2S transition time ratio is not within range, DTC P1134 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

### Conditions for Running the DTC

- No Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are set.
- DTC P0135 is not set.

### Conditions for Setting the DTC

- The PCM detects the HO2S transition time ratio is less than 0.6 or more than 3.3.
- The conditions are present for a 2 minutes after closed loop enable.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. When the system is operating correctly the HO2S voltage should toggle above and below the specified values.
5. If the low circuit is shorted to ground the HO2S voltage will be less than 400 mV when the signal circuit is jumped to ground.
6. The specified value is what is measured on a correctly operating system.
7. The specified value is what is measured on a correctly operating system.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set (except HO2S DTCs), refer to other DTCs first before proceeding with this table.<br>1. Engine at operating temperature.<br>2. Operate engine above 1200 RPM for two minutes.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does scan tool indicate HO2S voltage varying outside the specified values? | 400-500 mV | *Go to Step 3* | *Go to Step 4* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect and test for the following:<br>• Exhaust leak. Refer to *Exhaust System Inspection* and *Exhaust Leakage* in Engine Exhaust.<br>• The HO2S is installed correctly.<br>• Damaged wiring. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |

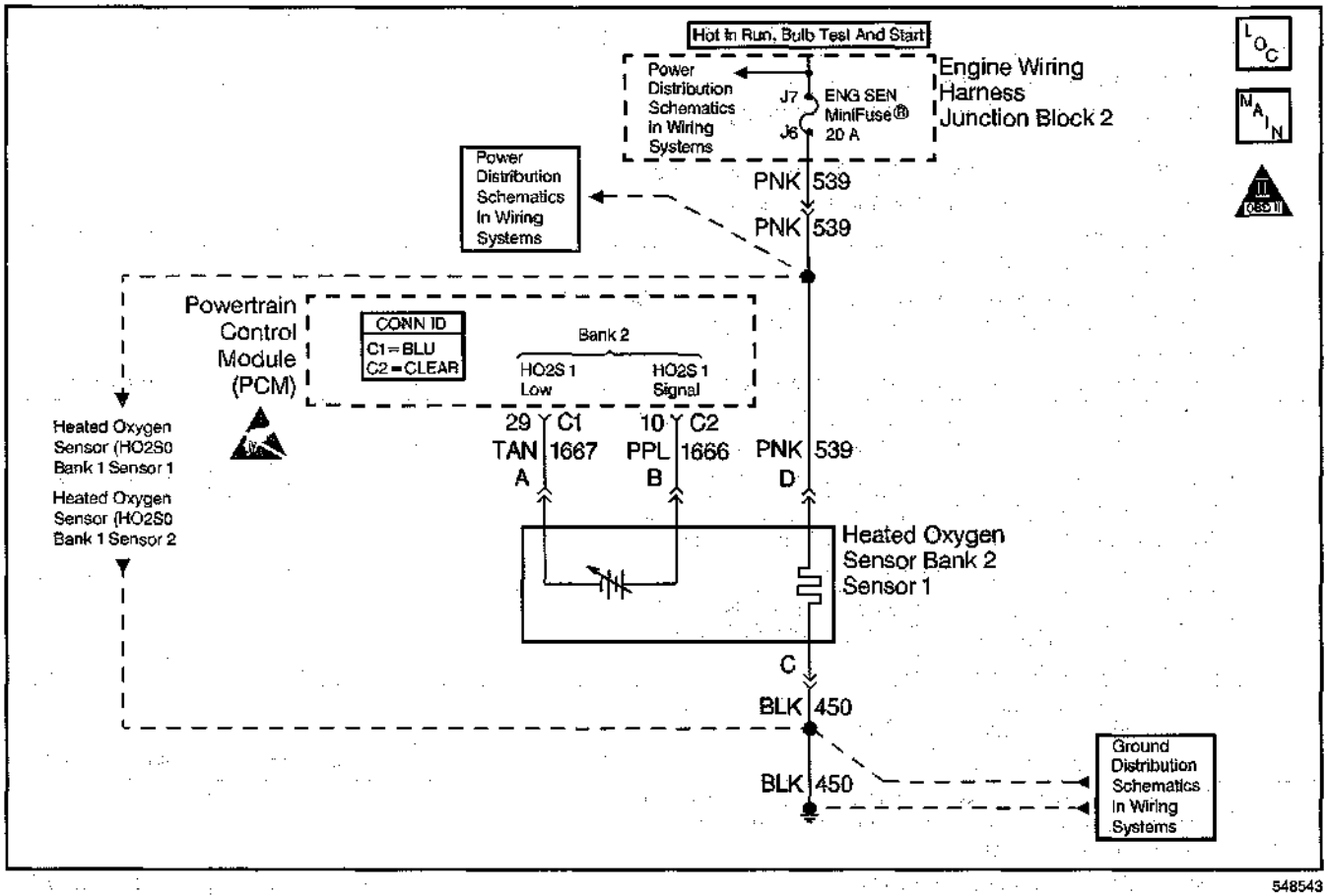
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## DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Disconnect the HO2S.<br>3. Jumper the signal circuit (PCM side) to a good ground.<br>4. With a scan tool, observe HO2S voltage parameter.<br>Does the scan tool indicate HO2S voltage more than the specified value? | 400 mV | *Go to Step 6* | *Go to Step 10* |
| 6 | 1. Remove the jumper wire.<br>2. Measure the voltage on the HO2S signal circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 4.5V | *Go to Step 7* | *Go to Step 9* |
| 7 | Measure the voltage on the HO2S low circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the low circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Test the low circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 12 | **Important:** Determine the cause of contamination before replacing the sensor.<br>Inspect and test for the following:<br>• Fuel Contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*<br>Engine oil or coolant consumption. Refer to *Oil Consumption Diagnosis* in Engine Mechanical.<br>• Use of improper RTV sealant. Refer to *Silicon Contamination of Heated Oxygen Sensors Notice* in Cautions and Notices.<br>Replace the effected HO2S sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Test for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Use the scan tool in order to check for DTCs.<br>Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1153 HO2S Insufficient Switching Bank 2 Sensor 1




### Circuit Description

The PCM monitors the heated oxygen sensor (HO2S) activity. The PCM counts the number of times that the HO2S signal voltage crosses the rich to lean and lean to rich thresholds for a 100 second test period. If the PCM determines that the HO2S did not switch enough times, DTC P1153 will be set. A lean to rich switch is determined when the HO2S voltage changes from less than 300 mV to more than 600 mV. A rich to lean switch is determined when the HO2S voltage changes from more than 600 mV to less than 300mV.

### Conditions for Running the DTC

- No Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are set.
- DTC P0155 is not set.

### Conditions for Setting the DTC

- The PCM monitors fewer than 55 lean to rich and rich to lean switches for Bank 2 HO2S 1.
- The HO2S voltage remains between 300 and 600 millivolts.
- The conditions are present for a 2 minute after closed loop enable.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. When the system is operating correctly the HO2S voltage should toggle above and below the specified values.
5. If the low circuit is shorted to ground the HO2S voltage will be less than 400 mV when the signal circuit is jumped to ground.
6. The specified value is what is measured on a correctly operating system.
7. The specified value is what is measured on a correctly operating system.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P1153 HO2S Insufficient Switching Bank 2 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set (except HO2S DTCs), refer to other DTCs first before proceeding with this table.<br>1. Engine at operating temperature.<br>2. Operate engine above 1200 RPM for two minutes.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does scan tool indicate HO2S voltage varying outside the specified values? | 400-500 mV | *Go to Step 3* | *Go to Step 4* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect and test for the following:<br>• Exhaust leak. Refer to *Exhaust System Inspection* and *Exhaust Leakage* in Engine Exhaust.<br>• The HO2S is installed correctly.<br>• Damaged wiring. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |

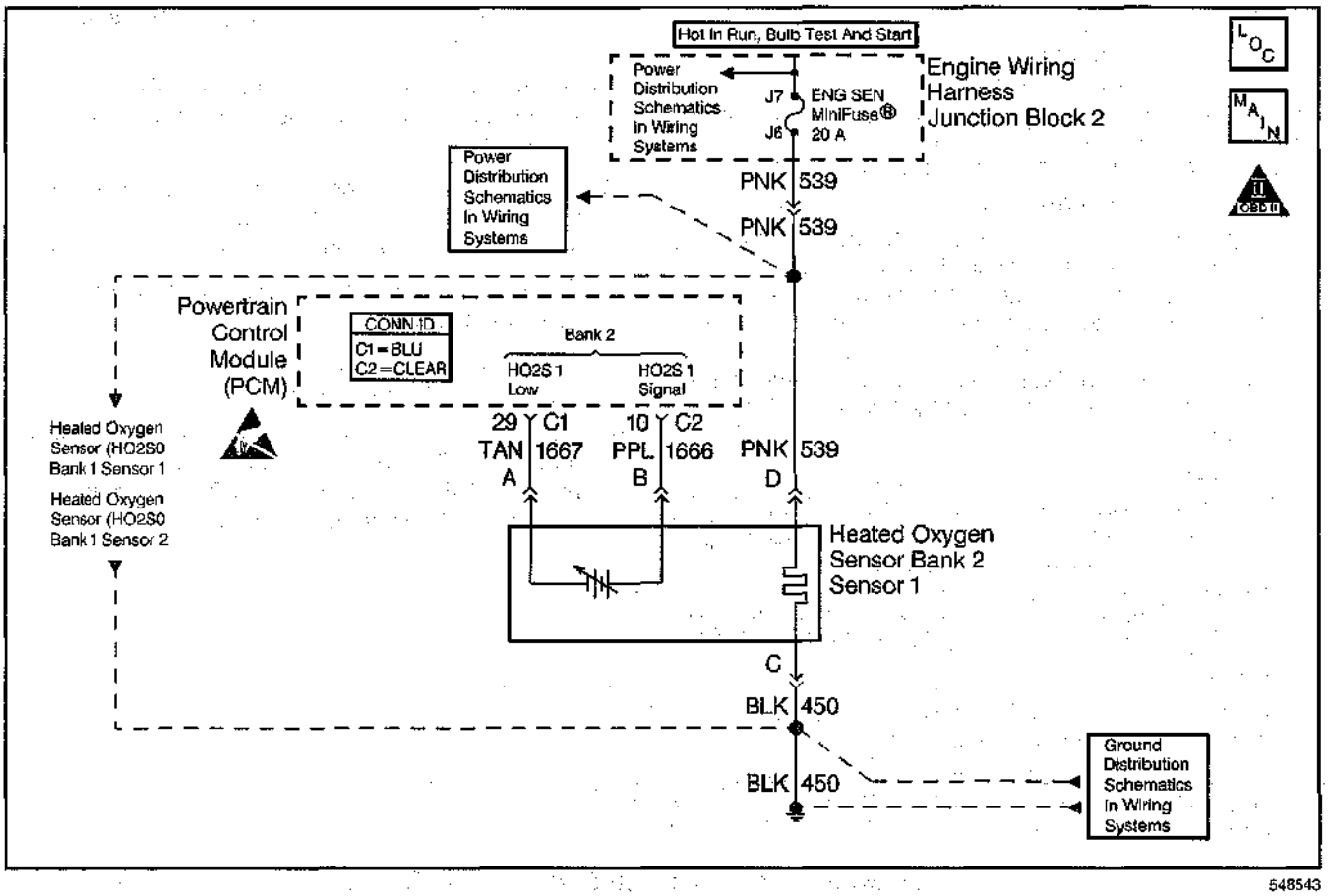
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## DTC P1153 HO2S Insufficient Switching Bank 2 Sensor 1 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Disconnect the HO2S.<br>3. Jumper the signal circuit (PCM side) to a good ground.<br>4. With a scan tool, observe HO2S voltage parameter.<br>Does the scan tool indicate HO2S voltage more than the specified value? | 400 mV | *Go to Step 6* | *Go to Step 10* |
| 6 | 1. Remove the jumper wire.<br>2. Measure the voltage on the HO2S signal circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 4.5V | *Go to Step 7* | *Go to Step 9* |
| 7 | Measure the voltage on the HO2S low circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the low circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Test the low circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 12 | **Important:** Determine the cause of contamination before replacing the sensor.<br>Inspect and test for the following:<br>• Fuel Contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*<br>Engine oil or coolant consumption. Refer to *Oil Consumption Diagnosis* in Engine Mechanical.<br>• Use of improper RTV sealant. Refer to *Silicon Contamination of Heated Oxygen Sensors Notice* in Cautions and Notices.<br>Replace the effected HO2S sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Test for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Use the scan tool in order to check for DTCs.<br>Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1154 HO2S Transition Time Ratio Bank 2 Sensor 1




### Circuit Description

The PCM continuously monitors the heated oxygen sensor (HO2S) activity. The PCM counts the number of times that the HO2S responds from rich to lean and from lean to rich and adds the amount of time it took to complete all transitions for a 100 second test period. With this information, an average time for all transitions can be determined. The PCM then divides the rich to lean average by the lean to rich average to obtain a ratio. If the HO2S transition time ratio is not within range, DTC P1154 will be set indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

### Conditions for Running the DTC

- No Fuel injector, MAF, TP, EVAP, IAT, MAP, Fuel trim, EGR or ECT DTCs are set.
- DTC P0155 is not set.

### Conditions for Setting the DTC

- The PCM detects the HO2S transition time ratio is less than 0.6 or more than 3.3.
- The conditions are present for a 2 minutes after closed loop enable.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. When the system is operating correctly the HO2S voltage should toggle above and below the specified values.
5. If the low circuit is shorted to ground the HO2S voltage will be less than 400 mV when the signal circuit is jumped to ground.
6. The specified value is what is measured on a correctly operating system.
7. The specified value is what is measured on a correctly operating system.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### DTC P1154 HO2S Transition Time Ratio Bank 2 Sensor 1

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set (except HO2S DTCs), refer to other DTCs first before proceeding with this table.<br>1. Engine at operating temperature.<br>2. Operate engine above 1200 RPM for two minutes.<br>3. With a scan tool, observe the HO2S voltage parameter.<br>Does scan tool indicate HO2S voltage varying outside the specified values? | 400-500 mV | *Go to Step 3* | *Go to Step 4* |
| 3 | Operate vehicle within Fail Records conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | Inspect and test for the following:<br>• Exhaust leak. Refer to *Exhaust System Inspection* and *Exhaust Leakage* in Engine Exhaust.<br>• The HO2S is installed correctly.<br>• Damaged wiring. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 5* |

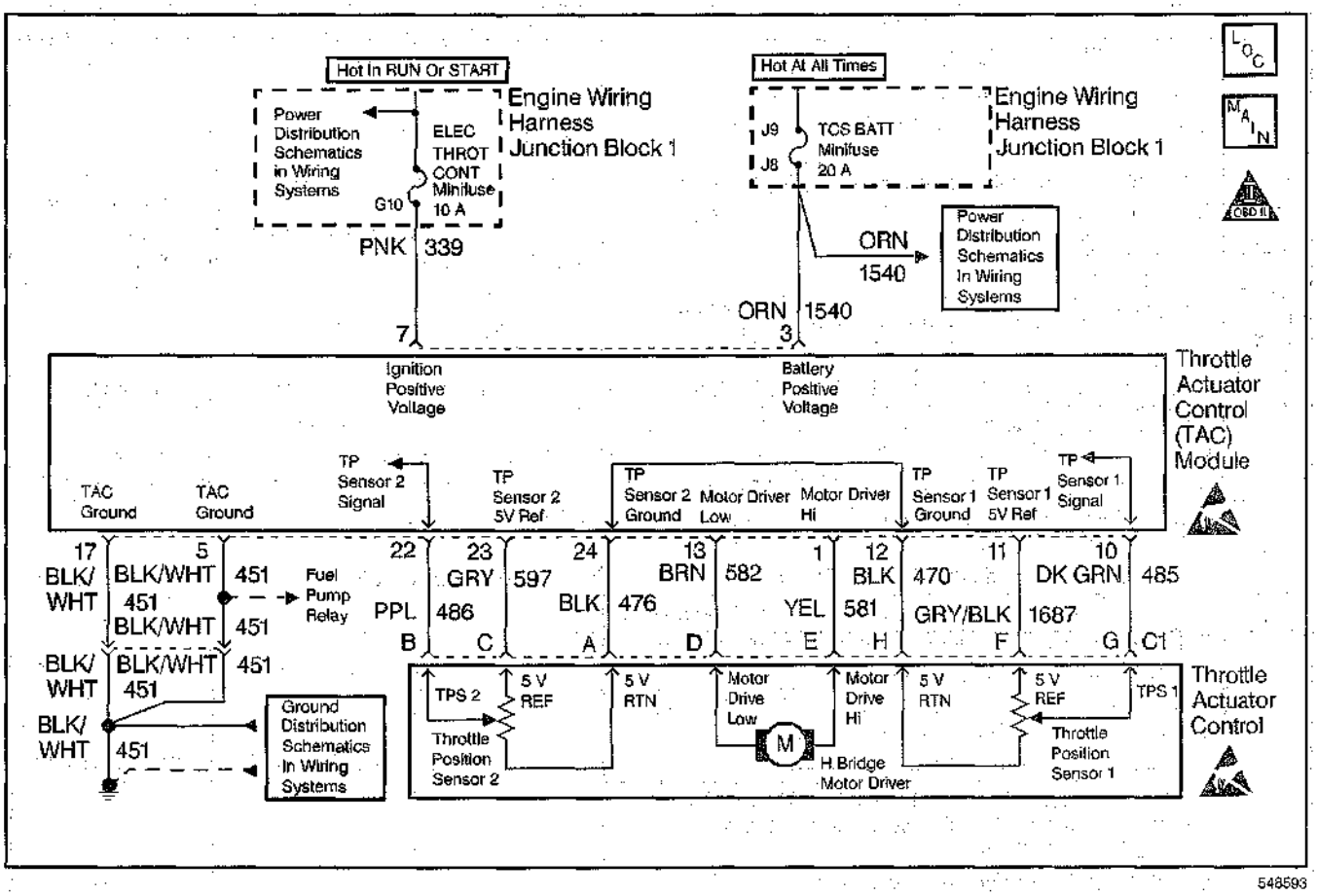
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## DTC P1154 HO2S Transition Time Ratio Bank 2 Sensor 1 (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Disconnect the HO2S.<br>3. Jumper the signal circuit (PCM side) to a good ground.<br>4. With a scan tool, observe HO2S voltage parameter.<br>Does the scan tool indicate HO2S voltage more than the specified value? | 400 mV | *Go to Step 6* | *Go to Step 10* |
| 6 | 1. Remove the jumper wire.<br>2. Measure the voltage on the HO2S signal circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 4.5V | *Go to Step 7* | *Go to Step 9* |
| 7 | Measure the voltage on the HO2S low circuit (PCM side) using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | 5V | *Go to Step 11* | *Go to Step 8* |
| 8 | Test the low circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Test the signal circuit for an open or high resistance. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 10 | Test the low circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 11 | Test for poor connections at the HO2S. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 12* |
| 12 | **Important:** Determine the cause of contamination before replacing the sensor.<br>Inspect and test for the following:<br>• Fuel Contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*<br>Engine oil or coolant consumption. Refer to *Oil Consumption Diagnosis* in Engine Mechanical.<br>• Use of improper RTV sealant. Refer to *Silicon Contamination of Heated Oxygen Sensors Notice* in Cautions and Notices.<br>Replace the effected HO2S sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 13 | Test for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/ Programming.*<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 16* |
| 16 | Use the scan tool in order to check for DTCs.<br>Does the scan tool indicate any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1220 Throttle Position (TP) Sensor 2 Circuit




548593

### Circuit Description

The throttle position (TP) sensor is mounted on the throttle body/TAC assembly. The sensor is actually two individual throttle position sensors within one housing. Two separate signal, ground and reference circuits are used in order to connect the TP sensor assembly and the throttle actuator control (TAC) module. The TP sensor signal voltage increases as the throttle opens. The signal circuit for TP Sensor is pulled up to reference voltage.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are not set.
- The ignition switch in the crank or run position.
- The ETC serial data is operational.

### Conditions for Setting the DTC

The TP sensor 2 voltage is less than 0.25 volts or more than 4.49 volts.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

**DTC P1220 Throttle Position (TP) Sensor 2 Circuit**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If the code does not set this ignition, refer to Diagnostic Aids.<br>1. Turn ON the ignition.<br>2. With a scan tool, observe the TP sensors Disagree parameter.<br>Does the scan tool indicate YES? | — | *Go to Step 3* | *Go to Step 11* |
| 3 | 1. With a scan tool, observe the TP sensor voltage parameter.<br>2. Depress the throttle to wide open throttle (WOT) and release.<br>Does the scan tool indicate voltage at or near the specified value throughout throttle travel? | 1 V | *Go to Step 21* | *Go to Step 4* |
| 4 | Does scan tool indicate voltage below the specified value throughout throttle travel? | 1 V | *Go to Step 5* | *Go to Step 7* |
| 5 | 1. With a scan tool, observe the TP sensor voltage parameter.<br>2. Disconnect the TAC throttle body.<br>Does the scan tool indicate voltage at or near the specified value when the TAC is disconnected? | 5 V | *Go to Step 6* | *Go to Step 13* |
| 6 | 1. Turn OFF the ignition for 15 seconds.<br>2. Turn ON the ignition.<br>3. Measure the voltage on the reference circuit using a DMM that is connected to a good ground.<br>Does the voltage measure within the specified range? | 3.9–4.6V | *Go to Step 23* | *Go to Step 17* |

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## DTC P1220 Throttle Position (TP) Sensor 2 Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 7 | 1. Disconnect the TAC / throttle body.<br>2. Turn ON the ignition.<br>3. With a scan tool, observe the TP sensor voltage parameter.<br>4. Connect a test lamp between the signal and return circuits.<br>Does the scan tool indicate voltage at the specified value when the test lamp is installed? | 0V | *Go to Step 10* | *Go to Step 8* |
| 8 | 1. Remove the test lamp from the return circuit.<br>2. Connect the test lamp to a good ground.<br>Does the scan tool indicate voltage at the specified value when the test lamp is installed? | 0V | *Go to Step 14* | *Go to Step 9* |
| 9 | Did the test lamp illuminate when the it was connected between the signal circuit and ground? | — | *Go to Step 15* | *Go to Step 16* |
| 10 | 1. Turn OFF the ignition for 15 seconds.<br>2. Turn ON the ignition.<br>3. Measure the voltage on the reference circuit using a DMM that is connected to a good ground.<br>Does the voltage measure within the specified range? | 3.9–4.6V | *Go to Step 23* | *Go to Step 18* |
| 11 | Inspect the ELEC THROT CONT and TCS BATT fuses.<br>Are the fuses OK? | — | *Go to Step 12* | *Go to Step 19* |
| 12 | 1. Disconnect the TAC module.<br>2. Probe the feed circuits using a test lamp with a test lamp that is connected to a good ground.<br>Does the test lamp illuminate when probing the feed circuits? | — | Go to *DTC P1515 Control Module Throttle Actuator Position Performance* or *DTC P1516 Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance* | *Go to Step 20* |
| 13 | Test the signal circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 26* |
| 14 | Test the return circuit for an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 25* |
| 15 | Test the signal circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 26* |
| 16 | Test the signal circuit for an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 25* |
| 17 | Test the reference circuit for an open or short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 25* |
| 18 | Test the reference circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 26* |
| 19 | Repair the short to ground in the feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | — |

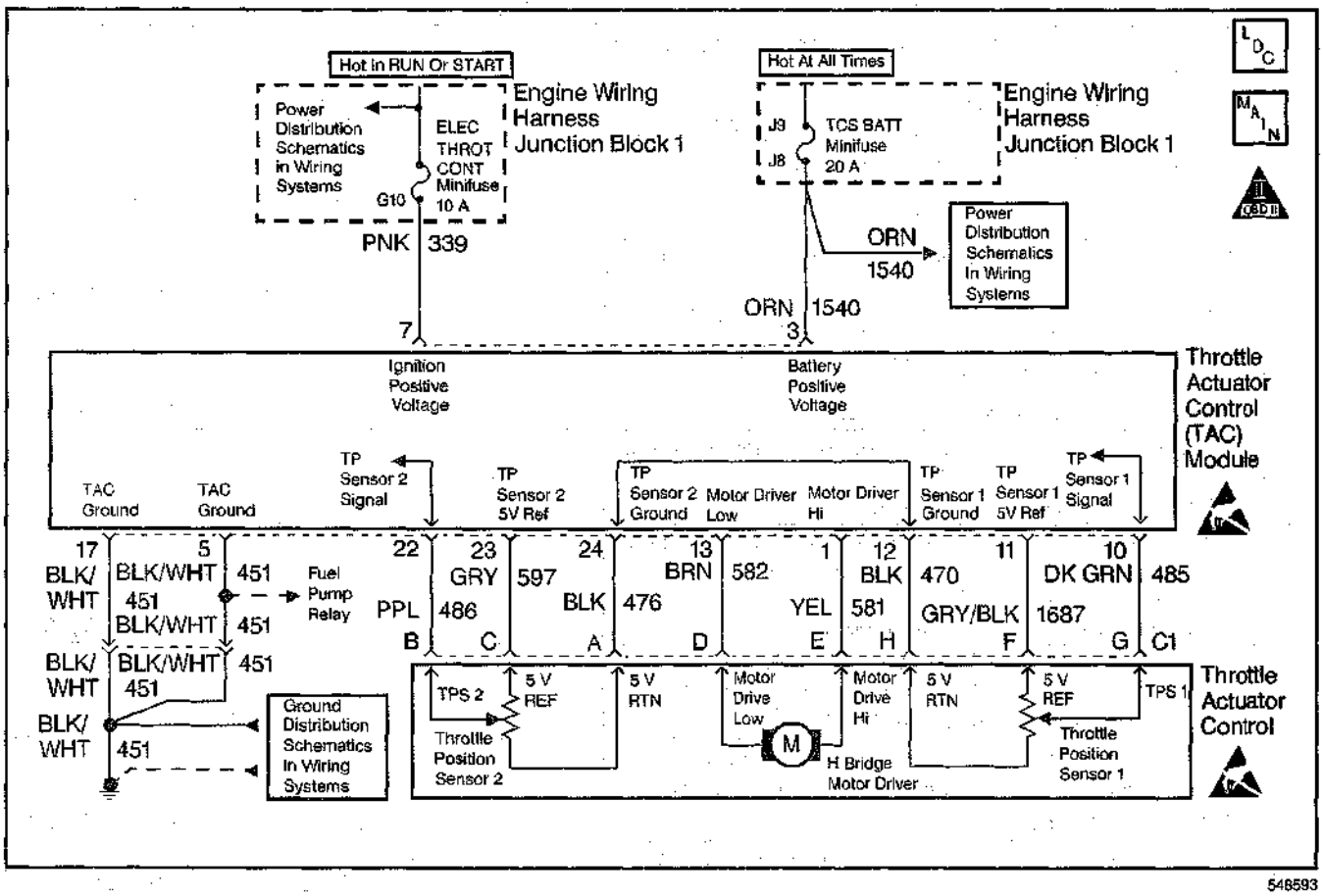
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## DTC P1220 Throttle Position (TP) Sensor 2 Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 20 | Repair the open in the feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 27* | — |
| 21 | Test the return circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 22* |
| 22 | Test for continuity between the reference circuit in the TAC and ground. Refer to *Circuit Testing* in Wiring Systems.<br>Is continuity indicated? | — | *Go to Step 24* | *Go to Step 26* |
| 23 | Inspect for a poor connection at the TAC. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 24* |
| 24 | Replace the throttle body/TAC assembly. Refer to *Throttle Body Assembly Replacement.*<br>Did you complete the replacement? | — | *Go to Step 27* | — |
| 25 | Inspect for a poor connection at the TAC module. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 27* | *Go to Step 26* |
| 26 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 27* | — |
| 27 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 28* |
| 28 | Does the scan tool display any DTCs that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1221 Throttle Position (TP) Sensor 1- 2 Correlation




548593

### Circuit Description

The throttle position (TP) sensor is mounted on the throttle body/TAC assembly. The sensor is actually two individual throttle position sensors within one housing. Two separate signal, ground and reference circuits are used in order to connect the TP sensor assembly and the throttle actuator control (TAC) module. Each TP sensor signal voltage increases as the throttle opens. The signal circuit for TP sensors are pulled up to reference voltage.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are not set.
- The ignition switch is in the crank or run position.
- The ETC serial data is operational.

### Conditions for Setting the DTC

TP sensor 1 and TP sensor 2 disagree by more than 0.17 volts.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

18. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

**DTC P1221 Throttle Position (TP) Sensor 1- 2 Correlation**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If DTC P1518, 1120 or 1220 are also set, refer to those DTCs first for further diagnosis.<br>1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe the TP Disagree parameter.<br>Does the scan tool indicate NO? | — | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. With a scan tool, select Diagnostic Trouble Code (DTCs).<br>2. Move the harness and related connectors while observing the DTC information.<br>Does the harness movement cause this DTC to fail this ignition? | — | *Go to Step 10* | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the TAC.<br>3. Turn ON the ignition.<br>4. Measure the voltage on both the TP 1 and TP 2 reference circuits using a digital multimeter that is connected to a good ground.<br>Does the voltage measure within the specified range? | 3.9–4.6 V | *Go to Step 5* | *Go to Step 11* |
| 5 | Measure the voltage on both the TP 1 and TP 2 signal circuits using a DMM that is connected to a good ground.<br>Does the voltage measure within the specified range? | 3.9–4.6 V | *Go to Step 6* | *Go to Step 12* |
| 6 | Measure for continuity between the TP 1 reference and the TP 2 reference at the TAC using a DMM.<br>Does the DMM indicate continuity? | — | *Go to Step 13* | *Go to Step 7* |

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## DTC P1221 Throttle Position (TP) Sensor 1- 2 Correlation (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 7 | Measure for continuity between the TP 1 signal and the TP 2 signal at the TAC using a DMM.<br>Does the DMM indicate continuity? | — | *Go to Step 13* | *Go to Step 8* |
| 8 | 1. Disconnect the TAC module.<br>2. Leave the TAC disconnected.<br>3. Measure for continuity between the TP 1 reference and the TP 2 reference at the TAC module harness connector using a DMM.<br>Does the DMM indicate continuity? | — | *Go to Step 15* | *Go to Step 9* |
| 9 | Measure for continuity between the TP 1 signal and the TP 2 signal at the TAC module harness connector using a DMM.<br>Does the DMM indicate continuity? | — | *Go to Step 16* | *Go to Step 14* |
| 10 | Repair the harness/connections as necessary. Refer to *Wiring Repairs* and *Connector Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 11 | Repair the short to voltage in the reference circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 14* |
| 12 | Repair the short to voltage in the signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 14* |
| 13 | Replace the throttle body/TAC assembly. Refer to *Throttle Body Assembly Replacement*.<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 14 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)*.<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 15 | Repair the TP 1 and TP 2 reference circuits shorted together. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 16 | Repair the TP 1 and TP 2 signal circuits shorted together. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 17 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 18* |
| *18* | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1271 Accelerator Pedal Position (APP) Sensor 1-2 Correlation

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual accelerator pedal position sensors within one housing. Three separate signal, ground and reference circuits are used which are contained within the throttle actuator control (TAC) module. The APP sensor signal voltage increases as the Accelerator pedal is depressed. The signal circuits pull to ground within the TAC module.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518, P1276, P1281 are not set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

APP sensor 1 disagrees with APP sensor 2 by more than 10.5 percent or the APP 1 signal is shorted to the APP 2 signal.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

5. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

**DTC P1271 Accelerator Pedal Position (APP) Sensor 1-2 Correlation**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Are any other DTCs set? | — | Diagnose these DTCs first | *Go to Step 3* |
| 3 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).* Did you complete the replacement? | — | *Go to Step 4* | — |
| 4 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 5* |
| *5* | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1272 Accelerator Pedal Position (APP) Sensor 2-3 Correlation

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual accelerator pedal position sensors within one housing. Three separate signal, ground and reference circuits are used which are contained within the throttle actuator control (TAC) module. The APP sensor signal voltage increases as the Accelerator pedal is depressed. The signal circuits pull to ground within the TAC module.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518, P1281, P1286 are not set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

APP sensor 1 disagrees with APP sensor 3 by more 10.5 percent or APP sensor 1 signal is shorted to APP sensor 3 signal.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

5. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

**DTC P1272 Accelerator Pedal Position (APP) Sensor 2-3 Correlation**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Are any other DTCs set? | — | Diagnose these DTCs first | *Go to Step 3* |
| 3 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).* Did you complete the replacement? | — | *Go to Step 4* | — |
| 4 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 5* |
| 5 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1273 Accelerator Pedal Position (APP) Sensor 1-3 Correlation

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual accelerator pedal position sensors within one housing. Three separate signal, ground and reference circuits are used which are contained within the throttle actuator control (TAC) module. The APP sensor signal voltage increases as the Accelerator pedal is depressed. The signal circuits pull to ground within the TAC module.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518, P1276, P1286 are not set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

APP sensor 2 disagrees with APP sensor 3 by more than 10.5 percent or the APP sensor 2 signal and APP sensor 3 signal are shorted together.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

5. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

**DTC P1273 Accelerator Pedal Position (APP) Sensor 1-3 Correlation**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Are any other DTCs set? | — | Diagnose these DTCs first | *Go to Step 3* |
| 3 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).* Did you complete the replacement? | — | *Go to Step 4* | — |
| 4 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 5* |
| 5 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1275 Accelerator Pedal Position (APP) Sensor 1 Circuit

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual accelerator pedal position sensors within one housing. Three separate signal, ground and reference circuits are used which are contained within the throttle actuator control (TAC) module. The APP sensor signal voltage increases as the Accelerator pedal is depressed. The signal circuits pull to ground within the TAC module.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

APP sensor 1 voltage is less than 0.68 volts or more than 4.5 volts.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

7. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

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## DTC P1275 Accelerator Pedal Position (APP) Sensor 1 Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are also set, refer to the appropriate DTC for further diagnosis.<br>1. Turn ON the ignition, with your foot OFF the accelerator pedal and the engine OFF.<br>2. With the scan tool, observe the APP sensor voltage parameter for this APP.<br>Does the scan tool indicate voltage within the specified range? | 0.7–1.1 V | *Go to Step 3* | *Go to Step 5* |
| 3 | Fully depress the accelerator pedal.<br>Does the scan tool indicate the voltage within the specified range? | 2.7–4.2 V | *Go to Step 4* | *Go to Step 5* |
| 4 | 1. With the scan tool, select Diagnostic Trouble Codes (DTCs).<br>2. Depress the accelerator pedal to wide open throttle (WOT) and then return it to closed throttle.<br>Did this DTC fail this ignition? | — | *Go to Step 5* | Go to Diagnostic Aids |
| 5 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)*.<br>Did you complete the replacement? | — | *Go to Step 6* | — |
| 6 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 7* |
| 7 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1276 Accelerator Pedal Position (APP) Sensor 1 Performance

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual accelerator pedal position sensors within one housing. Three separate signal, ground and reference circuits are used which are contained within the throttle actuator control (TAC) module. The APP sensor signal voltage increases as the Accelerator pedal is depressed. The signal circuits pull to ground within the TAC module.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are not set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

APP sensor 1 disagrees with APP sensor 2 by more than 10.5 percent and APP sensor 1 disagrees with APP sensor 3 by more than 10.5 percent.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

6. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

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## DTC P1276 Accelerator Pedal Position (APP) Sensor 1 Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set, refer to the appropriate DTC for further diagnosis.<br>1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe the APP sensor voltage parameter for this APP.<br>Does the scan tool indicate the voltage within the specified range? | 0.5–1.3 V | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. With a scan tool, observe the APP disagree parameters.<br>2. Slowly depress the accelerator pedal to WOT stopping briefly at approximately 25 percent, 50 percent, and 75 percent. Then slowly return to a closed throttle position stopping briefly at approximately 75 percent, 50 percent, and 25 percent.<br>Does the scan tool indicate NO for all APP disagree parameters? | — | Go to Diagnostic Aids | *Go to Step 4* |
| 4 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 5* | — |
| 5 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 6* |
| *6* | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1280 Accelerator Pedal Position (APP) Sensor 2 Circuit

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual accelerator pedal position sensors within one housing. Three separate signal, ground and reference circuits are used which are contained within the throttle actuator control (TAC) module. The APP sensor signal voltage increases as the Accelerator pedal is depressed. The signal circuits pull to ground within the TAC module.

### Conditions for Running the DTC

- DTCs P0601, P0602, P0606, P1517, P1518 are not set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

The APP sensor 2 voltage is this less than 0.68 volts or more 4.5 volts

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

7. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

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## DTC P1280 Accelerator Pedal Position (APP) Sensor 2 Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are also set, refer to the appropriate DTC for further diagnosis.<br>1. Turn ON the ignition, with your foot OFF the accelerator pedal and the engine OFF.<br>2. With the scan tool, observe the APP sensor voltage parameter for this APP.<br>Does the scan tool indicate voltage within the specified range? | 0.7–1.1 V | *Go to Step 3* | *Go to Step 5* |
| 3 | Fully depress the accelerator pedal.<br>Does the scan tool indicate the voltage within the specified range? | 2.7–4.2 V | *Go to Step 4* | *Go to Step 5* |
| 4 | 1. With the scan tool, select Diagnostic Trouble Codes (DTCs).<br>2. Depress the accelerator pedal to wide open throttle (WOT) and then return it to closed throttle.<br>Did this DTC fail this ignition? | — | *Go to Step 5* | Go to Diagnostic Aids |
| 5 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)*.<br>Did you complete the replacement? | — | *Go to Step 6* | — |
| 6 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 7* |
| 7 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1281 Accelerator Pedal Position (APP) Sensor 2 Performance

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual accelerator pedal position sensors within one housing. Three separate signal, ground and reference circuits are used which are contained within the throttle actuator control (TAC) module. The APP sensor signal voltage increases as the Accelerator pedal is depressed. The signal circuits pull to ground within the TAC module.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are not set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

APP sensor 2 disagrees with APP sensor 1 by more than 10.5 percent and APP sensor 2 disagrees with APP sensor 3 by more than 10.5 percent.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

6. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

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## DTC P1281 Accelerator Pedal Position (APP) Sensor 2 Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set, refer to the appropriate DTC for further diagnosis.<br>1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe the APP sensor voltage parameter for this APP.<br>Does the scan tool indicate the voltage within the specified range? | 0.5–1.3 V | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. With a scan tool, observe the APP disagree parameters.<br>2. Slowly depress the accelerator pedal to WOT stopping briefly at approximately 25 percent, 50 percent, and 75 percent. Then slowly return to a closed throttle position stopping briefly at approximately 75 percent, 50 percent, and 25 percent.<br>Does the scan tool indicate NO for all APP disagree parameters? | — | Go to Diagnostic Aids | *Go to Step 4* |
| 4 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 5* | — |
| 5 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 6* |
| *6* | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1285 Accelerator Pedal Position (APP) Sensor 3 Circuit

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual accelerator pedal position sensors within one housing. Three separate signal, ground and reference circuits are used which are contained within the throttle actuator control (TAC) module. The APP sensor signal voltage increases as the Accelerator pedal is depressed. The signal circuits pull to ground within the TAC module.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are not set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

APP sensor 3 voltage is less than 0.68 volts or more than 4.5 volts.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

7. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

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## DTC P1285 Accelerator Pedal Position (APP) Sensor 3 Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are also set, refer to the appropriate DTC for further diagnosis.<br>1. Turn ON the ignition, with your foot OFF the accelerator pedal and the engine OFF.<br>2. With the scan tool, observe the APP sensor voltage parameter for this APP.<br>Does the scan tool indicate voltage within the specified range? | 0.7–1.1 V | *Go to Step 3* | *Go to Step 5* |
| 3 | Fully depress the accelerator pedal.<br>Does the scan tool indicate the voltage within the specified range? | 2.7–4.2 V | *Go to Step 4* | *Go to Step 5* |
| 4 | 1. With the scan tool, select Diagnostic Trouble Codes (DTCs).<br>2. Depress the accelerator pedal to wide open throttle (WOT) and then return it to closed throttle.<br>Did this DTC fail this ignition? | — | *Go to Step 5* | Go to Diagnostic Aids |
| 5 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)*.<br>Did you complete the replacement? | — | *Go to Step 6* | — |
| 6 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 7* |
| 7 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1286 Accelerator Pedal Position (APP) Sensor 3 Performance

### Circuit Description

The accelerator pedal position (APP) sensors are mounted on the accelerator pedal/TAC module assembly. There are three individual accelerator pedal position sensors within one housing. Three separate signal, ground and reference circuits are used which are contained within the throttle actuator control (TAC) module. The APP sensor signal voltage increases as the Accelerator pedal is depressed. The signal circuits pull to ground within the TAC module.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are not set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

APP sensor 3 disagrees with APP sensor 1 by more than 10.5 percent and APP sensor 3 disagrees with APP sensor 2 by more than 10.5 percent.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

6. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

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## DTC P1286 Accelerator Pedal Position (APP) Sensor 3 Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set, refer to the appropriate DTC for further diagnosis.<br>1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, observe the APP sensor voltage parameter for this APP.<br>Does the scan tool indicate the voltage within the specified range? | 0.5–1.3 V | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. With a scan tool, observe the APP disagree parameters.<br>2. Slowly depress the accelerator pedal to WOT stopping briefly at approximately 25 percent, 50 percent, and 75 percent. Then slowly return to a closed throttle position stopping briefly at approximately 75 percent, 50 percent, and 25 percent.<br>Does the scan tool indicate NO for all APP disagree parameters? | — | Go to Diagnostic Aids | *Go to Step 4* |
| 4 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 5* | — |
| 5 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 6* |
| *6* | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1336 Crankshaft Position (CKP) System Variation Not Learned

### Circuit Description

The crankshaft position system variation learning feature is used to calculate reference period errors caused by slight tolerance variations in the crankshaft, the crankshaft balancer interrupter rings, and the crankshaft position sensor hall effect switches. The calculated error allows the PCM to accurately compensate for reference period variations. This enhances the ability of the PCM to detect misfire events over a wider range of engine speed and load.

The crankshaft position system variation values are stored in the PCM non–volatile memory after a learn procedure has been performed. DTC P1336 set indicates that the crankshaft position system variation values have not been stored in the PCM and the crankshaft position system variation learn procedure must be performed. The learn procedure is required after the following service procedures have been performed, regardless of whether or not DTC P1336 is set:

- PCM replacement
- Engine replacement
- Crankshaft replacement
- Crankshaft balancer replacement
- Crankshaft position sensor replacement
- Any engine repairs which disturbs crankshaft/harmonic balancer to crankshaft position sensor relationship

### Conditions for Running the DTC

The engine is running.

### Conditions for Setting the DTC

Crankshaft position system variation values are not stored in the PCM memory.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

The crankshaft position system variation compensating values are stored in the PCM non-volatile memory after a learn procedure has been performed. If the actual crankshaft position variation is not within the crankshaft position system variation compensating values stored in the PCM, DTC P0300 may set, refer to Diagnostic Aids for DTC P0300.

If the crankshaft position system variation learn procedure cannot be performed successfully, check for the following conditions and correct as necessary:

- The engine coolant temperature less than 70°C (158°F).

  Allow the engine to warm to more than 70°C (158°F).
- Powertrain DTCs set

  The scan tool crankshaft position system variation learn function will be disabled if any powertrain DTCs other than DTC P1336 are stored.
- Camshaft position signal problem detected

  Refer to *DTC P0341 Camshaft Position (CMP) Sensor Performance.*
- 3X reference signal problem detected

  Refer to *DTC P1374 Crankshaft Position (CKP) High to Low Resolution Frequency Correlation*
- 18X reference signal problem detected

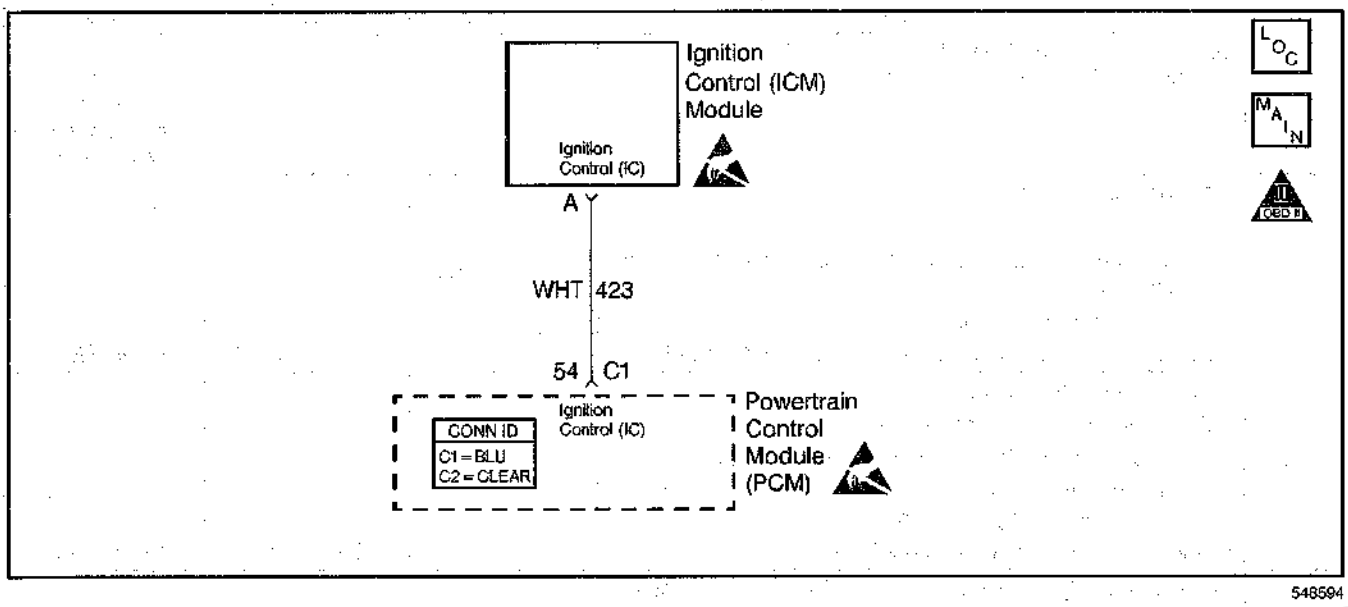
  Refer to *DTC P0336 Crankshaft Position (CKP) Sensor Circuit.*

**DTC P1336 Crankshaft Position (CKP) System Variation Not Learned**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Perform the crankshaft position system variation learn procedure. Refer to *CKP System Variation Learn Procedure.*<br>Did you complete the procedure? | — | System OK | — |

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## DTC P1351 Ignition Coil Control Circuit High Voltage




### Circuit Description

The ignition control module (ICM) sends signals that the PCM requires for fuel control and spark advance calculations. At the start of engine crank, the ICM controls spark advance (Bypass mode). When the second 3X reference pulse is recognized by the PCM, the PCM applies 5 volts to the Bypass circuit. The 5 volts on the Bypass circuit commands the ICM to switch spark advance to PCM control (IC mode). At this time, The ICM will remove the ground it has applied to the IC circuit. If the PCM detects a open in the IC circuit, DTC P1351 will set. The engine may be started but will run on Bypass mode timing.

### Conditions for Running the DTC

The engine is running.

### Conditions for Setting the DTC

- The PCM detects an open in the IC circuit.
- The conditions is present for 300 3X reference periods (100 crankshaft revolutions).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

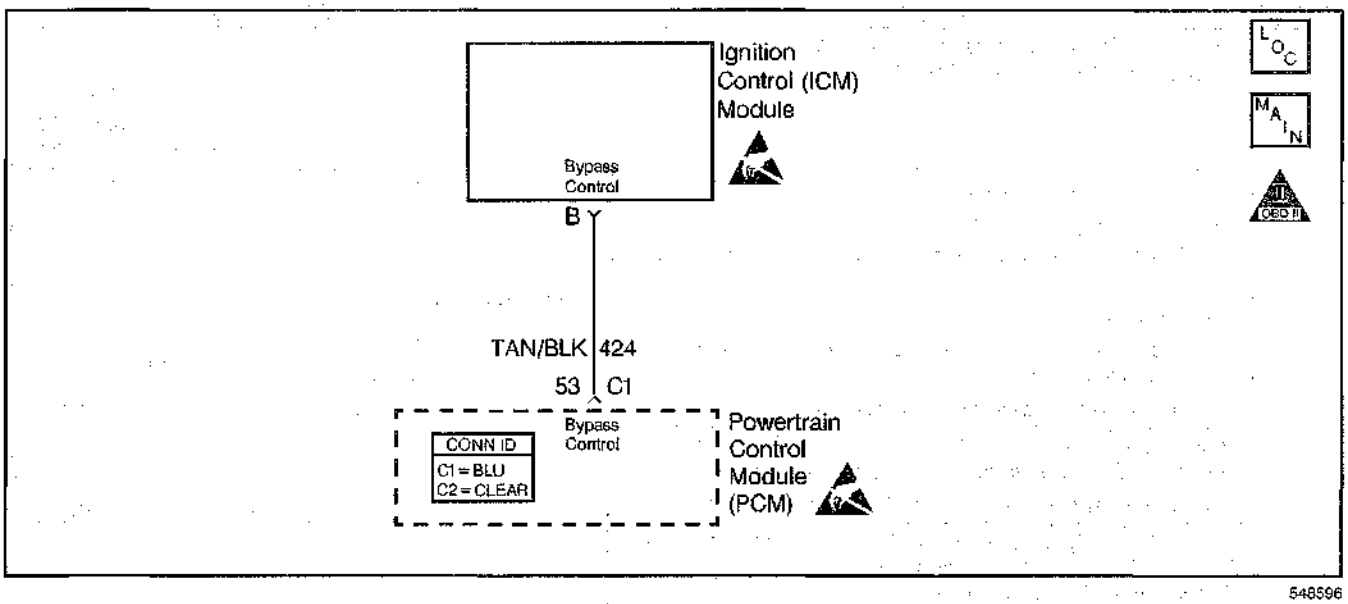
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## DTC P1351 Ignition Coil Control Circuit High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Connect a DMM between the IC and Reference Low Circuits.<br>4. Turn ON the ignition.<br>Does the voltage measure within the specified range? | 20mV-40mV | *Go to Step 4* | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Disconnect the ignition control module (ICM).<br>4. Test for an open in the IC circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 5* |
| 4 | Inspect for faulty connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 7* |
| 5 | Inspect for faulty connections at the ICM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 6* |
| 6 | Replace the ICM. Refer to *Ignition Control Module Replacement.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 7 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1352 Ignition Bypass Circuit High Voltage




### Circuit Description

The ignition control module (ICM) sends signals that the PCM requires for fuel control and spark advance calculations. At the start of engine crank, the ICM controls spark advance (Bypass mode.) When the second 3X reference pulse is recognized by the PCM, the PCM applies 5 volts to the Bypass circuit, commanding the ICM to switch spark advance to PCM control (IC mode). If the PCM detects an open in the Bypass circuit, DTC P1352 will set. The engine will start and may run in Bypass mode timing.

### Conditions for Running the DTC

The engine is running.

### Conditions for Setting the DTC

- The PCM detects an open in the Bypass circuit.
- The conditions is present for 300 3X reference periods (100 crankshaft revolutions).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

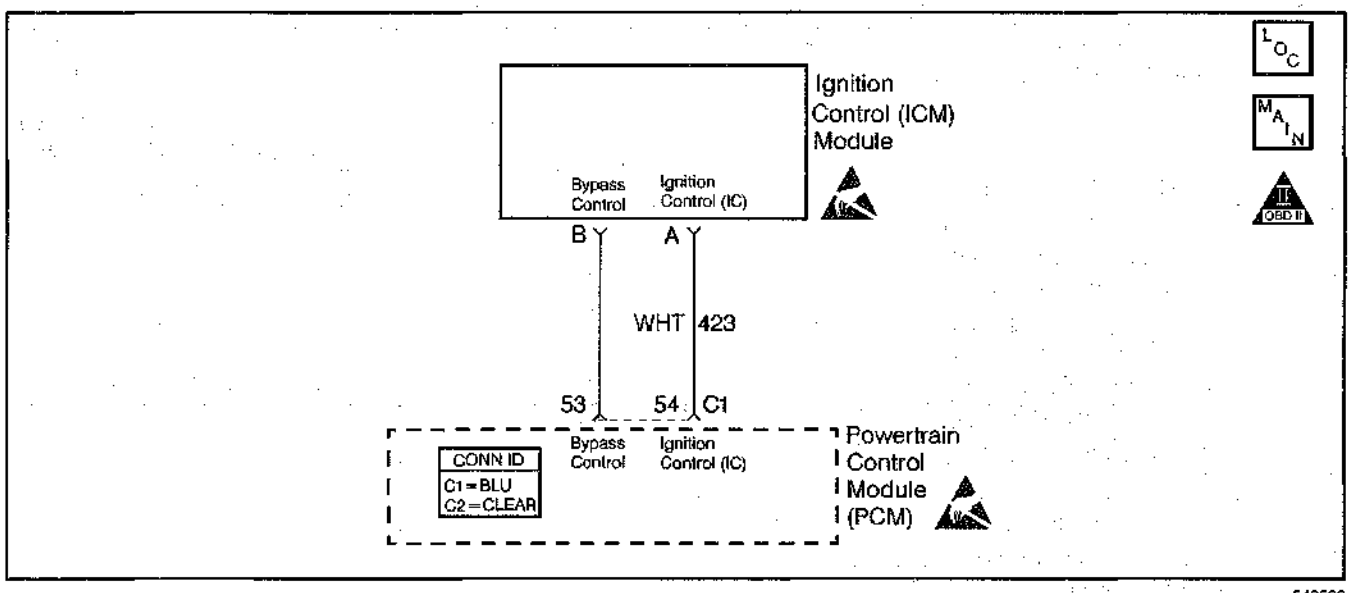
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## DTC P1352 Ignition Bypass Circuit High Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Connect a DMM between the IC and Reference Low Circuits.<br>4. Turn ON the ignition.<br>5. Probe the BYPASS circuit using a test lamp that is connected to B+.<br>Does the voltage measure within the specified range? | 150mV-250mV | *Go to Step 4* | *Go to Step 3* |
| 3 | Test for an open in the BYPASS circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 5* |
| 4 | Inspect for faulty connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 7* |
| 5 | Inspect for faulty connections at the ICM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 8* | *Go to Step 6* |
| 6 | Replace the ICM. Refer to *Ignition Control Module Replacement.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 7 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 8* | — |
| 8 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1361 Ignition Control (IC) Circuit Low Voltage




### Circuit Description

The ignition control module (ICM) sends signals that the PCM requires for fuel control and spark advance calculations. At the start of engine crank, the ICM controls spark advance (Bypass mode). When the second 3X reference pulse is recognized by the PCM, the PCM applies 5 volts to the Bypass circuit. The 5 volts on the Bypass circuit commands the ICM to switch spark advance to PCM control (IC mode). At this time, The ICM will remove the ground it has applied to the IC circuit. When the IC pulses are not grounded, the PCM can use the IC pulses to control spark advance. A short in the IC circuit or an open or short to ground in the Bypass circuit will cause the PCM to monitor no IC pulses after the PCM has switched the Bypass circuit ON. The PCM will set DTC P1361 under either of these conditions. The engine may be started but will run on Bypass mode timing.

### Conditions for Running the DTC

Engine is running.

### Conditions for Setting the DTC

- The PCM does not monitor IC pulses while IC mode spark advance is commanded.
- The conditions is present for 300 3X reference periods (100 crankshaft revolutions).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## DTC P1361 Ignition Control (IC) Circuit Low Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Is DTC P1362 also set? | — | *Go to Step 6* | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. Probe the IC circuit using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 4* | *Go to Step 13* |
| 4 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Disconnect the ignition control module (ICM).<br>4. Turn ON the ignition.<br>5. Probe the IC circuit using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 5* | *Go to Step 12* |
| 5 | Repair the short to voltage in the IC circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Disconnect the ICM.<br>4. Probe the IC circuit using a test lamp that is connected to B+<br>Does the test lamp illuminate? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | Repair the short to ground in the IC circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 8 | 1. Turn OFF the ignition.<br>2. Leave the PCM and the ICM disconnected.<br>3. Probe the BYPASS circuit using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 9* | *Go to Step 10* |
| 9 | Repair the short to ground in the BYPASS circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 10 | Test for a short between the IC and the BYPASS circuits. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 11* |
| 11 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Reconnect the ICM.<br>4. Turn ON the ignition.<br>5. With a DMM connected between the IC and the Reference Low circuits, probe the BYPASS circuit using a test lamp that is connected to B+.<br>Does the voltage toggle between the specified ranges? | 20mV-40mV<br>150mV-250mV | *Go to Step 13* | *Go to Step 12* |

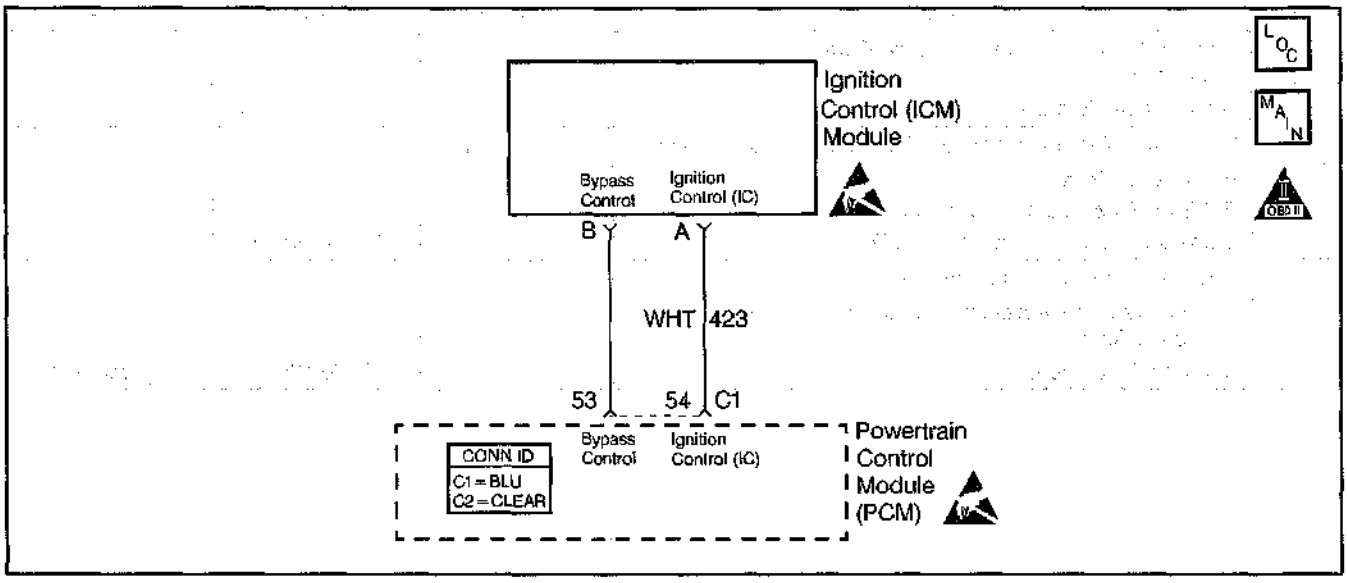
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## DTC P1361 Ignition Control (IC) Circuit Low Voltage (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 12 | Replace the ICM. Refer to *Ignition Control Module Replacement.*<br>Did you complete the replacement? | — | *Go to Step 14* | — |
| 13 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 14* | — |
| 14 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1362 Ignition Bypass Circuit Low Voltage




548599

### Circuit Description

The ignition control module (ICM) sends signals that the PCM requires for fuel control and spark advance calculations. At the start of engine crank, the ICM controls spark advance (Bypass mode.) When the second 3X reference pulse is recognized by the PCM, the PCM applies 5 volts to the Bypass circuit, commanding the ICM to switch spark advance to PCM control (IC mode). If the PCM detects a short to voltage in the Bypass circuit, DTC P1362 will set. A short to ground in the IC circuit or Bypass circuit will cause both DTC P1361 and DTC P1362 to set. The engine will start and may run in Bypass mode timing.

### Conditions for Running the DTC

The engine is running.

### Conditions for Setting the DTC

- The PCM detects a short to voltage in the Bypass circuit.
- The conditions is present for 300 3X reference periods (100 crankshaft revolutions).

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## DTC P1362 Ignition Bypass Circuit Low Voltage

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Is DTC P1361 set also? | — | *Go to Step 6* | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. Probe the BYPASS circuit using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 4* | *Go to Step 13* |
| 4 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Disconnect the ignition control module (ICM).<br>4. Turn ON the ignition.<br>5. Probe the BYPASS circuit using a test lamp that is connected to a ground.<br>Does the test lamp illuminate? | — | *Go to Step 5* | *Go to Step 12* |
| 5 | Repair the short to voltage in the BYPASS circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 6 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Disconnect the ICM.<br>4. Probe the IC circuit using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | Repair the short to ground in the IC circuit. Refer to *Wiring Repairs* in Wiring System.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 8 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Leave the ICM disconnected.<br>4. Probe the BYPASS circuit using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 9* | *Go to Step 10* |
| 9 | Repair the short to ground in the BYPASS circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 10 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Leave the ICM disconnected.<br>4. Test for a short between the IC and BYPASS circuits. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 11* |
| 11 | 1. Turn OFF the ignition.<br>2. Reconnect the ICM.<br>3. Leave the PCM disconnected.<br>4. Turn ON the ignition.<br>5. With a DMM connected between the IC and Reference Low circuits, probe the BYPASS circuit using a test lamp that is connected to B+.<br>Does the voltage toggle between the specified ranges? | 20mV-40mV<br>150mV-250mV | *Go to Step 13* | *Go to Step 12* |

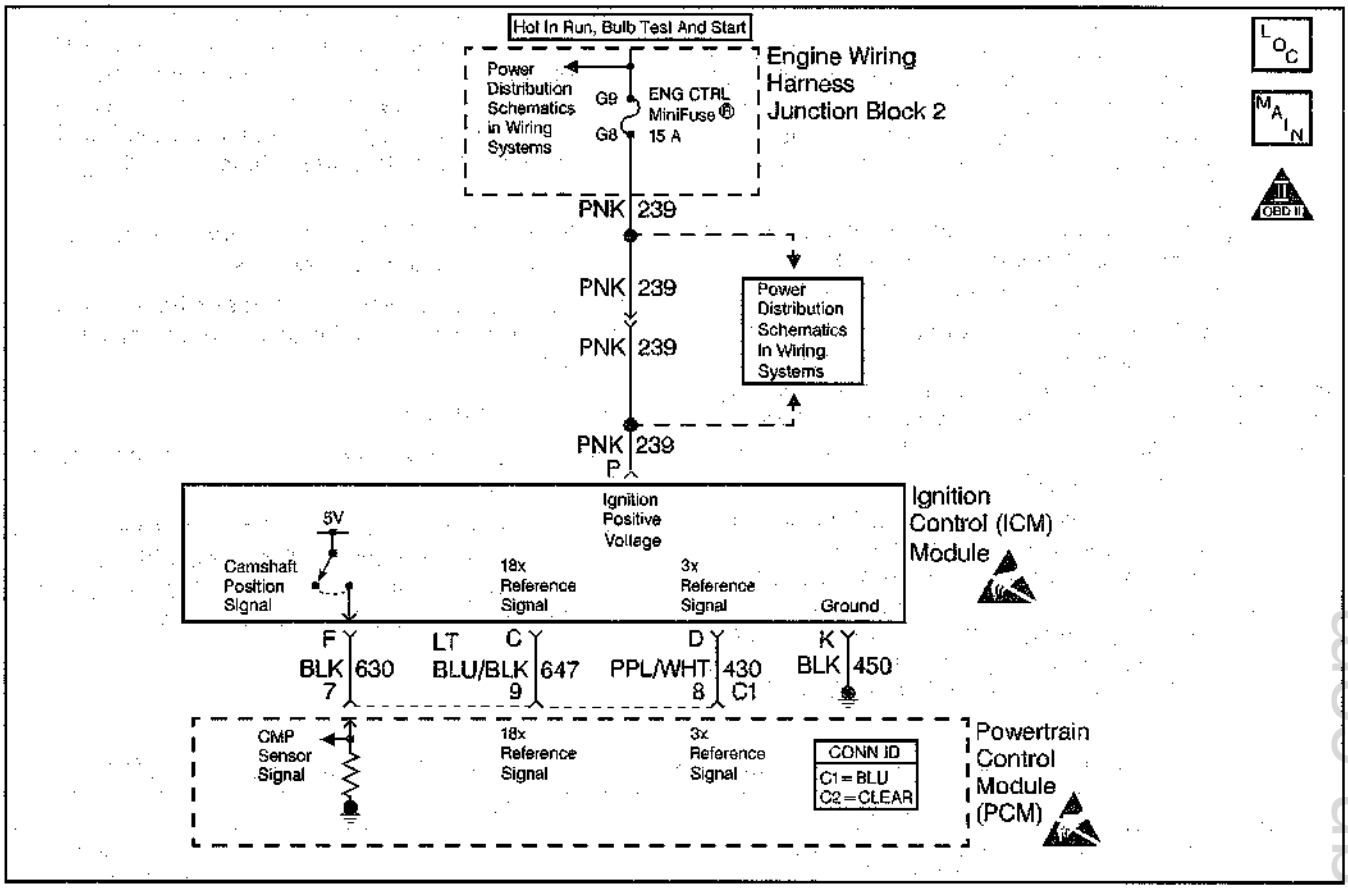
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## DTC P1362 Ignition Bypass Circuit Low Voltage (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 12 | Replace the ICM. Refer to *Ignition Control Module Replacement.*<br>Did you complete the replacement? | — | *Go to Step 14* | — |
| 13 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM.<br>Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 14* | — |
| 14 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1374 Crankshaft Position (CKP) High to Low Resolution Frequency Correlation




548570

### Circuit Description

The 3X reference signal is produced by the ignition control module. The ICM calculates the 3X reference signal by dividing the crankshaft position (CKP) sensor 18X pulses by 3 when the engine is running and CKP sync pulses are also being received. The PCM uses the 3X reference signal to calculate engine rpm and crankshaft position at engine speeds more than 1200 rpm. The PCM also uses the pulses on this circuit to initiate injector pulses. The PCM constantly monitors the number of pulses on the 3X reference circuit and compares the number of 3X reference pulses to the number of 18 X reference pulses and CAM signal pulses being received. If the PCM receives an incorrect number of pulses on the 3X reference circuit, DTC P1374 will set and the PCM will use the 18X reference signal circuit for fuel and ignition control. The engine will continue to start and run using the 18X reference and camshaft position PCM input signals only.

### Conditions for Running the DTC

The engine is running.

### Conditions for Setting the DTC

- The ratio of 18X reference pulses to CAM signal pulses received by the PCM equals 36:1.
- The ratio of 18X reference pulses to 3X reference pulses received by the PCM does not equal 6:1.
- The condition is present for more than 10 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

- Malfunctioning ignition coil — Remove the ignition coils and inspect the ignition control module and coils for cracks, carbon tracking, or other signs that indicate that the coil secondary circuit is arcing to the ICM or ICM wiring harness. Refer to TBD.
- Secondary ignition wires arcing to wiring harness — Inspect the secondary ignition wires for carbon tracking or other signs of damage.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

10. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

**DTC P1374 Crankshaft Position (CKP) High to Low Resolution Frequency Correlation**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Attempt to start the engine.<br>Does the engine start and continue to run? | — | *Go to Step 3* | Go to *Engine Cranks but Does Not Run* |
| 3 | Operate the vehicle within Fail Records conditions.<br>Does the scan tool indicate DTC P1374 failed this ignition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the ignition control module (ICM).<br>3. Install a *J 34730-2A* injector test lamp at any injector harness connector.<br>4. Turn ON the ignition.<br>5. Connect a test lamp to B+.<br>6. Repeatedly touch the test lamp to the 3X reference circuit at the ICM connector while observing the injector test lamp.<br>Does the injector test lamp blink? | — | *Go to Step 8* | *Go to Step 5* |
| 5 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. Test for the following conditions:<br>• 3X reference circuit open<br>• 3X reference circuit shorted to ground<br>• 3X reference circuit shorted to voltage<br>5. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 6* |

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## DTC P1374 Crankshaft Position (CKP) High to Low Resolution Frequency Correlation (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 6 | Inspect the 3X reference circuit for a faulty connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 7* |
| 7 | Inspect for the following conditions:<br>1. Incorrect harness routing near secondary ignition components.<br>2. Ignition coil arcing to the wiring harness or to the ICM.<br>3. Ignition coils for cracks, carbon tracking, or other signs of damage. Refer to *Ignition Coil(s) Replacement.*<br>4. Secondary ignition wires arcing to the wiring harness. Refer to *Spark Plug Wire Harness Replacement (3.8 L Right Bank)* or *Spark Plug Wire Harness Replacement (3.8 L Left Bank)* in Engine Electrical.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 10* |
| 8 | Inspect for poor connections at the ICM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 9* |
| 9 | Replace the ICM. Refer to *Ignition Coil(s) Replacement.*<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 10 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 11 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1380 Misfire Detected - Rough Road Data Not Available

Refer to *ABS Schematics*.

### Circuit Description

The PCM receives rough road information from the EBCM / EBTCM on the serial data circuit (CKT 800). The PCM uses the rough road information to enhance the misfire diagnostic by distinguishing crankshaft speed variations caused by driving on rough road surfaces from variations caused by true misfires. The EBCM / EBTCM transmits rough road information based on inputs from the wheel speed sensors. If the EBCM / EBTCM detects a condition which will not allow it to properly identify rough road situations while a misfire condition is being detected by the PCM, DTC P1380 will be set.

### Conditions for Running the DTC

- Engine load is less than 87 percent.
- Engine speed is less than 5000 RPM.
- Vehicle speed is more than 10 mph.
- A misfire DTC is occurring and requesting the MIL to be illuminated.

### Conditions for Setting the DTC

The PCM has detected a EBCM / EBTCM rough road sensing error.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

DTC P1380 set indicates that the ABS / TCS system has detected a malfunction which will not allow the EBCM / EBTCM to transmit correct rough road data to the PCM. Refer to *Self-Diagnostics* in ABS Brakes should be used to diagnose this condition.

**DTC P1380 Misfire Detected - Rough Road Data Not Available**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | Go to *Self-Diagnostics* ABS/TCS | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |

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## DTC P1381 Misfire Detected - No Communication with Brake Control Module

Refer to *ABS Schematics.*

### Circuit Description

The PCM receives rough road information from the EBCM / EBTCM on the Class 2 serial data circuit. The PCM uses the rough road information to enhance the misfire diagnostic by distinguishing crankshaft speed variations caused by driving on rough road surfaces from variations caused by true misfires. The EBCM / EBTCM transmits rough road information based on inputs from the wheel speed sensors. If a loss of communication occurs which causes the PCM not to receive rough road information while DTC P0300 is requesting the MIL, DTC P1381 will set.

### Conditions for Running the DTC

- Engine load is less than 87 percent.
- Engine speed is less than 5000 RPM.
- Vehicle speed is more than 10 mph.
- A misfire DTC is occurring and requesting the MIL to be illuminated.

### Conditions for Setting the DTC

The PCM is detecting a loss of communication with the EBCM / EBTCM for at least 10 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. Ensures that the EBCM/EBTCM is capable of transmitting serial data on the UART serial data circuit.
4. Tests the UART serial data circuit at the EBCM/EBTCM for correct voltage.

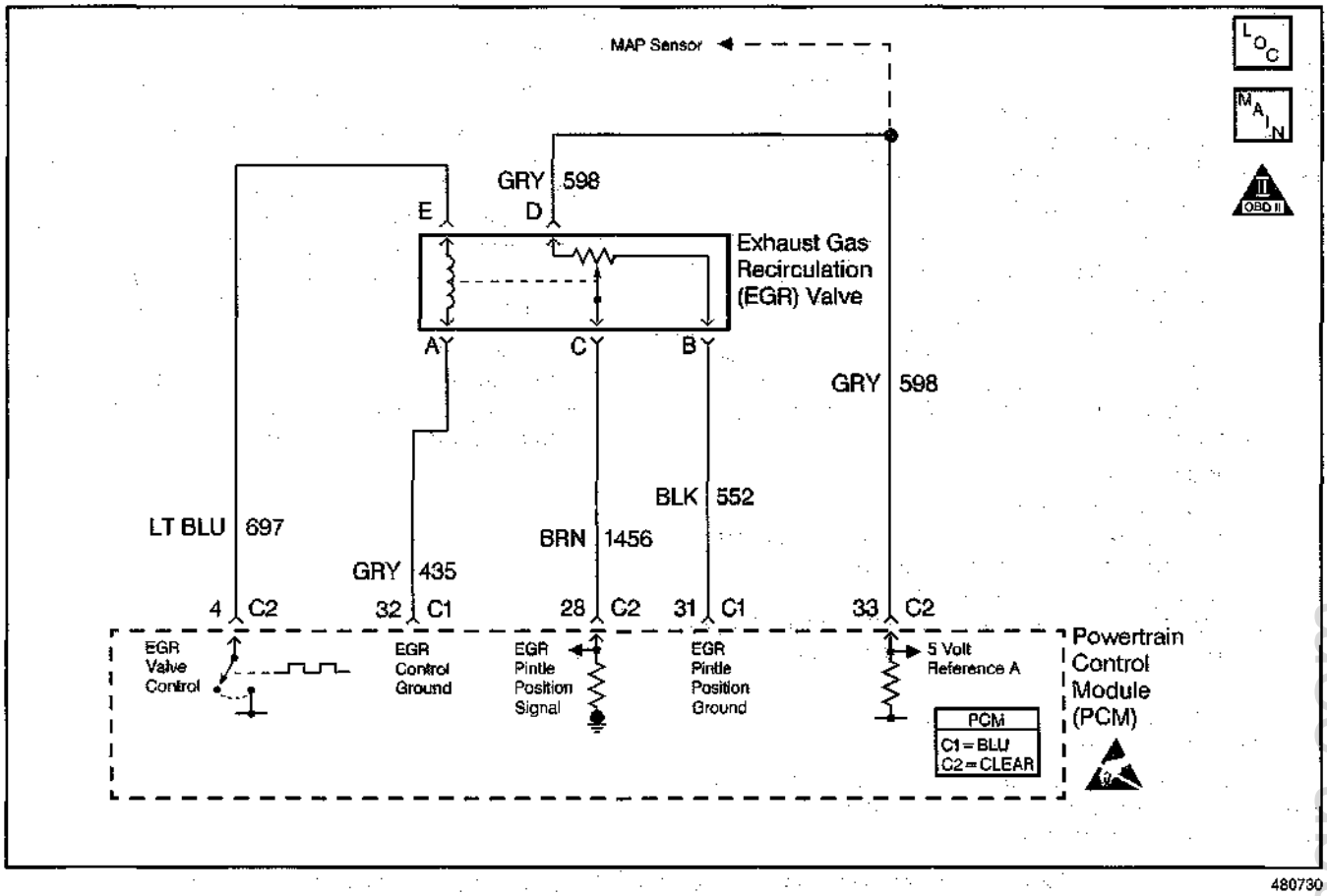
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## DTC P1381 Misfire Detected - No Communication with Brake Control Module

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition.<br>2. With a scan tool, attempt to display ABS data.<br>Can ABS data be displayed? | — | *Go to Step 3* | *Go to Step 4* |
| 3 | Test the serial data circuit for an open or a faulty connection. Refer to *Circuit Testing* and *Wiring Repairs* or *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | Go to Diagnostic Aids |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the EBTCM.<br>3. Turn ON the ignition.<br>4. Measure the voltage on the serial data circuit using a DMM that is connected to a good ground.<br>Does the voltage vary within the specified range? | 1-5V | *Go to Step 5* | *Go to Step 6* |
| 5 | Inspect for a poor connection at the EBTCM. *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 7* | *Go to Step 6* |
| 6 | Test for an open in the serial data circuit to the EBTCM. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 7* | Go to *Self-Diagnostics* in ABS/TCS |
| 7 | 1. Turn ON the ignition.<br>2. With a scan tool, attempt to display ABS data.<br>Can ABS data be displayed? | — | System OK | *Go to Step 4* |

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## DTC P1404 Exhaust Gas Recirculation (EGR) Closed Position Performance




### Circuit Description

The PCM monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM. When the ignition is turned ON, the PCM learns the EGR closed valve pintle position. The PCM compares the learned EGR closed valve pintle position to the actual EGR position when the EGR valve is commanded closed. If the actual EGR position indicates that the EGR valve is still open when the PCM is commanding the EGR valve closed, DTC P1404 will set.

### Conditions for Running the DTC

System voltage is more than or equal to 10 volts.

### Conditions for Setting the DTC

- EGR Feedback is 0.2 volt more than the EGR Closed Valve Pintle Position when the Desired EGR Position is commanded to 0 percent
- The above condition is present for more than 20 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

2. Verifies that the malfunction is present.
4. If DTC P1404 will only set under certain conditions, the malfunction may be intermittent; refer to DTC P1404 Diagnostic Aids. If an intermittent wiring problem is not present, check for a poor connection at the PCM or the EGR valve. If the connections are OK and DTC P1404 continues to set, replace the EGR valve.
14. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

### DTC P1404 Exhaust Gas Recirculation (EGR) Closed Position Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If DTC P0403 is set, diagnose it first.<br>With a scan tool and the engine idling, observe actual EGR position parameter.<br>Does the scan tool indicate actual EGR position at the specified value? | 0% | *Go to Step 3* | *Go to Step 5* |
| 3 | 1. Turn ON the ignition.<br>2. With a scan tool, increment the EGR valve through all positions while comparing Desired EGR Position to actual EGR position parameters.<br>Does the Desired EGR Position remain close to actual EGR position at all commanded positions? | — | *Go to Step 4* | *Go to Step 6* |
| 4 | Operate the vehicle within Fail Records conditions.<br>Does the scan tool indicate DTC P1404 failed this ignition? | — | *Go to Step 5* | Go to Diagnostic Aids |
| 5 | 1. Disconnect the EGR valve.<br>2. With a scan tool, observe actual EGR position parameter.<br>Does the scan tool indicate actual EGR position at the specified value? | 0% | *Go to Step 6* | *Go to Step 7* |
| 6 | Probe the EGR pintle position sensor ground circuit using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 9* | *Go to Step 8* |

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## DTC P1404 Exhaust Gas Recirculation (EGR) Closed Position Performance (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 7 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. Measure the voltage on the EGR valve pintle position signal circuit using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | 0V | *Go to Step 12* | *Go to Step 11* |
| 8 | Test the EGR pintle position sensor ground circuit for an open. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 13* |
| 9 | Inspect for poor connections at the EGR valve. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 10* |
| 10 | Replace the EGR valve. Refer to *EGR Valve Replacement.*<br>***Notice:*** If the EGR valve shows signs of excessive heat, inspect the exhaust system for blockage—possibly a plugged converter—using the procedure found on the Restricted Exhaust System Check. If the exhaust system is restricted, repair the cause. Inspect for an open injector caused by one or more of the following conditions:<br>• Stuck<br>• Grounded driver circuit<br>• Possible faulty control module<br>If one of the above conditions is found, inspect the oil for possible fuel contamination.<br>Did you find and correct the condition? | — | *Go to Step 15* | — |
| 11 | Repair short to voltage in the EGR pintle position signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 15* | — |
| 12 | 1. Test for the following conditions:<br>• The EGR valve pintle position signal circuit for a short to the 5 volt reference circuit.<br>• The EGR valve pintle position signal circuit for a short to the EGR valve control circuit.<br>2. If a problem is found, repair as necessary. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| 13 | Inspect the circuits related to the EGR valve for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 15* | *Go to Step 14* |
| *14* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 15* | — |
| 15 | 1. Use the scan tool in order to clear DTCs.<br>2. Operate the vehicle within Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

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## DTC P1441 Evaporative Emission (EVAP) System Flow During Non-Purge

Refer to *EVAP System Overview*.

### System Description

THE powertrain control module (PCM) supplies a ground to energize the EVAP purge valve (purge on). The EVAP purge valve control is pulse width modulated (PWM) or turned on and off several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met. The system checks for conditions that cause the EVAP system to purge continuously by commanding the EVAP vent valve ON (Closed) and the EVAP canister purge valve OFF (Closed). If vacuum level in the fuel tank increases during the test, a continuous purge flow condition is indicated. This can be caused by any of the following conditions:

- EVAP canister purge valve leaking internally
- EVAP purge and engine vacuum lines switched at the EVAP canister purge valve
- EVAP canister purge valve control circuit grounded

If any of these conditions are present, DTC P1441 will set.

### Conditions for Running the DTC

- No ECT, IAT, MAP, TP, MAF sensor, VSS, HO2S, Misfire, Fuel trim, Injector circuit, EGR pintle position DTCs set.
- All conditions for DTC P0440, P0442 and P0446 diagnostic tests have been met and passed.
- Startup engine coolant temperature is not more than 4°C and 30°C (40° F and 86°F).
- Startup engine is not more than 8°C (14°F).
- Startup Intake air temperature not more than 2°C and 30°C (40°F and 86°F).
- Startup intake air temperature not more than 2°C (4°F).
- Fuel tank level is between 15 percent and 85 percent.
- BARO is more than 75kPa.

### Conditions for Setting the DTC

A continuous open purge flow condition is detected during the diagnostic test (fuel tank pressure decreases to less than -11 inch H2O.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

**Important:** Although this diagnostic is considered type A, it acts like a type B diagnostic. Whenever the EVAP diagnostics report that a system has passed, or if the battery has been disconnected, the diagnostic must fail during 2 consecutive cold start trips before setting a DTC. The initial failure is not reported to the diagnostic executive or displayed on a scan tool. A passing system always reports to the diagnostic executive immediately.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Check for the following conditions:

- Poor connection at the PCM.

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

  Inspect the wiring harness for damage.
- If the harness appears to be OK, connect the *J 41413* to the EVAP service port, pressurize the EVAP system to 10 inch H2O and observe the fuel tank pressure display on the scan tool while moving connectors and wiring harnesses related to the EVAP purge valve. A sudden change in the display will indicate the location of the malfunction.

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- Incorrect vacuum line routing.

  Verify that the source vacuum line routing to the EVAP purge valve is correct and that the EVAP purge and source vacuum lines to the EVAP canister purge valve are not switched.

- Malfunctioning or damaged canister.

  Use the following procedure to check for a carbon release condition:

  1. Turn OFF the ignition.
  2. Remove the EVAP purge valve. Refer to *EVAP Canister Purge Valve Replacement.*
  3. Lightly tap the EVAP purge valve on a clean work area looking for carbon particles exiting either of the vacuum ports.
  4. If no carbon release is evident, reinstall the components and continue with the DTC P1441 table. If carbon is being released from either component, continue with this service procedure.
  5. Remove the charcoal canister from the vehicle.
  6. Ensure that the main cylinder valve is turned OFF on the *J 41413* EVAP purge/pressure diagnostic station.
  7. Disconnect the black hose that connects the nitrogen cylinder to the EVAP purge/pressure diagnostic station at the pressure regulator by unscrewing the knurled nut on the regulator. No tools are required to remove the black hose from the regulator.
  8. Using a section of vacuum line, connect one end over the open threaded fitting of the EVAP purge/pressure diagnostic station pressure regulator.
  9. Connect the remaining end to the EVAP purge valve end of the EVAP purge line at the vehicle and turn on the main nitrogen cylinder valve. Continue to blow any debris from the purge line for 15 seconds.
  10. Return the *J 41413* EVAP pressure/purge diagnostic station to its original condition by re-installing the black hose that was disconnected in step 7.
  11. Replace the following components:
      - The EVAP purge valve. Refer to *EVAP Canister Purge Valve Replacement.*
      - The EVAP canister. Refer to *EVAP Canister Replacement.*
  12. Proceed with the DTC P1441 diagnostic table.

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

## Test Description

The numbers below refer to the step numbers on the diagnostic table:

1. The Powertrain On-Board Diagnostic (OBD) System Check promps you to complete some of the basic check and store the Freeze Frame and Failure Records data on the scan tool if applicable.
2. If an EVAP purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction will very likely correct the condition that set this DTC.
3. Inspects for a fuel tank pressure sensor stuck high condition. The fuel tank pressure must be relieved by removing the canister line from the fuel tank or EVAP canister. The fuel fill cap will not relieve the tank due to a check valve in the filler neck. The check valve seals when pressure is applied to prevent vapors from escaping through the filler neck. The scan tool should read within 1.0 inch H2O of the specified value.
4. Inspects for a leaking or stuck open EVAP canister purge valve/solenoid. the scan tool should read within 1.0 inch HG of the specified value.
5. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes. the EVAP station is pressurizing a sensor that normally reads vacuum. The scan tool reads high pressure at 0 volts and high vacuum at 5 volts. The scan tool can only read a max pressure of 6.0 inches of H2O (0 volts). However the EVAP service station can pressurize the system to much higher pressures. The scan tool value should be within 0.5 in H2O of the specified value.
6. If the EVAP purge and engine vacuum lines are switched at the EVAP purge valve/solenoid, the valve/solenoid will leak vacuum.

12. The EVAP station is pressurizing a sensor that normally reads vacuum. The scan tool reads High pressure at 0 volts and high vacuum at 5 volts. The scan tool can only read a max pressure of 6.0 inches of H2O (0 volts). However the EVAP service station can pressurize the system to much higher pressures. The scan tool value should be within 0.5 inch H2O of the specified value.

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## DTC P1441 Evaporative Emission (EVAP) System Flow During Non-Purge

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Visually/Physically inspect for the following conditions:<br>• Vacuum or purge lines disconnected. Refer to *Emission Hose Routing Diagram* Emission hose routing Diagram.<br>• Loose or missing fuel fill cap.<br>Did *DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit* or *DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit* also set? | — | Go to applicable DTC | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the EVAP canister Line from the EVAP canister purge valve. This will relieve the fuel tank pressure.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe the fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 0 in. H2O | *Go to Step 4* | *Go to Step 12* |
| 4 | **Important:** Before continuing with diagnosis, zero the EVAP pressure and vacuum (inches of H2O) gauges on the *J 41413* EVAP pressure/purge diagnostic station, refer to tool operating instructions.<br>1. Turn OFF the ignition.<br>2. Reconnect all EVAP hardware that was previously disconnected<br>3. Install the *J 41415-40* fill tank cap Adaptor to the fuel fill neck and fuel fill cap.<br>4. Connect the EVAP station to the fuel tank cap adaptor.<br>5. Turn ON the ignition, with the engine OFF<br>6. With a scan tool, capture Fail Record data for DTC P1441 and clear DTCs.<br>7. With a scan tool, select Seal option to seal the EVAP system.<br>**Important:** Do not exceed the pressure in the specified value.<br>8. With the EVAP station, attempt to pressurize the system to the specified value by slowly turning the rotary switch to the PRESSURE position. Monitor pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>Did you achieve the specified value? | 5 in. H2O | *Go to Step 5* | *Go to Step 6* |
| 5 | 1. With the EVAP station, maintain tank pressure at the specified value. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>2. With a scan tool observe the fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 5 in. H2O | Go to Diagnostic Aids | *Go to Step 9* |
| 6 | Inspect the EVAP purge and source vacuum line routing and connections at the EVAP purge valve. Refer to *Emission Hose Routing Diagram.*<br>Did you find and correct the condition? | — | *Go to Step 12* | *Go to Step 7* |

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## DTC P1441 Evaporative Emission (EVAP) System Flow During Non-Purge (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 7 | 1. Connect the inch HG vacuum hose on the EVAP service station to the canister side of the purge valve.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, select the Seal option to seal the EVAP system.<br>4. Start the engine.<br>5. Run the engine from 1200-1500 RPM and observe vacuum level.<br>Does the vacuum measure near the specified value? | 0 in. Hg | Go to Diagnostic Aids | *Go to Step 8* |
| 8 | **Important:** Check for carbon release into the EVAP system. Refer to Diagnostic Aids.<br>Replace the EVAP canister purge valve. Refer to *EVAP Canister Purge Valve Replacement.*<br>Did you complete the replacement? | — | *Go to Step 12* | — |
| 9 | Visually/physically inspect for the following conditions:<br>• Restricted fuel tank vapor line<br>• Restricted EVAP purge line<br>Did you find and correct the condition? | — | *Go to step 12* | Go to *DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage* |
| 10 | Check for a kinked or restricted canister purge line between the EVAP canister purge valve and EVAP canister.<br>Did you find and correct the condition? | 0 in. H2O | *Go to Step 12* | — |
| 11 | 1. Turn OFF the ignition.<br>2. Disconnect the EVAP canister line from the fuel tank or EVAP canister. This will relieve the fuel tank pressure.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 0 in. H2O | *Go to Step 10* | Go to *DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage* |
| *12* | 1. Reconnect all EVAP hardware that was previously disconnected<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, select the seal option to seal the EVAP system.<br>4. With the EVAP station, pressurize the system to the first specified (higher) value by slowly turning the rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>Does the EVAP pressure decrease to less than the second specified (lower) value within 2 minutes with the rotary switch in the OFF/HOLD position? | 15 in. H2O<br>10 in. H2O | *Go to Step 3* | System OK |

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## DTC P1514 Throttle Body Performance

### Circuit Description

The PCM uses the TP, BARO, IAT and engine RPM in order to calculate an expected mass airflow rate. The PCM compares this value to the mass airflow value and the speed density calculation in order to verify the proper throttle operation.

### Conditions for Running the DTC

- No other ETC DTCs are present.
- No PCM processor DTCs are present.
- Engine is running and engine speed is more than 600 RPM.

### Conditions for Setting the DTC

The PCM detects that the actual airflow (MAF) and Speed Density is much more than the expected (calculated) airflow rate.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

- Inspect the throttle blade for being broken, bent, or missing.
- Skewed cam sensor Signal - Intermittently shorted to ground, causing a fluctuating RPM as seen on the scan tool.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. Physically/visually inspect the throttle body assembly and correct any problems that you observe. Manually move the throttle blade from closed to wide open throttle (WOT). You should not need to use excessive force. The throttle blade should move smoothly through the full range and should return to a slightly open position on its own.
5. When the PCM detects a problem within the ETC System other DTCs may set due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

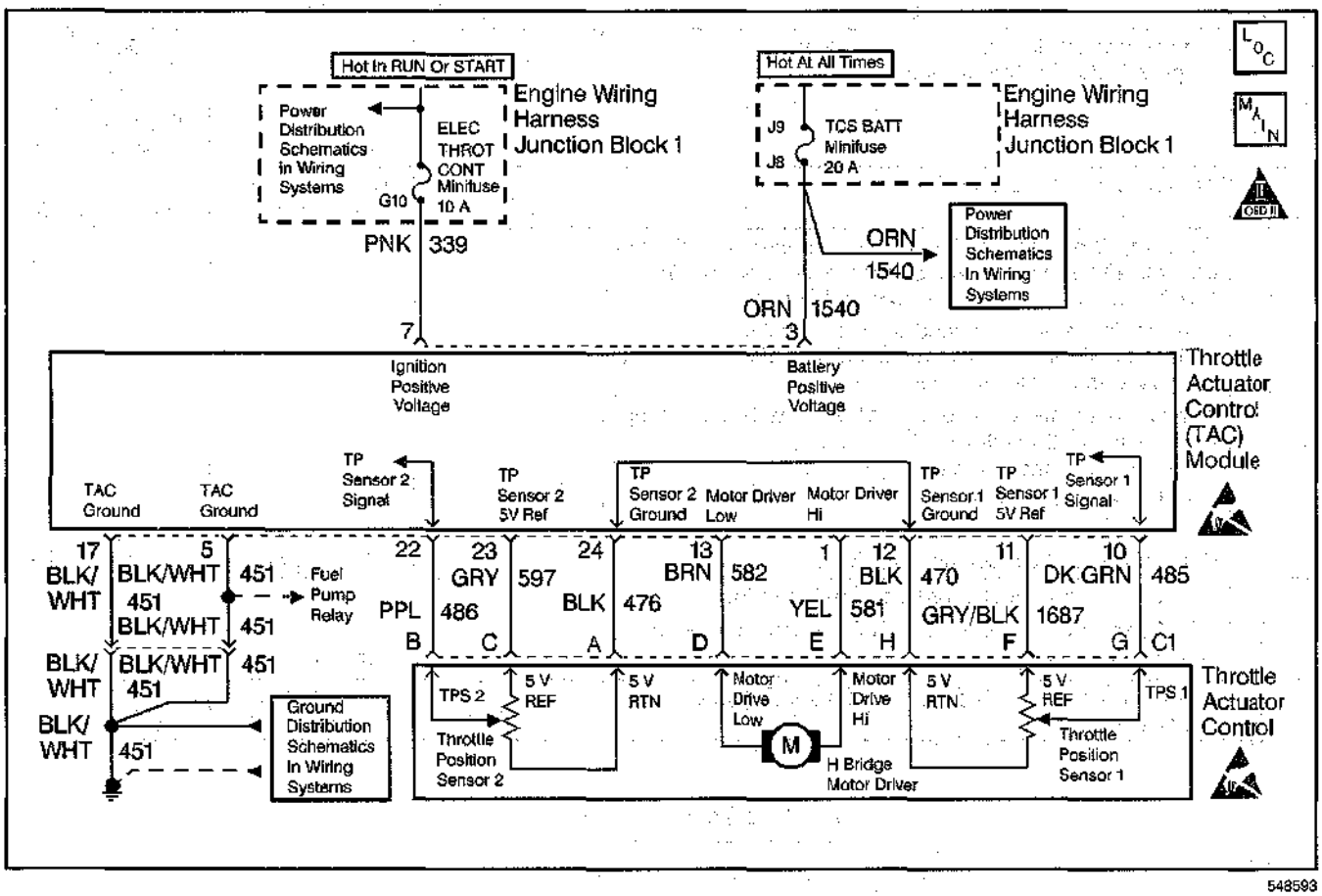
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## DTC P1514 Throttle Body Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Are any other DTCs set? | — | Diagnose these DTCs first | *Go to Step 3* |
| 3 | ***Caution: Turn OFF the ignition before inserting fingers into the throttle bore. Unexpected movement of the throttle blade could cause personal injury.***<br>**Important:** If any of the conditions listed below exist, replace the throttle body/TAC assembly. Refer to *Throttle Body Assembly Replacement*.<br>Inspect the throttle body for the following while modulating the throttle using the scan tool:<br>• Loose or damaged throttle blade<br>• Broken throttle shaft<br>• Drive mechanism damage<br>Did you find and correct the condition? | — | *Go to Step 4* | Go to Diagnostic Aids |
| 4 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 5* | *Go to Step 2* |
| 5 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to the applicable DTC | System OK |

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## DTC P1515 Control Module Throttle Actuator Position Performance




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### Circuit Description

The commanded throttle position, based on accelerator pedal position and possibly other limiting factors, is compared to the actual throttle position. The PCM monitors the Commanded and actual throttle position. This DTC sets if the PCM detects the problem.

### Conditions for Running the DTC

- No other ETC DTCs are set.
- No PCM processor DTCs are present.
- The ignition is in the crank or run position.
- The ignition voltage is more than 8.5 volts with key ON engine OFF.
- The ETC system is not in the battery saver mode.

### Conditions for Setting the DTC

The PCM detects that the commanded and actual throttle positions are not within a calibrated range of each other.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Ensure that the starting and charging systems are operating properly. Low system voltage causes this DTC to set.

If you do not find any trouble, check for mechanical problems or binding that may be temperature related. Components may not move freely in extreme heat or cold due to the presence of contaminants or ice formation.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. If the TP indicated angle does not follow the movement of the throttle blade, and no TP sensor DTCs are set, there is a mechanical problem with the throttle shaft or the TP sensor. Replace the throttle body assembly. Re-install the air inlet duct after repairs are completed.
18. When the PCM detects a problem within the ETC System other DTCs may set due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

### DTC P1515 Control Module Throttle Actuator Position Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If you came from one of the following DTC tables continue with this table and go to step 3.<br>Is DTC P1120, P1220 or P1221 set? | — | Diagnose these DTCs first | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition for 15 seconds.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, observe the TP sensor 1 and 2 angle parameter.<br>4. Slowly depress the accelerator pedal to wide open throttle (WOT) and then slowly return it to closed throttle.<br>Does the TP sensor 1 and 2 angle increase to near the specified value as the pedal is depressed and decrease as the pedal is released? | 100% | Go to Diagnostic Aids | *Go to Step 4* |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the TAC.<br>3. Turn ON the ignition.<br>4. Measure the voltage across the Throttle Actuator circuits (Motor Hi and Motor Low) using a DMM.<br>Does the voltage measure specified range? | 7.5-8.5 V | *Go to Step 15* | *Go to Step 5* |

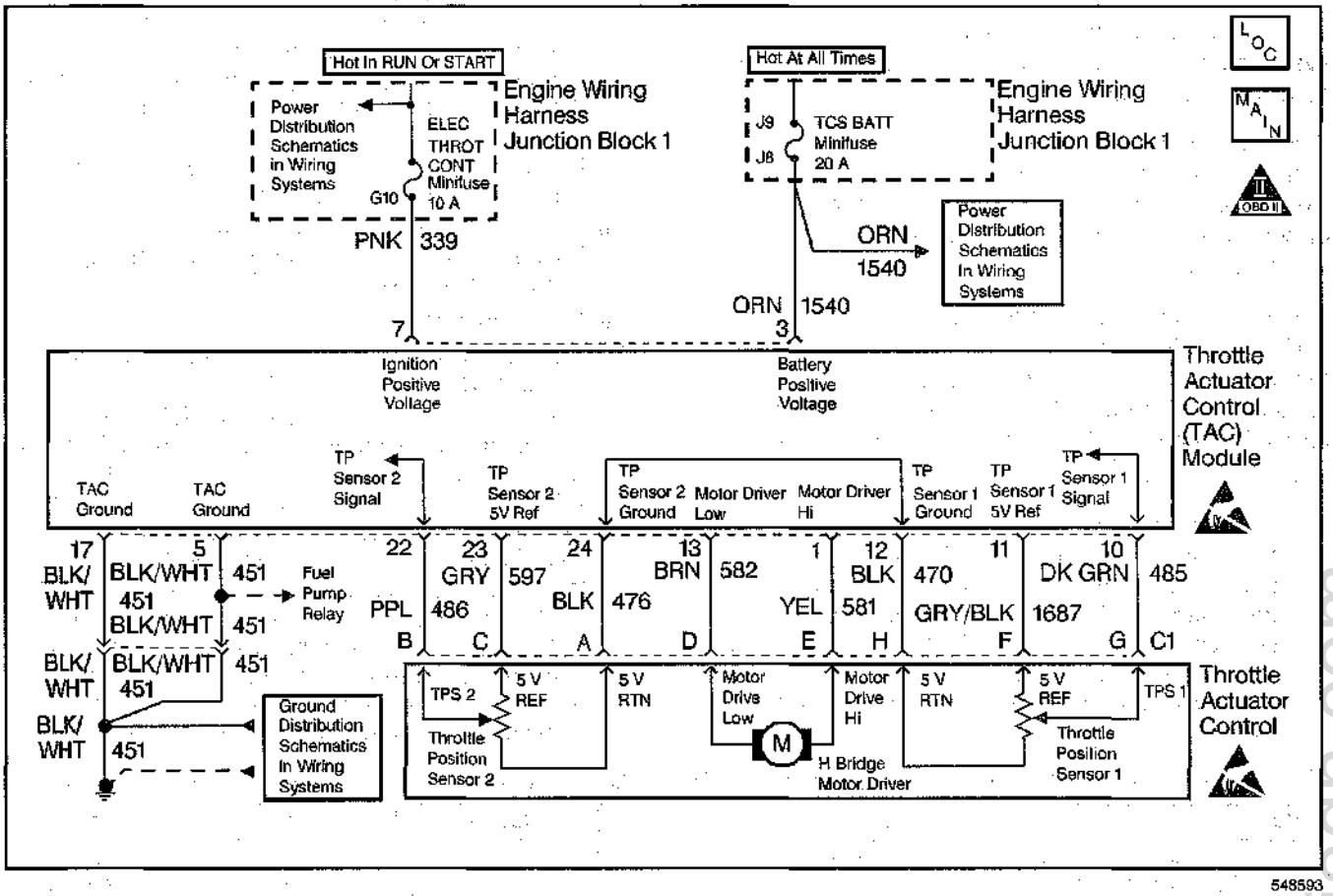
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## DTC P1515 Control Module Throttle Actuator Position Performance (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 5 | 1. Turn ON the ignition.<br>2. Measure the voltage on each Throttle Actuator circuit (Motor Hi and Motor Low) using a DMM that is connected to a good ground.<br>Is any voltage present? | — | *Go to Step 9* | *Go to Step 6* |
| 6 | Test for an open in each Throttle Actuator circuit (Motor Hi and Motor Low). Refer to *Circuit Testing* in Wiring Systems.<br>Did you find a problem? | — | *Go to Step 10* | *Go to Step 7* |
| 7 | Test for a short to ground on each Throttle Actuator circuit (Motor Hi and Motor Low). Refer to *Circuit Testing* in Wiring Systems.<br>Did you find a problem? | — | *Go to Step 11* | *Go to Step 8* |
| 8 | Test for continuity between each Throttle Actuator circuit (Motor Hi and Motor Low) and all other circuits in the TAC module connector. Refer to *Circuit Testing* in Wiring Systems.<br>Is continuity indicated? | — | *Go to Step 12* | *Go to Step 13* |
| 9 | Repair the short to voltage on the affected Throttle Actuator circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 10 | Repair the open or high resistance on the affected Throttle Actuator circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 11 | Repair the short to ground on the affected Throttle Actuator circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 12 | Repair the circuits that are shorted together. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 13 | Inspect for poor connections at the TAC module. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 14* |
| 14 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 15 | Inspect for poor connections at the TAC. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 16 | Replace the throttle body/TAC assembly. Refer to *Throttle Body Assembly Replacement.*<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 17 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 18* |
| *18* | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1516 Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance




### Circuit Description

The commanded throttle position, based on accelerator pedal position and possibly other limiting factors, is compared to the actual throttle position. The TP values should be within a calibrated range of each other. The TAC module monitors the Commanded and actual throttle position. This DTC sets if the TAC module detects the problem and send the message to the PCM across serial data.

### Conditions for Running the DTC

- The ignition is in the crank or run position.
- DTC P1518 is not present.

### Conditions for Setting the DTC

The TAC module detects that the commanded and actual throttle positions are not within a calibrated range of each other or the TAC module cannot determine throttle position or both TP sensors are invalid.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** Ensure that the starting and charging systems are operating properly. Low system voltage causes this DTC to set.

If you do not find any trouble, check for mechanical problems or binding that may be temperature related. Components may not move freely in extreme heat or cold due to the presence of contaminants or ice formation.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. If the TP indicated angle does not follow the movement of the throttle blade, and no TP sensor DTCs are set, there is a mechanical problem with the throttle shaft or the TP sensor. Replace the throttle body assembly. Re-install the air inlet duct after repairs are completed.
18. When the PCM detects a problem within the ETC System other DTCs may set due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

### DTC P1516 Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If you came from one of the following DTC tables continue with this table and go to step 3.<br>Is DTC P1120, P1220 or P1221 set? | — | Diagnose these DTCs first | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition for 15 seconds.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, observe the TP sensor 1 and 2 angle parameter.<br>4. Slowly depress the accelerator pedal to wide open throttle (WOT) and then slowly return it to closed throttle.<br>Does the TP sensor 1 and 2 angle increase to near the specified value as the pedal is depressed and decrease as the pedal is released? | 100% | Go to Diagnostic Aids | *Go to Step 4* |
| 4 | 1. Turn OFF the ignition.<br>2. Disconnect the TAC.<br>3. Turn ON the ignition.<br>4. Measure the voltage across the Throttle Actuator circuits (Motor Hi and Motor Low) using a DMM.<br>Does the voltage measure specified range? | 7.5-8.5 V | *Go to Step 15* | *Go to Step 5* |
| 5 | 1. Turn ON the ignition.<br>2. Measure the voltage on each Throttle Actuator circuit (Motor Hi and Motor Low) using a DMM that is connected to a good ground.<br>Is any voltage present? | — | *Go to Step 9* | *Go to Step 6* |

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## DTC P1516 Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 6 | Test for an open in each Throttle Actuator circuit (Motor Hi and Motor Low). Refer to *Circuit Testing* in Wiring Systems.<br>Did you find a problem? | — | *Go to Step 10* | *Go to Step 7* |
| 7 | Test for a short to ground on each Throttle Actuator circuit (Motor Hi and Motor Low). Refer to *Circuit Testing* in Wiring Systems.<br>Did you find a problem? | — | *Go to Step 11* | *Go to Step 8* |
| 8 | Test for continuity between each Throttle Actuator circuit (Motor Hi and Motor Low) and all other circuits in the TAC module connector. Refer to *Circuit Testing* in Wiring Systems.<br>Is continuity indicated? | — | *Go to Step 12* | *Go to Step 13* |
| 9 | Repair the short to voltage on the affected Throttle Actuator circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 10 | Repair the open or high resistance on the affected Throttle Actuator circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 11 | Repair the short to ground on the affected Throttle Actuator circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 12 | Repair the circuits that are shorted together. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 13 | Inspect for poor connections at the TAC module. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 14* |
| 14 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 15 | Inspect for poor connections at the TAC. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |
| 16 | Replace the throttle body/TAC assembly. Refer to *Throttle Body Assembly Replacement.*<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 17 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 18* |
| *18* | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1517 Throttle Actuator Control (TAC) Module Performance

### Circuit Description

The throttle actuator control (TAC) module contains data which is essential for proper ETC System operation. The TAC module continuously checks the integrity of this data. When the TAC module is unable to write or read data to and from RAM or the TAC module is unable to correctly read data from the flash memory or an internal TAC module processor fault is detected. This communicated to the PCM across serial data and this DTC sets.

### Conditions for Running the DTC

- The ignition is in the crank or run position.
- DTC P1518 is not present.

### Conditions for Setting the DTC

The TAC module determines that an internal data test did not pass.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing/replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

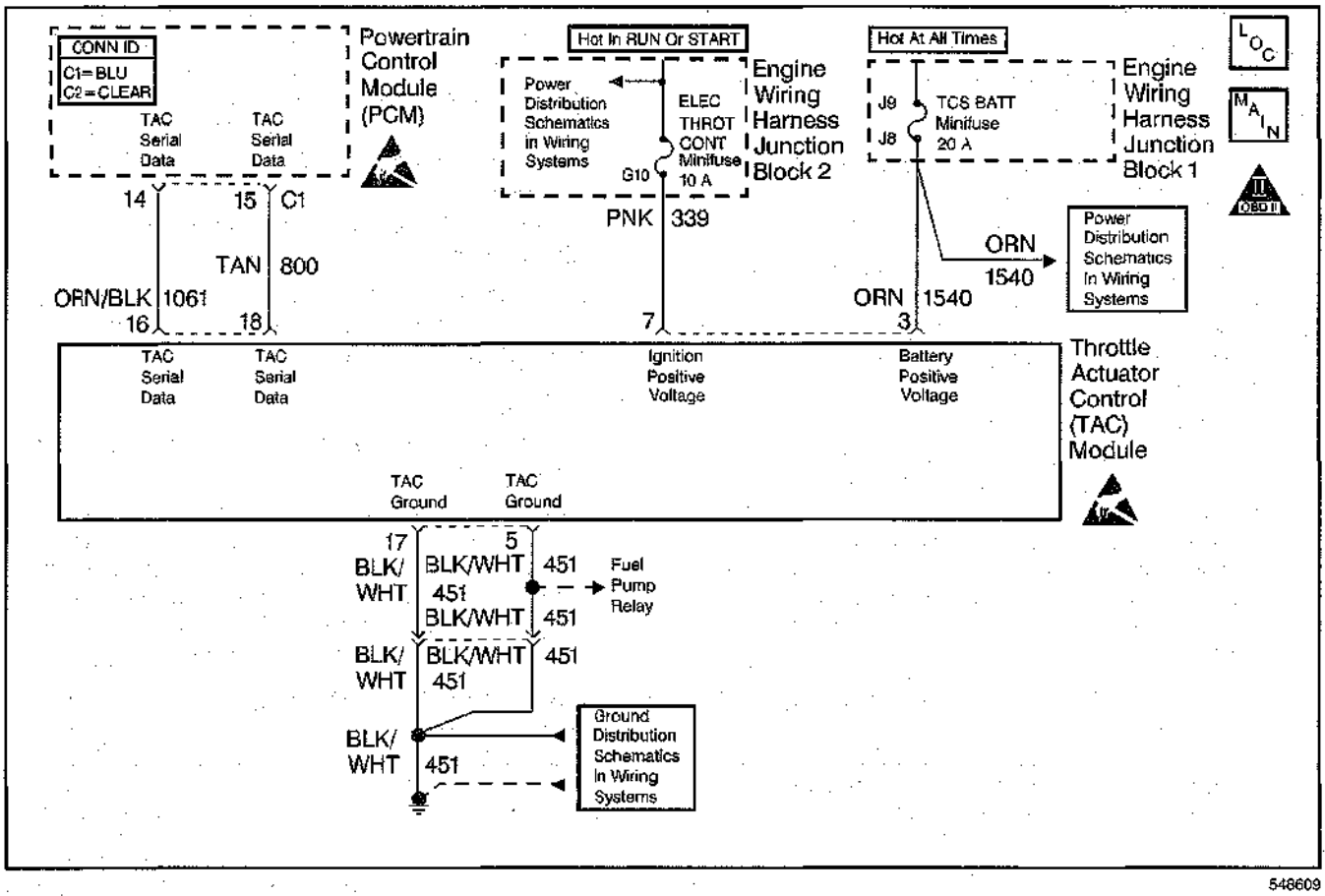
4. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

**DTC P1517 Throttle Actuator Control (TAC) Module Performance**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set, refer to the appropriate DTC first for further diagnosis.<br>Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 3* | — |
| 3 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the scan tool indicate this DTC failed this ignition? | — | *Go to Step 2* | *Go to Step 4* |
| *4* | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1518 Throttle Actuator Control (TAC) Module Serial Data Circuit




548609

### Circuit Description

The TAC module and the PCM communicate via a dedicated serial data circuit. This serial data circuit is separate from any other serial data circuit on the vehicle. Accurate transmitting and receiving of serial data requires not only good circuit integrity but also adequate system voltage. This diagnostic monitors the accuracy of the serial data transmitted between the TAC module and the PCM. If the PCM/TAC module detects a loss of data or invalid data, this DTC sets.

### Conditions for Running the DTC

The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

Invalid or missing serial data messages are detected for a predetermined amount of time.

### Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the first trip in which the diagnostic runs and fails.
- If equipped with traction control, the PCM will command the EBTCM via the serial data circuit to turn OFF traction control and illuminate the TRACTION OFF lamp.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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## Diagnostic Aids

Inspect for the following:

**Important:** DTC P1518 sets if the battery voltage is low or the PCM is replaced/reflashed. If the customers concern is slow cranking or no crank because battery voltage is low, ignore DTC P1518. Clear any DTCs from memory that may have set from the low battery voltage condition.

The following could cause an intermittent condition:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

## Test Description

The numbers below refer to the step numbers on the diagnostic table.

19. When the PCM detects a problem within the ETC System other DTCs may set due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

### DTC P1518 Throttle Actuator Control (TAC) Module Serial Data Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If DTC P1120, P1220, P1221, P1515 or P1516 are set, refer to the appropriate DTC first for further diagnosis.<br>Operate the vehicle within Fail Records conditions.<br>Does the scan tool indicate DTC P1518 failed this ignition? | — | *Go to Step 3* | Go to Diagnostic Aids |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the TAC module.<br>3. With the ignition OFF, measure the voltage of the TAC module ignition feed circuit using a DMM that is connected to a good ground.<br>Does voltage at or near the specified value? | 0 V | *Go to Step 4* | *Go to Step 10* |
| 4 | 1. Turn ON the ignition.<br>2. Measure the voltage from the TAC module ignition feed circuit using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | B+ | *Go to Step 5* | *Go to Step 12* |
| 5 | Test the TAC module ground circuits using a test lamp that is connected to B+.<br>Does the test lamp illuminate when probing both circuits? | — | *Go to Step 6* | *Go to Step 13* |
| 6 | Test for voltage between both TAC module serial data circuits and a good ground using a DMM.<br>Does the voltage measure within the specified range? | 2–5 V | *Go to Step 14* | *Go to Step 7* |
| 7 | Does the voltage measure more than the specified range? | 2–5 V | *Go to Step 11* | *Go to Step 8* |
| 8 | Does the voltage measure less than the specified range? | 2–5 V | *Go to Step 9* | — |

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## DTC P1518 Throttle Actuator Control (TAC) Module Serial Data Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 9 | Test for an open or short to ground in the serial data circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 18* | *Go to Step 16* |
| 10 | Repair the short to battery voltage in the ignition feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 18* | — |
| 11 | Test for a short to voltage on the TAC module serial data circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 18* | *Go to Step 17* |
| 12 | Repair the open or short to ground in the ignition feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 18* | — |
| 13 | Repair the open in the TAC module ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 18* | — |
| 14 | Inspect for a faulty serial data connections at the TAC module. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 18* | *Go to Step 15* |
| 15 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 18* | — |
| 16 | Inspect for faulty connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 18* | *Go to Step 17* |
| 17 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 18* | — |
| 18 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 19* |
| 19 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1519 Throttle Actuator Control (TAC) Module Internal Circuit

### Circuit Description

The TP sensor 1 signal is fed into a multiplier (5X) to produce a high resolution calculated TP sensor voltage. This higher resolution TP sensor voltage is used for actuator control in low throttle angle conditions.

### Conditions for Running the DTC

- DTCs P0606, P1517, P1518 are not set.
- The ignition switch is in the crank or run position.

### Conditions for Setting the DTC

The high resolution TP sensor is out of range.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

If the DTC is determined to be intermittent, reviewing the Fail Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

5. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

**DTC P1519 Throttle Actuator Control (TAC) Module Internal Circuit**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** If any other DTCs are set, refer to those DTCs first.<br>Operate within Fail Records conditions.<br>Does the scan tool indicate DTC P1519 failed this ignition? | — | Go to Diagnostic Aids | *Go to Step 3* |
| 3 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | *Go to Step 4* | — |
| 4 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 5* |
| 5 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1523 Throttle Closed Position Performance

### Circuit Description

During Battery Saver Mode the TAC module determines if the throttle plate is returning to the correct de-energized position. If this fault is detected the TAC module sends a message to the PCM across serial data and this DTC is set.

### Conditions for Running the DTC

- DTC P1518 is not set.
- The ignition is ON and the engine is OFF.
- The ignition voltage is more than 8.5 volts.
- Battery Saver Mode is active.

### Conditions for Setting the DTC

The TAC module detects that the commanded and actual throttle positions are not within a calibrated range of each other.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

If you do not find any trouble, inspect for mechanical problems or binding that may be temperature related. Components may not move freely in extreme heat or cold due to the presence of contaminants or ice formation.

The following could cause an intermittent condition:

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

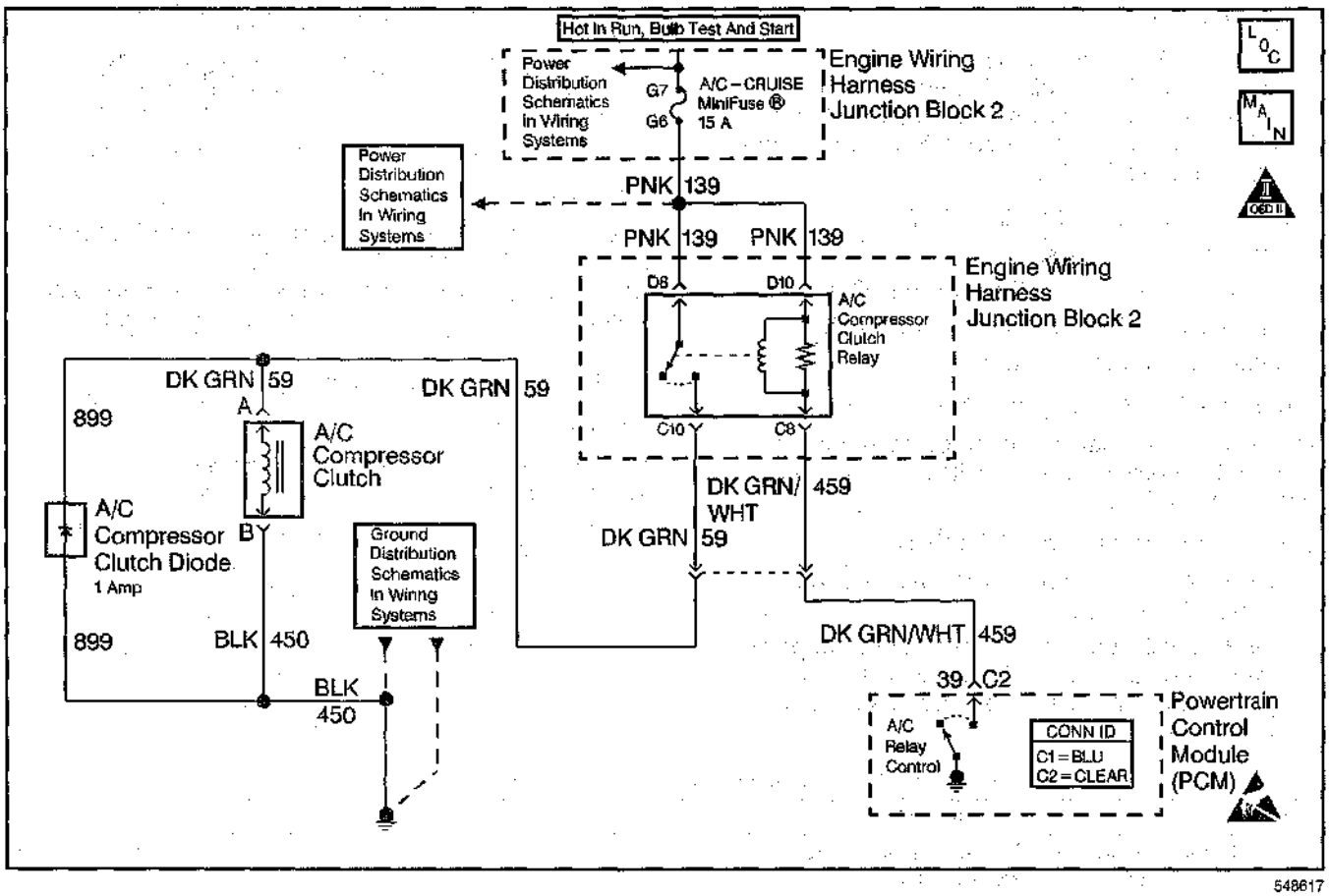
8. When the TAC module detects a problem within the ETC System the PCM receives a message across serial data and more than one ETC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual problem may correct more than one DTC. Keep this in mind when reviewing captured DTC info.

### DTC P1523 Throttle Closed Position Performance

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Are any other DTCs set? | — | Diagnose these DTCs first | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition for 15 seconds.<br>2. Turn ON the ignition, with the engine OFF.<br>3. Allow the pedal to rest at idle stop for 20 seconds.<br>4. With a scan tool, observe the indicated Throttle Position parameter.<br>Does the scan tool indicate throttle position within the specified range? | 10.8–23.2 % | *Go to Step 6* | *Go to Step 4* |
| 4 | Remove the throttle body/TAC assembly. Refer to *Throttle Body Assembly Replacement*.<br>Did you find any obstructions preventing the throttle blade from returning to the default position? | — | *Go to Step 5* | *Go to Step 6* |
| 5 | Remove the obstruction.<br>Did you complete the repair? | — | *Go to Step 7* | — |
| 6 | Replace the throttle body/TAC assembly. Refer to *Throttle Body Assembly Replacement*.<br>Did you complete the replacement? | — | *Go to Step 7* | — |
| 7 | 1. Use the scan tool in order to clear DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 8* |
| *8* | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1546 Air Conditioning (A/C) Clutch Relay Control Circuit




548617

### Circuit Description

Output driver modules (ODMs) are used by the PCM to turn on many of the current-driven devices that are needed to control various engine and Transaxle functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding ON. Unlike the quad driver modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P1546 set indicates an improper voltage level has been detected on the output circuit which controls the A/C compressor control relay.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An improper voltage level has been detected on the output circuit which controls the A/C compressor control relay.
- The above conditions are present for at least 30 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

1. The powertrain OBD System Check prompts you to complete some basic checks and store the freeze frame and failure records data on the scan tool.
2. Listen for an audible click when the relay operates. Command both the ON and OFF states. Repeat the commands as necessary.
3. Tests for voltage at the coil feed side of the relay.
4. Verifies that the PCM is providing ground to the relay.
5. Tests if ground is constantly being applied to the relay.

12. The PCM utilizes Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

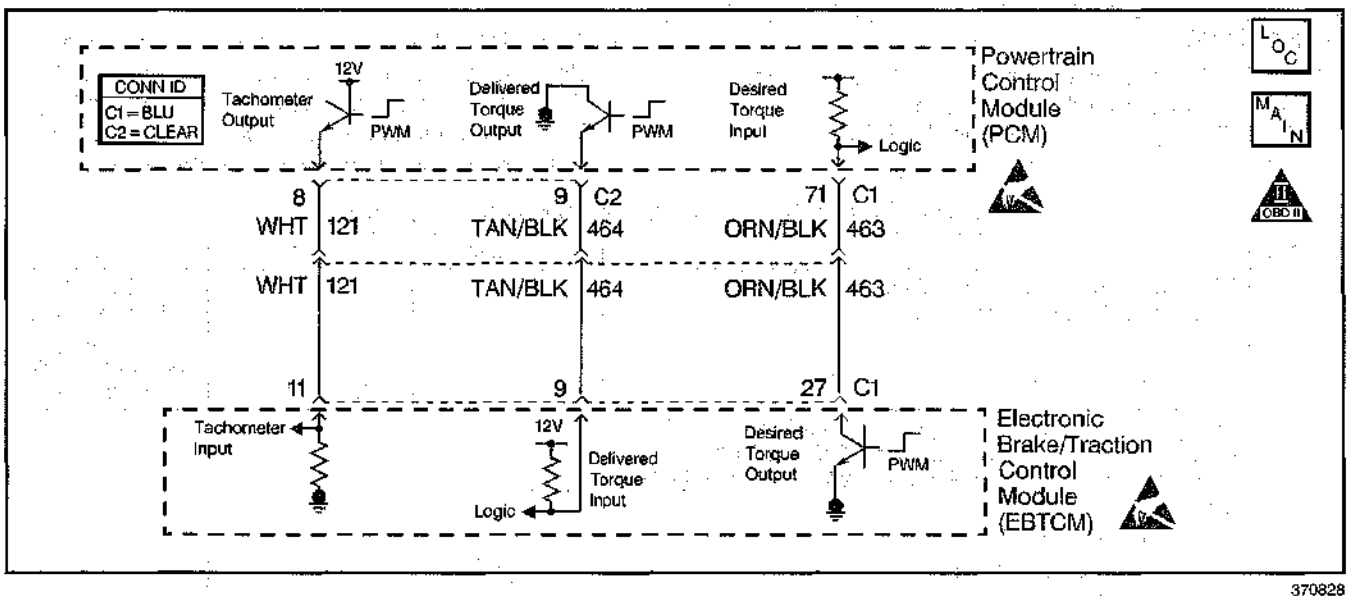
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## DTC P1546 Air Conditioning (A/C) Clutch Relay Control Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | Go to *Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn ON the ignition, with the engine OFF.<br>2. With a scan tool, command the A/C relay ON and OFF.<br>Does the relay turn ON and OFF with each command? | — | Go to Diagnostic Aids | Go to *Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the relay.<br>3. Turn ON the ignition, with the engine OFF.<br>4. Probe the coil feed circuit of the relay using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | Go to *Step 4* | Go to *Step 10* |
| 4 | 1. Connect a test lamp between the control circuit of the relay and the coil feed circuit of the relay.<br>2. With a scan tool, command the A/C relay ON and OFF.<br>Does the test lamp turn ON and OFF with each command? | — | Go to *Step 8* | Go to *Step 5* |
| 5 | Does the test lamp remain illuminated with each command? | — | Go to *Step 7* | Go to *Step 6* |
| 6 | Test the control circuit of the relay for a short to voltage or an open. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 7 | Test the control circuit of the relay for a short to ground. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 9* |
| 8 | Inspect for faulty connections at the relay. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 11* |
| 9 | Inspect for faulty connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Step 13* | Go to *Step 12* |
| 10 | Repair the feed circuit of the relay. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Step 13* | Go to *Cruise Control Diagnosis* in Cruise Control Systems |
| 11 | Replace the relay.<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 12 | **Important:** Perform the set up procedure for the PCM.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | Go to *Step 13* | — |
| 13 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | Go to *Step 2* | System OK |

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## DTC P1571 Traction Control Torque Request Circuit




### Circuit Description

The PCM supplies 5 volts on the desired torque circuit to the electronic brake and traction control module (EBTCM). The EBTCM toggles this 5 volt signal to a ground in order to produce a duty cycle signal. The signal is proportional to the amount of engine output torque reduction requested by the EBTCM. The EBTCM supplies this signal when it detects a wheel slip. In order to reduce engine output torque, the PCM reduces the amount of spark advance and in some cases, the PCM disables a number of fuel injectors. This diagnostic test checks for a desired torque signal failure. If the PCM does not receive the desired torque signal, this DTC sets.

### Conditions for Running the DTC

- The traction control has not failed.
- The engine speed is more than 500 RPM for 20 seconds.

### Conditions for Setting the DTC

The desired torque signal is not received by the PCM for 3 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

**Important:** Do not perform this diagnostic procedure if the customers concern is not related to the ABS and/or the Traction Control systems.

The following may cause an intermittent:

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table.

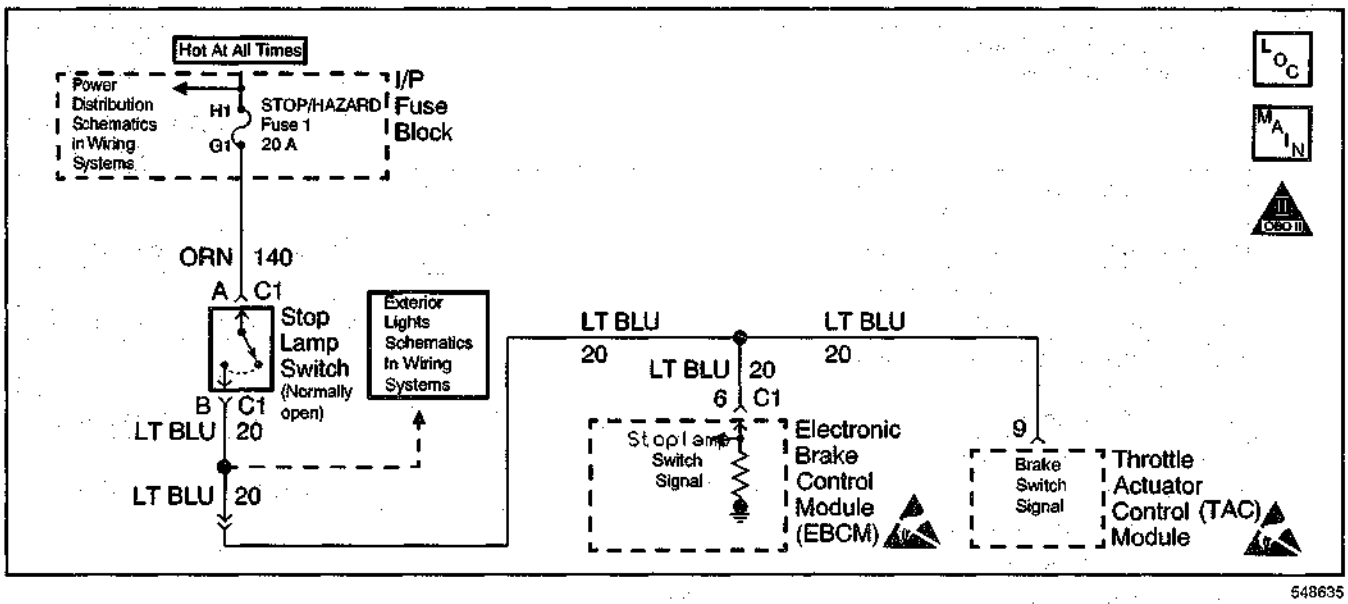
2. This step determines if the EBTCM is receiving the 5.0 volts from the PCM. Use the connector test kit adaptor when probing the EBTCM connector.
3. If no DTCs are set, inspect connections at the EBTCM.
11. This DTC will not report a pass. The scan tool status for this DTC will never report a pass. The scan tool will only display when the diagnostic fails. The repair is not complete if the scan tool indicates that the diagnostic ran and failed.

### DTC P1571 Traction Control Torque Request Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| *2* | **Important:** Perform this diagnostic procedure only if the customers concern is related to the ABS and/or the Traction Control systems. Refer to *Self-Diagnostics* in ABS Brakes.<br>1. Turn OFF the ignition.<br>2. Disconnect the EBTCM.<br>3. Turn ON the ignition.<br>4. Probe the desired torque circuit using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | 5.0 V | *Go to Step 3* | *Go to Step 4* |
| *3* | **Important:** Verify communication between the scan tool and the EBTCM before you continue with this table. If you can not establish communications, refer to *Self-Diagnostics* in ABS Brakes.<br>Are any ABS/TCS DTCs or BCM DTCs set? | — | Go to ABS Brakes or Body and Accessories for further diagnosis | Go to Diagnostic Aids |
| 4 | Did the voltage measure more than the specified value? | 5.2V | *Go to Step 7* | *Go to Step 5* |
| 5 | Probe the desired torque circuit using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 8* | *Go to Step 6* |
| 6 | Test for an open in the desired torque circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 9* |
| 7 | Repair the short to B+ on the Desired Torque circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 11* | — |
| 8 | Repair the short to ground on the Desired Torque circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 11* | — |
| 9 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 10* |
| 10 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| *11* | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 12* |
| 12 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1574 Stoplamp Switch Circuit




548635

### Circuit Description

The stop lamp switch (TAC brake switch) is a normally open switch. When the switch is closed, the TAC module senses ignition voltage on the signal circuit. If the PCM senses a high rate of deceleration without a input from this switch this DTC will set.

### Conditions for Running the DTC

- The engine speed is more than 1000 RPM.
- The wheel speed must be more than 20 MPH in order to enable the diagnostic. The diagnostic will disable when the wheel speed is less than 5 MPH.

### Conditions for Setting the DTC

- The vehicle speed decreases 0.5 MPH in 0.5 seconds without the PCM sensing a switch transition.
- The condition is present for 20 accel/decel cycles.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

In order to adjust the stop lamp switch perform the following:

1. With the brake pedal depressed, insert the brake lamp switch into the retainer until the switch body seats in the retainer. You can hear clicks as you push the threaded portion of the switch through the retainer.
2. Slowly pull the brake pedal fully rearward against the stop until you can no longer hear the clicks.

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## DTC P1574 Stoplamp Switch Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | With a scan tool, observe the TAC brake switch parameter.<br>Does the scan tool indicate Released? | — | *Go to Step 3* | *Go to Step 8* |
| 3 | Depress the brake pedal approximately half-way.<br>Does the scan tool indicate Applied? | — | Go to Diagnostic Aids | *Go to Step 4* |
| 4 | Test the adjustment of the brake switch. Refer to Diagnostic Aids.<br>Did you find and correct the condition? | — | *Go to Step 20* | *Go to Step 5* |
| 5 | Inspect the condition of the fuse.<br>Is the fuse OK? | — | *Go to Step 6* | *Go to Step 9* |
| 6 | 1. Disconnect the brake switch.<br>2. Turn ON the ignition.<br>3. Probe the brake switch feed circuit using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 7* | *Go to Step 11* |
| 7 | 1. With a scan tool, observe the TAC brake switch parameter.<br>2. Connect a fused jumper between the feed and signal circuits.<br>Does the parameter indicate Applied when the jumper is installed? | — | *Go to Step 15* | *Go to Step 12* |
| 8 | 1. With a scan tool, observe the TAC brake switch parameter.<br>2. Disconnect the brake switch.<br>Does the parameter indicate Released when the switch is disconnected? | — | *Go to Step 16* | *Go to Step 13* |
| 9 | Test the feed circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 20* | *Go to Step 10* |
| 10 | Repair the short to ground in the signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 20* | — |
| 11 | Repair the open in the feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 20* | — |
| 12 | Test the signal circuit for an open between the switch and the EBTCM. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 20* | *Go to Step 19* |
| 13 | 1. Turn ON the ignition.<br>2. Probe the signal circuit using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 14* | *Go to Step 17* |
| 14 | Repair the short to voltage on the signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 20* | — |
| 15 | Inspect for poor connections at brake switch. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 20* | *Go to Step 16* |

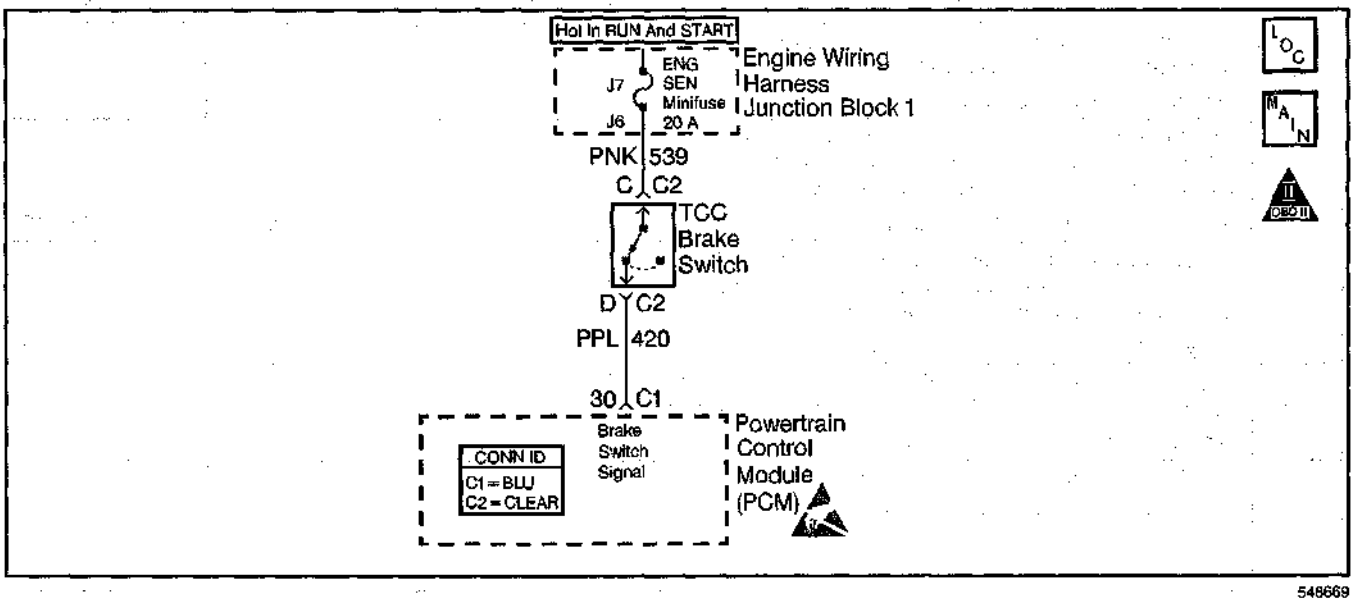
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## DTC P1574 Stoplamp Switch Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 16 | Replace the brake switch. Refer to *Stoplamp Switch Replacement* in Hydraulic Brakes.<br>Did you complete the replacement? | — | *Go to Step 20* | — |
| 17 | Test the signal circuit for an open or high resistance between the TAC module and the EBTCM. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 20* | *Go to Step 18* |
| 18 | Inspect for poor connections at the TAC module. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 20* | *Go to Step 19* |
| 19 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)*<br>Did you complete the replacement? | — | *Go to Step 20* | — |
| 20 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 21* |
| 21 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1586 Cruise Control Brake Switch 2 Circuit




### Circuit Description

The brake switch indicates brake pedal status to the powertrain control module (PCM). The brake switch is a normally-closed switch that supplies battery voltage to the PCM. Applying the brake pedal opens the switch, interrupting voltage to the PCM. This DTC is for manual transmission vehicles only, this switch is used for TCC operation on automatic transmission vehicles.

### Conditions for Running the DTC

- The engine speed is more than 1000 RPM for 1 secound.
- The wheel speed is more than 20 mph in order to enable the diagnostic. The diagnostic disables when the wheel speed is less than 5 mph.

### Conditions for Setting the DTC

- The vehicle speed decreases 1 MPH in 0.5 seconds without the PCM sensing a switch transition.
- The condition is present for 10 accel/decel cycles.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

- Ask about the customers driving habits. Ask about unusual driving conditions (e.g. stop and go, expressway, etc.).
- Inspect the brake switch for proper mounting and operation.
- Inspect for ABS DTCs. A faulty ABS condition may contribute to setting this DTC.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## DTC P1586 Cruise Control Brake Switch 2 Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | With a scan tool, observe the brake switch parameter.<br>Does the scan tool indicate Released? | — | *Go to Step 3* | *Go to Step 5* |
| 3 | Depress the brake pedal approximately half-way.<br>Does the scan tool indicate brake switch as Applied? | — | Go to Diagnostic Aids | *Go to Step 4* |
| 4 | Test the adjustment of the brake switch. Refer to *Stoplamp Switch Adjustment* in Hydraulic Brakes.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 8* |
| 5 | Inspect the condition of the fuse.<br>Is the fuse open? | — | *Go to Step 9* | *Go to Step 6* |
| 6 | 1. Disconnect the brake switch.<br>2. Turn ON the ignition.<br>3. Probe the feed circuit using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 7* | *Go to Step 10* |
| 7 | 1. With a scan tool, observe the brake switch parameter.<br>2. Install a fused jumper between the feed and signal circuit.<br>Does the parameter switch to Released? | — | *Go to Step 12* | *Go to Step 11* |
| 8 | 1. With a scan tool, observe the brake switch parameter.<br>2. Disconnect the brake switch.<br>Does the parameter switch to Applied? | — | *Go to Step 13* | *Go to Step 14* |
| 9 | Test the feed and signal circuits for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 12* |
| 10 | Repair the open in the feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | — |
| 11 | Test for an open in the signal circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 15* |
| 12 | Inspect for poor connections at the brake switch. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 13* |
| 13 | Replace the brake switch. Refer to *Stoplamp Switch Replacement* in Hydraulic Brakes.<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 14 | Repair the short to voltage in the signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 17* | *Go to Step 16* |
| 15 | Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 17* | *Go to Step 16* |

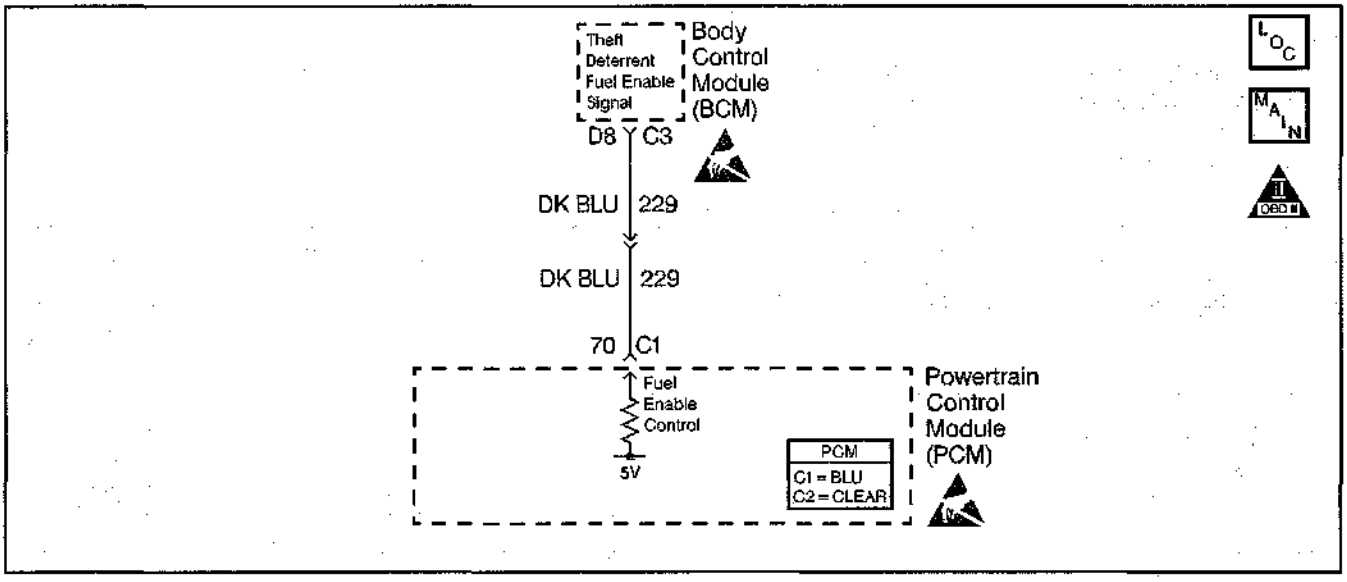
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## DTC P1586 Cruise Control Brake Switch 2 Circuit (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 16 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 17* | — |
| 17 | With a scan tool, observe the brake switch parameter.<br>Does the parameter indicate Released and switch to Applied when the brake pedal is depressed? | — | System OK | *Go to Step 2* |

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## DTC P1626 Theft Deterrent Fuel Enable Signal Lost




226770

### Circuit Description

The body control module (BCM) produces the Theft Deterrent Fuel Enable signal when ignition is ON and the proper key resistor pellet is sensed. The PCM monitors the Fuel Enable signal during crank. If the proper signal is present on the Theft Deterrent Fuel Enable circuit, the PCM enables fuel delivery to allow the engine to start. If the PCM detects that the fuel enable signal is not present or incorrect while the engine is running, DTC P1626 will be set. DTC P1626 can cause a no-start condition or normal operation depending on when the loss of the fuel enable signal was detected. The engine will continue to start and run if the condition that set DTC P1626 occurred after the BCM sensed the proper key resistor pellet and signaled the PCM to continue fuel delivery. The engine will start and immediately stall if the condition that set DTC P1626 occurred before the BCM sensed the proper key resistor pellet. With this condition present, the PCM will inhibit fuel delivery and the BCM will disable the starter. If the problem affects inputs to the BCM, the starter motor may be disabled. If this condition is present, refer to Vehicle Theft Deterrent System for further diagnosis.

### Conditions for Running the DTC

The engine is running.

### Conditions for Setting the DTC

- The PCM detects an incorrect signal on the Theft Deterrent Fuel Enable Circuit.
- The condition is present for more than 2 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## Test Description

The numbers below refer to the step numbers on the diagnostic table.

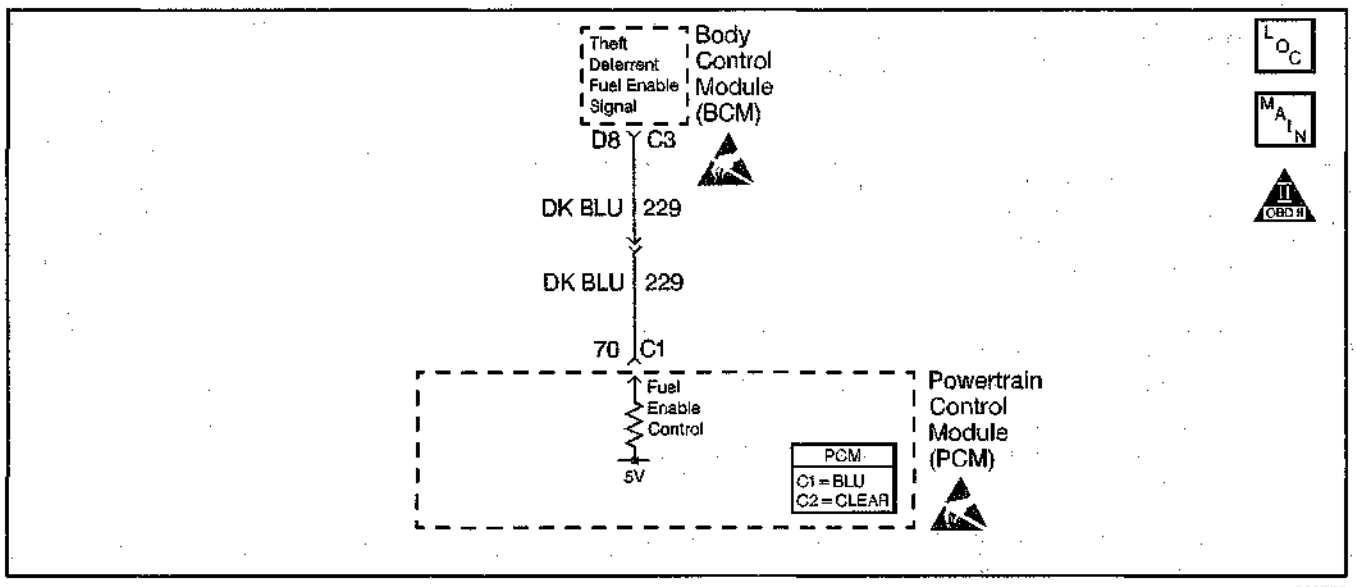
9. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

### DTC P1626 Theft Deterrent Fuel Enable Signal Lost

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check performed? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Before continuing, ensure that the vehicle battery is fully charged.<br>Attempt to start the engine.<br>Does the engine crank? | — | *Go to Step 3* | Go to *A Diagnostic System Check - Theft Deterrent* in Theft Deterrent |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the body control module (BCM).<br>3. Turn ON the ignition.<br>4. Measure the voltage on the vehicle theft deterrent fuel enable circuit using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | 5V | *Go to Step 4* | *Go to Step 6* |
| 4 | 1. Turn OFF the ignition.<br>2. Reconnect the BCM.<br>3. Turn ON the ignition.<br>4. Backprobe the BCM connector to measure frequency between the vehicle theft deterrent fuel enable circuit using a DMM that is connected to a good ground.<br>Does the frequency measure within the specified range? | 40–60 Hz | *Go to Step 5* | *Go to Step 8* |
| 5 | 1. Use the scan tool in order to clear DTCs.<br>2. Attempt to start the vehicle.<br>Does the vehicle start and continue running? | — | Go to Diagnostic Aids | *Go to Step 7* |
| 6 | Test the vehicle theft deterrent fuel enable circuit for an open, short to ground, or short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 7* |
| 7 | Inspect the theft deterrent fuel enable circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 9* |
| 8 | Inspect for poor connections at the BCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 10* |
| 9 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/ Programming.*<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 10 | Replace the BCM. Refer to *Body Control Module Replacement* in Body Control System.<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 11 | 1. Use the scan tool in order to clear DTCs.<br>2. With a scan tool, observe the VTD Fuel Disable parameter while cranking the engine.<br>Does the scan tool indicate Active? | — | *Go to Step 2* | System OK |

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## DTC P1629 Theft Deterrent Fuel Enable Signal Not Received




226770

### Circuit Description

The body control module (BCM) produces the Theft Deterrent Fuel Enable signal when ignition is ON and the proper key resistor pellet is sensed. The PCM monitors the Fuel Enable signal during crank. If the proper signal is present on the Theft Deterrent Fuel Enable circuit, the PCM enables fuel delivery and starter operation to allow the engine to start. If the PCM detects that the fuel enable signal is not present or incorrect while an attempt is made to start the engine, DTC P1629 will be set. The engine will not start and the starter motor will be disabled. This conditions will occur if the problem also affects inputs to the BCM. Refer to Vehicle Theft Deterrent System for further diagnosis.

### Conditions for Running the DTC

- DTC P1626 is not present.
- An attempt is made to start the engine.

### Conditions for Setting the DTC

The PCM detects an incorrect signal on the Theft Deterrent Fuel Enable Circuit.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.
- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.
- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

9. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

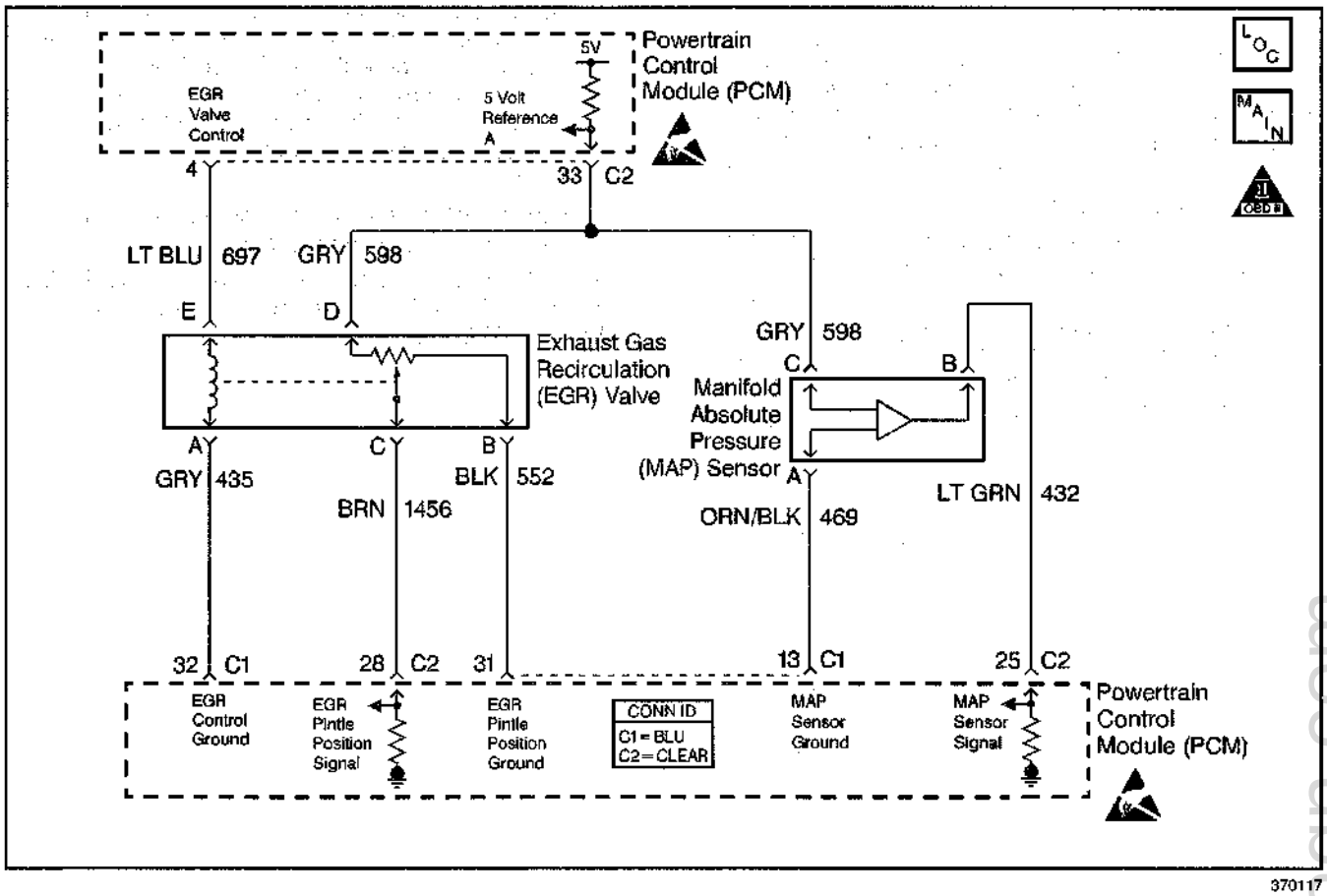
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## DTC P1629 Theft Deterrent Fuel Enable Signal Not Received

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On–Board Diagnostic (OBD) System Check performed? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Before continuing, ensure that the vehicle battery is fully charged.<br>Attempt to start the engine.<br>Does the engine crank? | — | *Go to Step 3* | Go to *A Diagnostic System Check - Theft Deterrent* in Theft Deterrent |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the body control module (BCM).<br>3. Turn ON the ignition.<br>4. Measure the voltage on the vehicle theft deterrent fuel enable circuit using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | 5V | *Go to Step 4* | *Go to Step 6* |
| 4 | 1. Turn OFF the ignition.<br>2. Reconnect the BCM.<br>3. Turn ON the ignition.<br>4. Backprobe the BCM connector to measure frequency between the vehicle theft deterrent fuel enable circuit using a DMM that is connected to a good ground.<br>Does the frequency measure within the specified range? | 40–60 Hz | *Go to Step 5* | *Go to Step 8* |
| 5 | 1. Use the scan tool in order to clear DTCs.<br>2. Attempt to start the vehicle.<br>Does the vehicle start and continue running? | — | Go to Diagnostic Aids | *Go to Step 7* |
| 6 | Test the vehicle theft deterrent fuel enable circuit for an open, short to ground, or short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 7* |
| 7 | Inspect the theft deterrent fuel enable circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 9* |
| 8 | Inspect for poor connections at the BCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 11* | *Go to Step 10* |
| 9 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 10 | Replace the BCM. Refer to *Body Control Module Replacement* in Body Control System.<br>Did you complete the replacement? | — | *Go to Step 11* | — |
| 11 | 1. Use the scan tool in order to clear DTCs.<br>2. With a scan tool, observe the VTD Fuel Disable parameter while cranking the engine.<br>Does the scan tool indicate Active? | — | *Go to Step 2* | System OK |

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## DTC P1635 5 Volt Reference 1 Circuit




370117

### Circuit Description

The PCM uses this 5 Volt Reference circuit as a sensor feed to the following sensors:

- The MAP sensor
- The EGR valve pintle position sensor

The PCM monitors the voltage on this 5 Volt Reference circuit. If the voltage is out of tolerance, the PCM will set DTC P1635.

### Conditions for Setting the DTC

The engine is running.

### Conditions for Setting the DTC

- The PCM detects a voltage out of tolerance condition on this 5 Volt Reference circuit.
- The above condition is present for more than 10 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

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### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

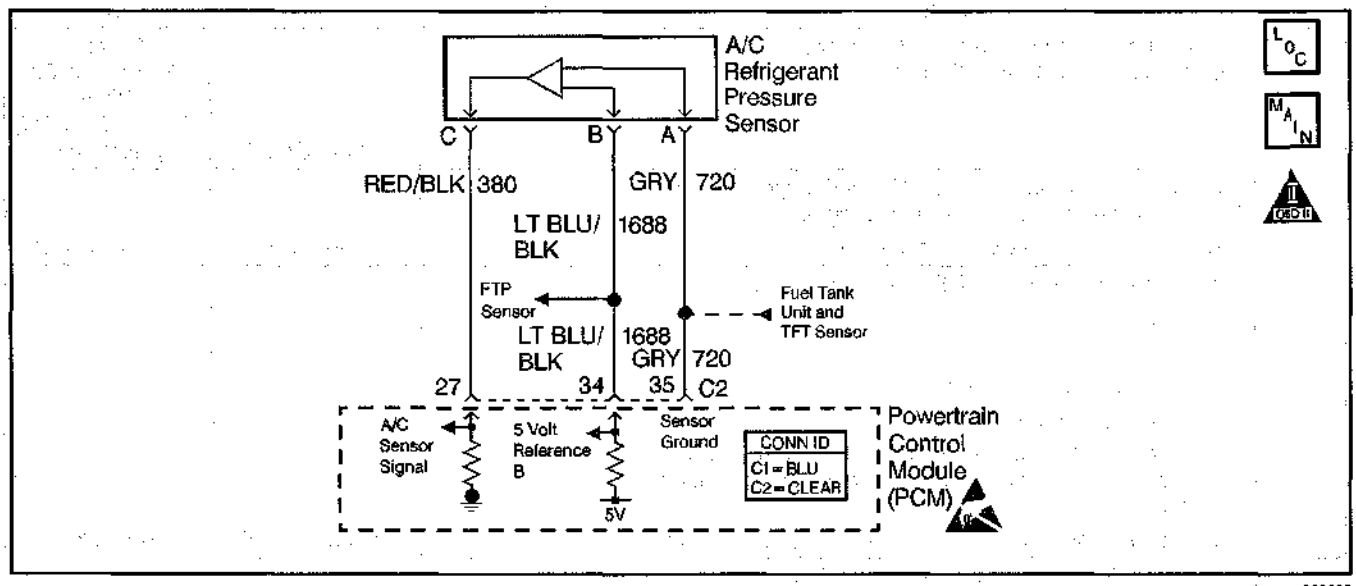
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## DTC P1635 5 Volt Reference 1 Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Visually/physically inspect the PCM and engine grounds. Ensure the grounds are clean and secure.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 3* |
| 3 | 1. Disconnect all of the following components:<br>• EGR<br>• MAP<br>• Fuel sender connector<br>• A/C pressure sensor<br>2. Measure the voltage on the 5 volt reference circuit at the EGR connector using a DMM that is connected to ground.<br>Does the voltage measure at or near the specified value? | 5V | *Go to Step 4* | *Go to Step 6* |
| 4 | 1. Leave the DMM connected to the EGR 5 volt reference circuit.<br>2. Reconnect each component one at a time.<br>Does the measured voltage remain at or near the specified value when each component is connected? | 5V | *Go to Step 5* | *Go to Step 7* |
| 5 | 1. Reconnect the EGR.<br>2. Disconnect the MAP.<br>3. Measure the voltage on the 5 volt reference circuit at the MAP sensor connector.<br>Does the voltage measure at or near the specified value? | 5V | Go to Diagnostic Aids | *Go to Step 8* |
| 6 | Is the voltage below the specified value? | 4.8V | *Go to Step 9* | *Go to Step 10* |
| 7 | Test the signal circuit of the effected component for a short to B+. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 11* |
| 8 | Test the signal circuit of the EGR for a short to B+. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 12* |
| 9 | Test the 5 volt reference circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 13* |
| 10 | Test the 5 volt reference circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 13* |
| 11 | Replace the effected component.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 12 | Replace the EGR. Refer to *EGR Valve Replacement.*<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 13 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 14* | — |
| 14 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 15* |
| 15 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1639 5 Volt Reference 2 Circuit




369065

### Circuit Description

The PCM uses this 5 volt reference circuit as a sensor feed for the A/C refrigerant pressure sensor and the fuel tank pressure sensor. The PCM monitors the voltage on this 5 Volt Reference circuit. If the voltage is out of tolerance, the PCM will set DTC P1639.

### Conditions for Running the DTC

The engine is running.

### Conditions for Setting the DTC

- The PCM detects a voltage out of tolerance condition on this 5 Volt Reference circuit.
- Above condition for more than 10 seconds.

### Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

### Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

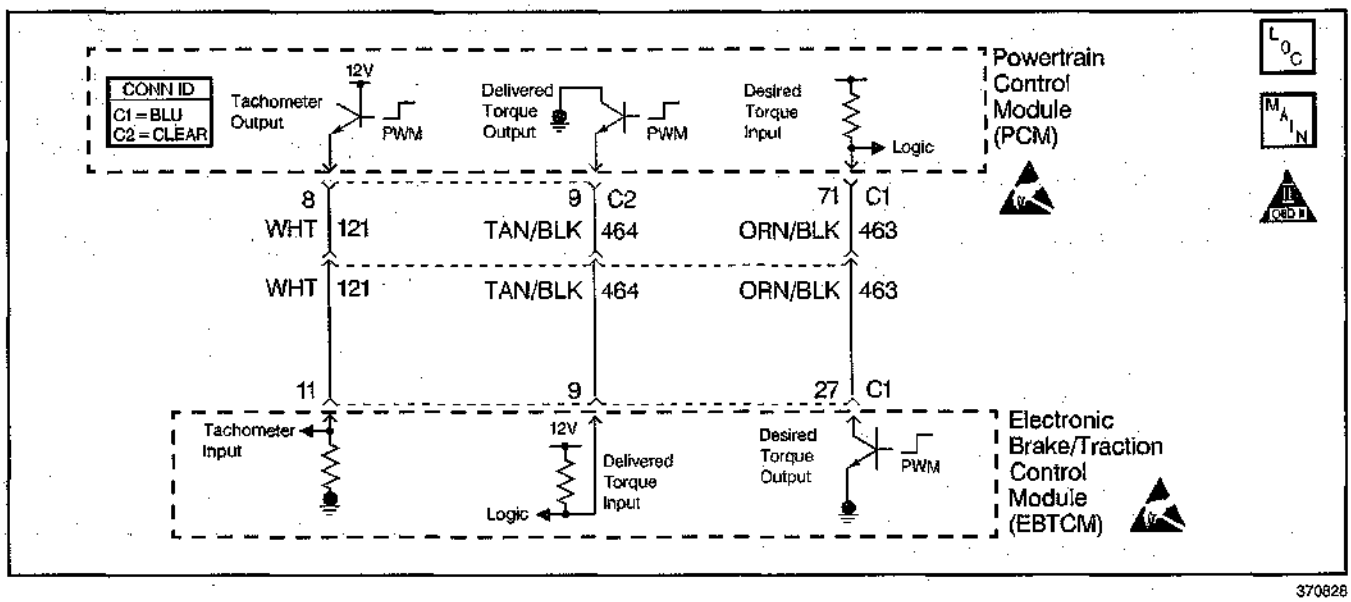
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## DTC P1639 5 Volt Reference 2 Circuit

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Visually/physically inspect the PCM and engine grounds. Ensure the grounds are clean and secure.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 3* |
| 3 | 1. Disconnect all of the following components:<br>• EGR<br>• MAP<br>• Fuel sender connector<br>• A/C pressure sensor<br>2. Measure the voltage on the 5 volt reference circuit at the A/C pressure sensor connector using a DMM that is connected to ground.<br>Does the voltage measure at or near the specified value? | 5V | *Go to Step 4* | *Go to Step 6* |
| 4 | 1. Leave the DMM connected to the A/C pressure sensor 5 volt reference circuit.<br>2. Reconnect each component one at a time.<br>Does the measured voltage remain at or near the specified value when each component is connected? | 5V | *Go to Step 5* | *Go to Step 7* |
| 5 | 1. Reconnect the A/C pressure sensor.<br>2. Disconnect the MAP.<br>3. Measure the voltage on the 5 volt reference circuit at the MAP sensor connector.<br>Does the voltage measure at or near the specified value? | 5V | Go to Diagnostic Aids | *Go to Step 8* |
| 6 | Is the voltage below the specified value? | 4.8V | *Go to Step 9* | *Go to Step 10* |
| 7 | Test the signal circuit of the effected component for a short to B+. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 11* |
| 8 | Test the signal circuit of the A/C pressure sensor for a short to B+. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 12* |
| 9 | Test the 5 volt reference circuit for a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 13* |
| 10 | Test the 5 volt reference circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 13* |
| 11 | Replace the effected component.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 12 | Replace the A/C pressure sensor.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 13 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the replacement? | — | *Go to Step 14* | — |
| 14 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Record conditions.<br>Does the DTC reset? | — | *Go to Step 2* | *Go to Step 15* |
| 15 | Does the scan tool indicate any DTCs set that you have not diagnosed? | — | Go to applicable DTC | System OK |

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## DTC P1689 Traction Control Delivered Torque Output Circuit




### Circuit Description

The electronic brake and traction control module (EBTCM) controls the PWM signal on the Desired Torque circuit while monitoring the wheel speed sensors to detect slippage. The PCM monitors the PWM signal and reduces engine torque as needed by retarding ignition timing, decreasing boost duty cycle, increasing air/fuel ratio, or, in severe cases, shutting OFF up to three fuel injectors. The PCM sends a PWM signal to the electronic brake and traction control module (EBTCM) on the delivered torque circuit informing the EBTCM of response made to the desired torque signal. A problem with the delivered torque circuit should cause DTC P1689 and ABS/TCS DTC 76 to set and traction control to be disabled. Refer to ABS/TCS for further information.

### Conditions for Running the DTC

The ignition is ON.

### Conditions for Setting the DTC

- An improper voltage level has been detected on the output circuit which controls the traction control delivered torque output.
- The above conditions present for at least 30 seconds.

### Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

### Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. Normally, ignition feed voltage should be present on the control circuit with the PCM disconnected and the ignition turned ON.
3. Tests for a shorted component or a short to B+ on the control circuit. Either condition would result in a measured current of over 500 milliamps. Also tests for a component that is going open while being operated, resulting in a measured current of 0 milliamps.
4. Tests for a short to voltage on the control circuit.
15. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed.

**DTC P1689 Traction Control Delivered Torque Output Circuit**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. Measure the voltage on the delivered torque control circuit using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | B+ | *Go to Step 3* | *Go to Step 6* |
| 3 | 1. Measure the current on the delivered torque control circuit using a DMM.<br>2. Observe the current for at least 2 minutes.<br>Does the current remain within the specified range? | 0.001–0.5 Amp (1-500 mA) | *Go to Step 11* | *Go to Step 4* |
| 4 | 1. Turn OFF the ignition.<br>2. Leave the PCM disconnected.<br>3. Disconnect the EBTCM.<br>4. Turn ON the ignition.<br>5. Measure the voltage on the delivered torque control circuit using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | 0 V | *Go to Step 10* | *Go to Step 5* |
| 5 | Repair short to voltage in the delivered torque control circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 16* | — |
| 6 | 1. Turn OFF the ignition.<br>2. Inspect the ignition feed fuse for the EBTCM.<br>Is the fuse open? | — | *Go to Step 7* | *Go to Step 8* |
| 7 | 1. Repair short to ground in ignition feed circuit for the EBTCM. Refer to *Wiring Repairs* in Wiring Systems.<br>2. Replace the fuse.<br>Did you complete the repair? | — | *Go to Step 16* | — |
| 8 | 1. Disconnect the EBTCM.<br>2. Turn ON the ignition.<br>3. Measure the voltage on the ignition feed circuit for the EBTCM using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | B+ | *Go to Step 9* | *Go to Step 13* |
| 9 | Test the delivered torque control circuit for an open or a short to ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 10* |

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**DTC P1689 Traction Control Delivered Torque Output Circuit (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 10 | 1. Test for the following conditions:<br>• The delivered torque control circuit for a poor connection at the PCM.<br>• The delivered torque control circuit for a faulty connection at the EBTCM.<br>• The EBTCM ignition feed circuit for a poor connection at the EBTCM.<br>2. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 14* |
| 11 | 1. Turn OFF the ignition.<br>2. Reconnect the PCM.<br>3. Disconnect the EBTCM.<br>4. Turn ON the ignition.<br>5. Connect a test lamp between the delivered torque control circuit and the ignition feed circuit.<br>6. With a scan tool, command the delivered torque output ON and OFF.<br>Does the test lamp blink ON and OFF? | — | Go to Diagnostic Aids | *Go to Step 12* |
| 12 | Inspect the delivered torque control circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 16* | *Go to Step 15* |
| 13 | Repair open in ignition feed circuit to the EBTCM. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 16* | — |
| 14 | Replace the EBTCM. Refer to *Electronic Brake Control Module (EBCM) Replacement* in ABS/TCS.<br>Did you complete the replacement? | — | *Go to Step 16* | — |
| *15* | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 16* | — |
| 16 | 1. Use the scan tool in order to clear the DTCs.<br>2. Operate the vehicle within the Fail Records conditions.<br>Does the DTC reset? | — | *Go to Step 2* | System OK |

## Symptoms

### Important Preliminary Checks Before Starting

Perform the *A Powertrain On Board Diagnostic (OBD) System Check* before using the Symptom tables, and verify all of the following are true:

- The PCM and MIL (Service Engine Soon) are operating correctly.
- There are no DTCs stored.
- Ensure that the engine coolant temperature is not above 130°C (266°F). This condition causes the PCM to operate in Engine Coolant Over Temperature-Fuel Disabled Mode. While in Engine Coolant Over Temperature-Fuel Disabled Mode, the PCM turns the fuel off to four cylinders at a time in order to keep engine temperatures from reaching damaging levels. The system perceives Engine Coolant Over Temperature as a lack of power, miss, or rough idle. If the vehicle is operating in Engine Coolant Over Temperature-Fuel Disabled Mode, refer to Engine/Engine Cooling for diagnosis.
- The scan tool data is within the normal operating range, refer to *Scan Tool Data List.*
- Verify the customer complaint, and locate the correct symptom in the table of contents. Inspect the items indicated under that symptom.

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### Visual/Physical Check

Several of the symptom procedures ask for a Careful Visual/Physical inspection. This step is extremely important – it can lead to correcting a problem without further testing and can save valuable time. This inspection checks for the following:

- PCM grounds are clean, tight, and in their proper location.
- Vacuum hoses are not split, kinked, and proper connections are present, as shown on the Vehicle Emission Control Information label. Inspect thoroughly for any type of leak or restriction
- Mass air flow (MAF) sensor is installed correctly. The arrows on the plastic portion of the sensor must point toward the engine
- Air intake ducts are not collapsed or damaged.
- No Air leaks at throttle body mounting area, Mass Air Flow (MAF) sensor, and the intake manifold sealing surfaces.
- Ignition wires are not cracked, hardened or carbon tracking.
- Ignition wires are routed correctly.
- Engine wiring is not damaged.
- Terminals have proper connections.

### Intermittent

**Important:** Inspect for improper installation of electrical components if an intermittent condition exists. Inspect for aftermarket theft deterrent devices, lights and cellular phones. Ensure that no aftermarket equipment is connected to the Class 2 circuit. If you can not locate an intermittent condition, a cellular phone signal communication may cause the condition.

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

Faulty electrical connections or wiring cause most intermittent problems. Perform a careful visual/physical inspection for the following conditions:

- Poor mating of the connector halves or a terminal not fully seated in the connector body (backed out).
- An improperly formed or damaged terminal.
- Reform or replace connector terminals in the problem circuit in order to insure proper contact tension.
- Poor terminal to wire connection requires removing the terminal from the connector body in order to check.

Road test the vehicle with a digital multimeter connected to the suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a malfunction in the circuit being monitored.

Use a scan tool in order to help detect intermittent conditions. The GM Techline equipment (Scan Tool) has several features that you can use to locate an intermittent condition. Use the following features to find intermittent faults:

- You can trigger the Snapshot feature in order to capture and store engine parameters within the scan tool when the malfunction occurs. You can then review this stored information in order to see what caused the malfunction.
- Using a Scan Tools Freeze Frame buffer or Failure Records buffer can also aid in locating an intermittent condition. Review and capture the information in the Freeze Frame and/or Failure record associated with the intermittent DTC being diagnosed. Drive the vehicle in the conditions that were present when the DTC originally set.

**Important:** If the intermittent condition exists as a start and then stall, check for DTCs relating to the theft deterrent system. Inspect for improper installation of electrical options such as lights, cellular phones etc.

Any of the following may cause an intermittent Malfunction Indicator Lamp (MIL) with no stored DTC:

- The ignition coils shorted to a ground, arcing at the ignition wires or the spark plugs.
- The PCM grounds, refer to PCM wiring diagrams.
- The ignition control (IC) wires for being routed to close to the secondary ignition wires, coils, or the generator — Ensure that all of the circuits from the PCM to the ignition coils have good connections.
- An open diode across the A/C compressor clutch and other open diodes.

Use the following tables when diagnosing a symptom complaint:

- *Hard Start*
- *Surges/Chuggles*
- *Lack of Power, Sluggishness, or Sponginess*
- *Detonation/Spark Knock*
- *Hesitation, Sag, Stumble*
- *Cuts Out, Misses*
- *Poor Fuel Economy*
- *Rough, Unstable, or Incorrect Idle and Stalling*
- *Dieseling, Run-On*
- *Backfire*

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## Hard Start

| Checks | Action |
|---|---|
| DEFINITION: Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies. | |
| Preliminary | • Refer to the *Symptoms*.<br>• Search for bulletins. |
| Sensor/System | • Test engine coolant tamperature (ECT) sensor for being shifted in value. Install a scan tool and compare the displayed engine coolant tamperature with intake air temperature on a cold engine. Test the resistance of the ECT sensor if engine coolant temperature is not within ± 3°C (5°F) of intake air temperature. Refer to *Temperature vs Resistance*. If the ECT sensor resistance is not within the specification, refer to *DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage* or *DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage*.<br>• Inspect the throttle body inlet screen for foreign objects or damage that may affect the MAF sensor airflow sample. Refer to *Throttle Body Air Inlet Screen Replacement*.<br>• EGR system. Inspect for the following conditions:<br>– EGR pipes and adapter for vacuum leaks.<br>– Remove the EGR valve and inspect for a stuck open pintle. Refer to *EGR Valve Replacement*. |
| Fuel System | • Test the fuel pump relay circuit for proper operation.<br>• Refer to *Fuel Pump Electrical Circuit Diagnosis*.<br>• Test for incorrect fuel pressure.<br>• Refer to *Fuel System Pressure Test*<br>• Test the fuel injectors.<br>– Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)*.<br>– Refer to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)*.<br>• Test for fuel contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. |

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**Hard Start (cont'd)**

| Checks | Action |
|---|---|
| Ignition System | • Test for proper ignition voltage output using the following steps:<br>– Clip the *J 26792* spark tester to engine ground.<br>– Connect one end of a spark plug wire to the spark tester, leave the other end of the spark plug wire to the coil being tested.<br>– Connect one end of another spark plug wire to the other coil tower, connect the other end of the spark plug wire to ground.<br>– Crank the engine while observing the spark tester, a spark should be observed.<br>– Repeat the above steps for each coil.<br>• If adequate spark is not present at the coils, inspect for the following conditions:<br>– Coils - Cracks, carbon tracking/arcing, or a resistance value outside the specified range.<br>**Coil Secondary Resistance**<br>5000 - 8000 ohms (5K - 8K ohms)<br>– Spark Plug wires - Signs of arcing/cross firing, cracks, carbon tracking, plug boot damage, pinched, incorrect routing, or a resistance value more than the specified value.<br>**Spark Plug Wire Resistance**<br>3280-4921 ohms/meter(1000-1500 ohms/ft)<br>**Important:** Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Ignition components will arc to ground when a secondary component is malfunctioning.<br>– Malfunctioning ignition control module.<br>– Ignition System Wiring - Loose ignition module feed or ground connection, or damaged system wiring.<br>• Remove spark plugs and inspect for the following conditions:<br>– Fouled plugs<br>– Cracks<br>– Wear<br>– Incorrect gap<br>– Burned or damaged electrodes<br>– Incorrect heat range<br>• If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. |
| Engine Mechanical | • Excessive oil in combustion chamber–Leaking valve seals.<br>• Low cylinder compression.<br>• For incorrect basic engine parts. Inspect the following:<br>– Cylinder heads<br>– Camshaft and valve train components<br>– Pistons, etc.<br>Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical. |

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## Surges/Chuggles

| Checks | Action |
|---|---|
| DEFINITION: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal. | |
| Preliminary | • Refer to the *Symptoms*.<br>• Search for bulletins.<br>• Be sure driver understands transmission torque converter clutch, and A/C compressor operation as explained in the owners manual. Inform customer how TCC and the A/C clutch operates. |
| Sensor/System | • Test the heated oxygen sensors. The heated oxygen sensors should respond quickly to different throttle positions. If not, inspect the HO2S for silicon or other contaminants from fuel or use of incorrect RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will reduce the amount of fuel delivered to the engine, causing a severe driveability problem. Refer to heated oxygen sensors in *Information Sensors/Switches Description*.<br>• Test the MAF sensor and inspect the related wiring.<br>• Test the EGR valve for a stuck open pintle. |
| Fuel System | • Test the fuel pressure.<br>Refer to *Fuel System Pressure Test* and *Fuel Pump Electrical Circuit Diagnosis*.<br>• Test for contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*.<br>• Ensure each injector harness is connected to the correct injector/cylinder. Refer to *Engine Controls Schematics*.<br>• Test items which can cause an engine to run rich (long term fuel trim is significantly in the negative range). Refer to Diagnostic Aids for *DTC P0172 Fuel Trim System Rich Bank 1*.<br>• Test items that can cause an engine to run lean (long term fuel trim is significantly in the positive range). Refer to Diagnostic Aids for *DTC P0171 Fuel Trim System Lean Bank 1*. |

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## Surges/Chuggles (cont'd)

| Checks | Action |
|---|---|
| Ignition System | • Test for proper ignition voltage output using the following steps:<br>– Clip the *J 26792* spark tester to engine ground.<br>– Connect one end of a spark plug wire to the spark tester, leave the other end of the spark plug wire to the coil being tested.<br>– Connect one end of another spark plug wire to the other coil tower, connect the other end of the spark plug wire to ground.<br>– Crank the engine while observing the spark tester, a spark should be observed.<br>– Repeat the above steps for each coil.<br>• If adequate spark is not present at the coils, test for the following conditions:<br>– Coils - Cracks, carbon tracking/arcing, or a resistance value outside the specified range.<br>**Coil Secondary Resistance**<br>5000 - 8000 ohms (5K - 8K ohms)<br>– Spark Plug wires - Signs of arcing/cross firing, cracks, carbon tracking, plug boot damage, pinched, incorrect routing, or a resistance value more than the specified value.<br>**Spark Plug Wires Resistance**<br>3280-4921 ohms/meter(1000-1500 ohms/ft).<br>**Important:** Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Ignition components will arc to ground when a secondary component is malfunctioning.<br>– Malfunctioning ignition control module.<br>– Ignition System Wiring - Loose ignition module feed or ground connection, or damaged system wiring.<br>• Remove spark plugs and inspect for the following conditions:<br>– Fouled plugs<br>– Cracks<br>– Wear<br>– Incorrect gap<br>– Burned or damaged electrodes<br>– Incorrect heat range<br>• If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. |
| Additional Tests | • Test TCC operation. Refer to A Diagnostic Starting Point in 4L60–E Automatic Transmission.<br>• Inspect the exhaust system for a possible restriction:<br>– Inspect the exhaust system for damaged or collapsed pipes.<br>– Inspect the muffler for heat distress or possible internal failure.<br>– Test for possible plugged Three-Way catalytic converter. Refer to *Restricted Exhaust System Check.* |

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## Lack of Power, Sluggishness, or Sponginess

| Checks | Action |
|---|---|
| DEFINITION: Engine delivers less than expected power. Little or no increase in speed when the accelerator pedal is pushed down part way. | |
| Preliminary Checks | • Refer to the *Symptoms*.<br>• Search for bulletins. |
| Fuel System | • Test the following items:<br>• Fuel pressure.<br>– Refer to *Fuel System Pressure Test* and *Fuel Pump Electrical Circuit Diagnosis*.<br>– Fuel injectors.<br>– Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)*.<br>– Refer to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)*.<br>– Contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*.<br>– Test items which can cause an engine to run rich (long term fuel trim is significantly in the negative range). Refer to Diagnostic Aids for *DTC P0172 Fuel Trim System Rich Bank 1*.<br>– Test items that can cause an engine to run lean (long term fuel trim is significantly in the positive range). Refer to Diagnostic Aids for *DTC P0171 Fuel Trim System Lean Bank 1*. |
| Sensor/System | • Using a scan tool, monitor KS system for excessive spark retard activity. Refer to *Knock Sensor (KS) System Description*.<br>If knock retard is above 10-12 degrees, disconnect the knock sensor and ground the sensor harness connector. Monitor the knock retard on the scan tool, there should be no knock retard present. If knock retard is still present, the PCM is malfunctioning. Replace the PCM. Refer to *PCM Replacement/Programming*.<br>• Test the EGR valve for a stuck open pintle. Refer to *EGR Valve Replacement*.<br>• Inspect for a restricted intake duct or a dirty air cleaner element. Refer to *Air Cleaner Element Replacement*. |

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## Lack of Power, Sluggishness, or Sponginess (cont'd)

| Checks | Action |
|---|---|
| Ignition System | • Test for proper ignition voltage output using the following steps:<br>– Clip the *J 26792* spark tester to engine ground.<br>– Connect one end of a spark plug wire to the spark tester, leave the other end of the spark plug wire to the coil being tested.<br>– Connect one end of another spark plug wire to the other coil tower, connect the other end of the spark plug wire to ground.<br>– Crank the engine while observing the spark tester, a spark should be observed.<br>– Repeat the above steps for each coil.<br>• If adequate spark is not present at the coils, test for the following conditions:<br>• Coils - Cracks, carbon tracking/arcing, or a resistance value outside the specified range.<br>**Coil Secondary Resistance**<br>5000 - 8000 ohms (5K - 8K ohms)<br>• Spark Plug wires - Signs of arcing/cross firing, cracks, carbon tracking, plug boot damage, pinched, incorrect routing, or a resistance value more than the specified value.<br>**Spark Plug Wires Resistance**<br>3280-4921 ohms/meter(1000-1500 ohms/ft).<br>**Important:** Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Ignition components will arc to ground when a secondary component is malfunctioning.<br>• Malfunctioning ignition control module.<br>• Ignition System Wiring - Loose ignition module feed or ground connection, or damaged system wiring.<br>• Remove spark plugs and inspect for the following conditions:<br>– Fouled plugs<br>– Cracks<br>– Wear<br>– Incorrect gap<br>– Burned or damaged electrodes<br>– Incorrect heat range<br>• If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. |
| Engine Mechanical | • Excessive oil in combustion chamber–Leaking valve seals.<br>• Low cylinder compression.<br>• For incorrect basic engine parts. Inspect the following:<br>– Camshaft<br>– Cylinder heads<br>– Pistons, etc.<br>• Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical. |
| Additional Tests | • Test the exhaust system for a possible restriction.<br>• Inspect the exhaust system for damaged or collapsed pipes.<br>• Inspect the muffler for heat distress or possible internal failure.<br>• Test for a plugged three–way catalytic converter. Refer to *Restricted Exhaust System Check.*<br>• Test for proper TCC operation. Refer to A Diagnostic Starting Point in 4L60E Automatic Transmission. |

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## Detonation/Spark Knock

| Checks | Action |
|---|---|
| DEFINITION: A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening. | |
| Preliminary Checks | • Refer to the *Symptoms*.<br>• Search for bulletins. |
| Fuel System | • Test for incorrect fuel pressure.<br>• Refer to *Fuel System Pressure Test* and *Fuel Pump Electrical Circuit Diagnosis*.<br>• Test for contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*.<br>• Test items that can cause an engine to run lean (long term fuel trim significantly in the positive range). Refer to Diagnostic Aids for *DTC P0171 Fuel Trim System Lean Bank 1*. |
| Ignition System | • Inspect the spark plugs for proper application.<br>• Refer to *Spark Plug Usage* in Engine Electrical. |
| Engine Cooling System | Inspect for obvious overheating problems:<br>• Low engine coolant.<br>• Restricted air flow to radiator, or restricted water flow through radiator.<br>• Electric cooling fans operation. Refer to *Electric Cooling Fan Diagnosis (Description)*.<br>• Correct coolant solution should be a 50/50 mix of GM approved antifreeze coolant and water. |
| Engine Mechanical | • Excessive oil in combustion chamber–Leaking valve seals.<br>• Low cylinder compression.<br>• Combustion chambers for excessive carbon buildup. Clean using Top engine cleaner. Follow instructions on can.<br>• For incorrect basic engine parts. Inspect the following:<br>– Camshaft<br>– Cylinder heads<br>– Pistons, etc.<br>• Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical. |
| Additional Tests | • Test for proper EGR system operation. Refer to *DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient*.<br>• Test the transaxle range switch input with the vehicle in drive and the gear selector in drive or overdrive.<br>• Test TCC operation. A malfunctioning TCC can cause the engine to spark knock. Refer to A Diagnostic Starting Point in 4L60E Automatic Transmission.<br>• If scan tool readings are normal and there are no engine mechanical problems, fill the fuel tank with a known quality gasoline that has a minimum octane reading of 87 and re-evaluate vehicle performance. |

## Hesitation, Sag, Stumble

| Checks | Action |
|---|---|
| DEFINITION: Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually more pronounced when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough. | |
| Preliminary | • Refer to the *Symptoms*.<br>• Search for bulletins. |
| Sensor/System | • Test the heated oxygen sensors. The heated oxygen sensors should respond quickly to different throttle positions. If not, inspect the HO2S for silicon or other contaminants from fuel or use of incorrect RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will reduce the amount of fuel delivered to the engine, causing a severe driveability problem. Refer to heated oxygen sensors in *Information Sensors/Switches Description*.<br>• Test the TP sensors and inspect the related wiring.<br>• Test the MAF sensor and inspect the related wiring.<br>• Test the EGR valve for a sticking pintle. Refer to *EGR Valve Replacement*. |

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## Hesitation, Sag, Stumble (cont'd)

| Checks | Action |
|---|---|
| Fuel System | • Test the fuel pressure.<br>• Refer to *Fuel System Pressure Test* and *Fuel Pump Electrical Circuit Diagnosis.*<br>• Test for contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*<br>• Test the injectors.<br>• Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F).*<br>• Refer to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F).*<br>• Test items which can cause an engine to run rich (long term fuel trim is significantly in the negative range). Refer to Diagnostic Aids for *DTC P0172 Fuel Trim System Rich Bank 1.*<br>• Test items that can cause an engine to run lean (long term fuel trim is significantly in the positive range). Refer to Diagnostic Aids for *DTC P0171 Fuel Trim System Lean Bank 1.* |
| Ignition System | • Test for proper ignition voltage output using the following steps:<br>– Clip the *J 26792* spark tester to engine ground.<br>– Connect one end of a spark plug wire to the spark tester, leave the other end of the spark plug wire to the coil being tested.<br>– Connect one end of another spark plug wire to the other coil tower, connect the other end of the spark plug wire to ground.<br>– Crank the engine while observing the spark tester, a spark should be observed.<br>– Repeat the above steps for each coil.<br>• If spark is not present at the coils, test for the following conditions:<br>– Coils - Cracks, carbon tracking/arcing, or a resistance value outside the specified range.<br>**Coil Secondary Resistance**<br>5000 - 8000 ohms (5K - 8K ohms)<br>– Spark Plug wires - Signs of arcing/cross firing, cracks, carbon tracking, plug boot damage, pinched, incorrect routing, or a resistance value more than the specified value.<br>**Spark Plug Wires Resistance**<br>3280-4921 ohm/meter(1000-1500 ohm/ft).<br>**Important:** Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Ignition components will arc to ground when a secondary component is malfunctioning.<br>– Malfunctioning ignition control module.<br>– Ignition System Wiring - Loose ignition module feed or ground connection, or damaged system wiring.<br>• Remove spark plugs and inspect for the following conditions:<br>– Fouled plugs<br>– Cracks<br>– Wear<br>– Incorrect gap<br>– Burned or damaged electrodes<br>– Incorrect heat range<br>• If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. |

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## Cuts Out, Misses

| Checks | Action |
|---|---|
| DEFINITION: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. | |
| Preliminary | • Refer to the *Symptoms*.<br>• Search for bulletins. |
| Fuel System | • Test system fuel pressure.<br>• Refer to *Fuel System Pressure Test* and *Fuel Pump Electrical Circuit Diagnosis*.<br>• Test the fuel injectors.<br>• Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)*.<br>• Refer to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)*.<br>• Test for contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*.<br>• Test items which can cause an engine to run rich (long term fuel trim significantly in the negative range). Refer to Diagnostic Aids for *DTC P0172 Fuel Trim System Rich Bank 1*.<br>• test items that can cause an engine to run lean (long term fuel trim significantly in the positive range). Refer to Diagnostic Aids for *DTC P0171 Fuel Trim System Lean Bank 1*.<br>• Inspect for fuel in the fuel pressure regulator vacuum hose. If fuel is present, replace the fuel pressure regulator. Refer to *Fuel Pressure Regulator Replacement*. |
| Sensor/System | • Inspect for conditions which cause an incorrect idle speed.<br>– Throttle body tampering, excessive deposits, or damage.<br>– Restricted air intake duct or dirty air cleaner element. Refer to *Air Cleaner Element Replacement*.<br>– Large vacuum leak.<br>• Test the Electronic Throttle Control and inspect the related circuit wiring.<br>• Test the EGR system:<br>– The EGR pipes and adapter for vacuum leaks.<br>– Remove the EGR valve and inspect for a sticking pintle. Refer to *EGR Valve Replacement*.<br>• Inspect the PCV valve for proper installation.<br>– Refer to *Crankcase Ventilation System Inspection*.<br>– Test the transaxle range switch input with the vehicle in drive and the gear selector in drive or overdrive.<br>– Inspect for the following conditions:<br>– Bent harmonic balancer interrupter rings.<br>– Damaged crankshaft position sensor. |

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## Cuts Out, Misses (cont'd)

| Checks | Action |
|---|---|
| Ignition System | • Test for proper ignition voltage output using the following steps:<br>– Clip the *J 26792* spark tester to engine ground.<br>– Connect one end of a spark plug wire to the spark tester, leave the other end of the spark plug wire to the coil being tested.<br>– Connect one end of another spark plug wire to the other coil tower, connect the other end of the spark plug wire to ground.<br>– Crank the engine while observing the spark tester, a spark should be observed.<br>– Repeat the above steps for each coil.<br>• If adequate spark is not present at the coils, test for the following conditions:<br>– Coils - Cracks, carbon tracking/arcing, or a resistance value outside the specified range.<br>**Coil Secondary Resistance**<br>5000 - 8000 ohms (5K - 8K ohms)<br>– Spark Plug wires - Signs of arcing/cross firing, cracks, carbon tracking, plug boot damage, pinched, incorrect routing, or a resistance value more than the specified value.<br>**Spark Plug Wires Resistance**<br>3280-4921 ohms/meter(1000-1500 ohm/ft)<br>**Important:** Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Ignition components will arc to ground when a secondary component is malfunctioning.<br>– Malfunctioning ignition control module<br>– Ignition System Wiring - Loose ignition module feed or ground connection, or damaged system wiring.<br>• Remove spark plugs and test for the following conditions:<br>– Fouled plugs<br>– Cracks<br>– Wear<br>– Incorrect gap<br>– Burned or damaged electrodes<br>– Incorrect heat range<br>• If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.<br>• test for the following intermittent ignition system conditions:<br>– Intermittent CKP Sync or CKP 18X Signal.<br>– Intermittent ignition feed circuit or sensor ground circuit to the crankshaft position sensor or the camshaft position sensor.<br>– Intermittent 3X reference signal.<br>– Intermittent camshaft position signal |

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## Cuts Out, Misses (cont'd)

| Checks | Action |
|---|---|
| Engine Mechanical | • Test the following:<br>– Engine compression<br>– Sticking or leaking valves<br>– Worn camshaft lobes<br>– Valve timing<br>– Bent push rods<br>– Worn rocker arms<br>– Broken valve springs<br>– Excessive oil in combustion chamber–Leaking valve seals<br>– Low cylinder compression<br>• For incorrect basic engine parts. Inspect the following:<br>– Camshaft<br>– Cylinder heads<br>– Pistons, etc.<br>• Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical. |
| Additional Tests | • Test the exhaust system for a possible restriction.<br>– Inspect exhaust system for damaged or collapsed pipes.<br>– Inspect mufflers for heat distress or possible internal failure.<br>– For possible plugged Three–Way catalytic converter. Refer to *Restricted Exhaust System Check.*<br>• An engine miss condition can be caused by Electromagnetic Interference (EMI) on the reference circuit. EMI can usually be detected by monitoring engine RPM with a scan tool. A sudden increase or decrease in RPM with little change in actual engine RPM change indicates that EMI is present. Inspect the routing of secondary ignition wires. Also, inspect the ignition coils for cracks, carbon tracking, or signs of arcing.<br>• Inspect for intake and exhaust manifold passages for casting flash.<br>• Inspect for loose, worn, or broken motor mounts. |

## Poor Fuel Economy

| Checks | Action |
|---|---|
| DEFINITION: Fuel economy, as measured by an actual road test is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test. | |
| Preliminary | • Refer to the *Symptoms.*<br>• Search for bulletins.<br>• Check owners driving habits.<br>– Is A/C ON full time (Defroster mode ON)?<br>– Are tires at correct pressure?<br>– Are excessively heavy loads being carried?<br>– Is acceleration too much, too often? |
| Fuel System | • Test for incorrect fuel pressure. Refer to *Fuel System Pressure Test.*<br>• Test the fuel injectors.<br>– Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F).*<br>– Refer to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F).*<br>• Test for contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*<br>• Ensure each injector harness is connected to the correct injector/cylinder. Refer to *Engine Controls Schematics.*<br>• Inspect for fuel in the pressure regulator vacuum hose. |
| Sensor/System | • Inspect the intake system and crankcase for air leaks.<br>• Test for proper calibration of speedometer. Connect a *J 33431-C* signal generator to VSS electrical connector. Ignition ON, tester ON and monitor the speedometer. |

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## Poor Fuel Economy (cont'd)

| Checks | Action |
|---|---|
| Ignition System | • Test for proper ignition voltage output using the following steps:<br>– Clip the *J 26792* spark tester to engine ground.<br>– Connect one end of a spark plug wire to the spark tester, leave the other end of the spark plug wire to the coil being tested.<br>– Connect one end of another spark plug wire to the other coil tower, connect the other end of the spark plug wire to ground.<br>– Crank the engine while observing the spark tester, a spark should be observed.<br>– Repeat the above steps for each coil.<br>• If adequate spark is not present at the coils, test for the following conditions:<br>– Coils - Cracks, carbon tracking/arcing, or a resistance value outside the specified range.<br>**Coil Secondary Resistance**<br>5000 - 8000 ohms (5K - 8K ohms)<br>– Spark Plug wires - Signs of arcing/cross firing, cracks, carbon tracking, plug boot damage, pinched, incorrect routing, or a resistance more than the specified value.<br>**Spark Plug Wires Resistance**<br>3280-4921 ohms/meter(1000-1500 ohm/ft).<br>**Important:** Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Ignition components will arc to ground when a secondary component is malfunctioning.<br>– Malfunctioning ignition control module<br>– Ignition System Wiring - Loose ignition module feed or ground connection, or damaged system wiring.<br>• Remove spark plugs and inspect for the following conditions:<br>– Fouled plugs<br>– Cracks<br>– Wear<br>– Incorrect gap<br>– Burned or damaged electrodes<br>– Incorrect heat range<br>• If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. |
| Engine Cooling System | • Test engine coolant level for a low condition.<br>• Test for incorrect or malfunctioning engine thermostat. Refer to *Engine Overheating* in Engine Cooling. |
| Engine Mechanical | • Test for the following:<br>– Engine compression<br>– Sticking or leaking valves<br>– Worn camshaft lobes<br>– Valve timing<br>– Bent push rods<br>– Worn rocker arms<br>– Broken valve springs<br>– Excessive oil in combustion chamber–Leaking valve seals<br>• For incorrect basic engine parts. Inspect for the following:<br>– Camshaft<br>– Cylinder heads<br>– Pistons, etc.<br>• Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical. |
| Additional Tests | • Test TCC operation. Refer to A Diagnostic Starting Point in 4L60E Automatic Transmission.<br>• Test the exhaust system for a possible restriction.<br>– Inspect exhaust system for damaged or collapsed pipes.<br>– Inspect mufflers for heat distress or possible internal failure.<br>– For possible plugged Three–Way catalytic converter. Refer to *Restricted Exhaust System Check.* |

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## Poor Fuel Fill Quality

| Problem | Causes |
|---|---|
| DEFINITION: Difficulty when refueling the vehicle. | |
| Difficult to fill | • The check valve is stuck closed.<br>• The fill limiter vent valve is stuck closed.<br>• The EVAP canister is restricted.<br>• The EVAP vent valve is stuck closed.<br>• Restricted EVAP pipes.<br>• High Reid vapor pressure.<br>• High fuel temperature.<br>• The fuel filler hose/pipe is pinched, kinked, or blocked.<br>• Ignition switch ON. |
| Over fill | • The pressure relief valve in the fill limiter vent valve is stuck open.<br>• The pressure relief valve in the fill limiter vent valve is leaking.<br>• The fill limiter vent valve is stuck open.<br>• The fill limiter vent valve is leaking. |
| Pre-mature shut-off of the fuel dispensing nozzle | • The check valve is stuck closed.<br>• The fill limiter vent valve is stuck closed.<br>• The EVAP canister is restricted.<br>• The EVAP vent valve is stuck closed.<br>• Restricted EVAP pipes.<br>• High Reid vapor pressure.<br>• High fuel temperature.<br>• The fuel filler hose/pipe is pinched, kinked, or blocked.<br>• Ignition switch ON. |
| Fuel Spit Back | • The check valve is stuck open.<br>• The check valve is stuck closed.<br>• The check valve is leaking.<br>• High Reid vapor pressure.<br>• High fuel temperature. |
| Liquid fuel in EVAP canister | • The fill limiter vent valve is stuck open.<br>• The fill limiter vent valve is leaking. |
| Liquid fuel leak | • The pressure relief valve in the fill limiter vent valve is stuck open.<br>• The pressure relief valve in the fill limiter vent valve is leaking.<br>• The fuel filler hose is loose or torn.<br>• The fill limiter vent valve is stuck open. |
| Fuel Odor | • The pressure relief valve in the fill limiter vent valve is stuck open.<br>• The pressure relief valve in the fill limiter vent valve is leaking.<br>• The EVAP canister is saturated. |

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## Rough, Unstable, or Incorrect Idle and Stalling

| Checks | Action |
|---|---|
| DEFINITION: Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine. | |
| Preliminary Checks | • Refer to the *Symptoms*.<br>• Search for bulletins. |
| Fuel System | • Test the fuel pressure.<br>– Refer to *Fuel System Pressure Test*.<br>– Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)*.<br>– Refer to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)*.<br>• test for contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*.<br>• Inspect for fuel in the pressure regulator vacuum hose.<br>• Ensure each injector harness is connected to the correct injector/cylinder. Refer to *Engine Controls Schematics*.<br>• Test items which can cause an engine to run rich (long term fuel trim is significantly in the negative range). Refer to Diagnostic Aids for *DTC P0172 Fuel Trim System Rich Bank 1*.<br>• Test items that can cause an engine to run lean (long term fuel trim is significantly in the positive range). Refer to Diagnostic Aids for *DTC P0171 Fuel Trim System Lean Bank 1*. |
| Sensor/System | • Inspect for conditions which cause an incorrect idle speed.<br>– Throttle body tampering, excessive deposits, or damage.<br>– Restricted air intake duct or dirty air cleaner element. Refer to *Air Cleaner Element Replacement*.<br>– Large vacuum leak.<br>• Inspect the crankcase ventilation valve for proper installation. Refer to *Crankcase Ventilation System Inspection*.<br>• Test the ETC and inspect related wiring.<br>• Test the EGR system for proper operation. Refer to *DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient*.<br>• Test the transaxle range switch input with the vehicle in drive and the gear selector in drive or overdrive. |

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

| Checks | Action |
|---|---|
| Ignition System | • Test for proper ignition voltage output using the following steps:<br>– Clip the *J 26792* spark tester to engine ground.<br>– Connect one end of a spark plug wire to the spark tester, leave the other end of the spark plug wire to the coil being tested.<br>– Connect one end of another spark plug wire to the other coil tower, connect the other end of the spark plug wire to ground.<br>– Crank the engine while observing the spark tester, a spark should be observed.<br>– Repeat the above steps for each coil.<br>• If adequate spark is not present at the coils, test for the following conditions:<br>• Coils - Cracks, carbon tracking/arcing, or a resistance value outside the specified range.<br>**Coil Secondary Resistance**<br>5000 - 8000 ohms (5K - 8K ohms)<br>• Spark Plug wires - Signs of arcing/cross firing, cracks, carbon tracking, plug boot damage, pinched, incorrect routing, or a resistance value more than the specified value.<br>**Spark Plug Wires Resistance**<br>3280-4921 ohms/meter(1000-1500 ohms/ft).<br>**Important:** Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Ignition components will arc to ground when a secondary component is malfunctioning.<br>• Malfunctioning ignition control module.<br>• Ignition System Wiring - Loose ignition module feed or ground connection, or damaged system wiring.<br>• Remove spark plugs and test for the following conditions:<br>– Fouled plugs<br>– Cracks<br>– Wear<br>– Incorrect gap<br>– Burned or damaged electrodes<br>– Incorrect heat range<br>• If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. |
| Engine Mechanical | • Test the following:<br>– Engine compression<br>– Sticking or leaking valves<br>– Worn camshaft lobes<br>– Valve timing<br>– Bent push rods<br>– Worn rocker arms<br>– Broken valve springs<br>– Excessive oil in combustion chamber–Leaking valve seals<br>• For incorrect basic engine parts. Inspect the following:<br>– Camshaft<br>– Cylinder heads<br>– Pistons, etc.<br>• Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical. |

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

| Checks | Action |
|---|---|
| Additional Tests | • Test the exhaust system for a possible restriction.<br>– Inspect exhaust system for damaged or collapsed pipes.<br>– Inspect mufflers for heat distress or possible internal failure.<br>– For possible plugged Three–Way catalytic converter. Refer to *Restricted Exhaust System Check.*<br>• Inspect for loose, worn, or broken motor mounts.<br>• An engine miss condition can be caused by Electromagnetic Interference (EMI) on the reference circuit. EMI can usually be detected by monitoring engine RPM with a scan tool. A sudden increase or decrease in RPM with little change in actual engine RPM indicates that EMI is present. Inspect for incorrect routing of secondary ignition wires. Also inspect the ignition coils for cracks, carbon tracking, or signs of arcing.<br>• Inspect for intake and exhaust manifold passages for casting flash. |

## Dieseling, Run-On

| Checks | Action |
|---|---|
| DEFINITION: Engine continues to run after key is turned OFF, but runs very rough. If engine runs smooth, inspect the ignition switch and adjustment. | |
| Preliminary Checks | • Refer to the *Symptoms.*<br>• Search for bulletins. |
| Fuel System | Test the Fuel injectors.<br>• Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F).*<br>• Refer to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F).* |
| Additional Tests: | Test for short between B+ and any of the ignition feed circuit. Refer to *Circuit Testing.* |

## Backfire

| Checks | Actions |
|---|---|
| DEFINITION: Fuel ignites in the intake manifold, or in the exhaust system, making loud popping noise. | |
| Preliminary Checks | • Refer to the *Symptoms.*<br>• Search for bulletins. |
| Sensor/System | • Inspect for the following intermittent ignition system conditions:<br>– Intermittent CKP Sync or CKP 18X signal<br>– Intermittent ignition feed circuit or sensor ground circuit to the crankshaft position sensor or the camshaft position sensor.<br>– Intermittent 3X reference signal<br>– Intermittent camshaft position signal<br>• Inspect the throttle body inlet screen for foreign objects or damage that can affect the MAF sensor airflow sample. |
| Fuel System | • Test for incorrect fuel pressure. Refer to *Fuel System Pressure Test.*<br>• Test for contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*<br>• Ensure each injector harness connector is connected to the correct injector. Refer to *Engine Controls Schematics.* |

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**Backfire (cont'd)**

| Checks | Actions |
|---|---|
| Ignition System | • Test for proper ignition voltage output using the following steps:<br>– Clip the *J 26792* spark tester to engine ground.<br>– Connect one end of a spark plug wire to the spark tester, leave the other end of the spark plug wire to the coil being tested.<br>– Connect one end of another spark plug wire to the other coil tower, connect the other end of the spark plug wire to ground.<br>– Crank the engine while observing the spark tester, a spark should be observed.<br>– Repeat the above steps for each coil.<br>• If adequate spark is not present at the coils, test for the following conditions:<br>– Coils - Cracks, carbon tracking/arcing, or a resistance value outside the specified range.<br>**Coil Secondary Resistance**<br>5000 - 8000 ohms (5K - 8K ohms)<br>– Spark plug wires - Signs of arcing/cross firing, cracks, carbon tracking, plug boot damage, pinched, incorrect routing, or a resistance value more than the specified value.<br>**Spark Plug Wires Resistance**<br>3280-4921 ohm/meter(1000-1500 ohms/ft).<br>**Important:** Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Ignition components will arc to ground when a secondary component is malfunctioning.<br>– Malfunctioning ignition control module<br>– Ignition system wiring - Loose ignition module feed or ground connection, or damaged system wiring.<br>• Remove spark plugs and inspect for the following conditions:<br>– Fouled plugs<br>– Cracks<br>– Wear<br>– Incorrect gap<br>– Burned or damaged electrodes<br>– Incorrect heat range<br>• If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. |
| Engine Mechanical | Test for the following:<br>• Engine compression<br>• Sticking or leaking valves<br>• Worn camshaft lobes<br>• Valve timing<br>• Bent push rods<br>• Worn rocker arms<br>• Broken valve springs<br>• Excessive oil in combustion chamber–Leaking valve seals<br>• Low cylinder compression<br>• For incorrect basic engine parts. Inspect the following:<br>– Camshaft<br>– Cylinder heads<br>– Pistons, etc.<br>• Refer to *Base Engine Misfire Diagnosis* in Engine Mechanical. |
| Additional Tests | • Inspect the intake and exhaust manifolds for casting flash.<br>• Test TCC operation. Refer to A Diagnostic Starting Point in 4L60E Automatic Transmission.<br>• Test the exhaust system for a possible restriction.<br>– Inspect exhaust system for damaged or collapsed pipes.<br>– Inspect mufflers for heat distress or possible internal failure.<br>– For possible plugged Three–Way catalytic converter. Refer to *Restricted Exhaust System Check.* |

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## Restricted Exhaust System Check

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Remove a pre-catalyst HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement.*<br>2. In place of the HO2S, install a *J 35314-A/BT-8515/ BT-8515A* exhaust back pressure tester.<br>3. Start the engine.<br>4. With the transmission in Park or Neutral and the engine idling at normal operating temperature, observe the exhaust system back pressure reading on the gage.<br>Does the reading exceed the specified value? | 8.6 kPa (1.25 psi) | *Go to Step 4* | *Go to Step 3* |
| 3 | 1. Leave the transmission in Park or Neutral.<br>2. With the exhaust back pressure tester in place of the pre-catalyst HO2S, increase engine speed to 2000 rpm.<br>3. Observe the exhaust system back pressure reading on the gage.<br>Does the reading exceed the specified value? | 20.7 kPa (3 psi) | *Go to Step 4* | System OK |
| 4 | 1. Reinstall the pre-catalyst HO2S.<br>2. Remove the post-catalyst HO2S.<br>3. In place of the H02S, install *J 35314-A/BT-8515/ BT-8515A* exhaust back pressure tester.<br>4. Engine at normal operating temperature.<br>5. Leave the transmission in Park or Neutral.<br>6. Increase engine speed to 2000 rpm.<br>7. Observe the exhaust system back pressure reading on the gage.<br>Does the reading exceed the specified value? | 20.7 kPa (3 psi) | *Go to Step 5* | *Go to Step 6* |
| 5 | Locate and repair the restriction in the exhaust system past the three way catalytic converter. Possible faults include the following:<br>• Collapsed pipe<br>• Heat distress<br>• Internal muffler failure<br>Did you complete the repair? | — | *Go to Step 7* | — |
| 6 | Replace the three way catalytic Converter. Refer to *Catalytic Converter Replacement (3.8 L)* in Engine Exhaust.<br>Did you complete the repair? | — | *Go to Step 7* | — |
| 7 | 1. Remove a pre-catalyst HO2S.<br>2. In place of the HO2S, install *J 35314-A/BT-8515/ BT-8515A* exhaust back pressure tester.<br>3. Leave the transmission in Park or Neutral.<br>4. Engine idling at normal operating temperature.<br>5. Observe the exhaust system back pressure reading on the gage.<br>Does the reading exceed the specified value? | 8.6 kPa (1.25 psi) | *Go to Step 4* | *Go to Step 8* |
| 8 | 1. Leave the transmission in Park or Neutral.<br>2. With exhaust each pressure tester in place of the pre-catalyst HO2S, increase engine speed to 2000 rpm.<br>3. Observe the exhaust system back pressure reading on the gage.<br>Does the reading exceed the specified value? | 20.7 kPa (3 psi) | *Go to Step 5* | System OK |

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## Powertrain Control Module Diagnosis

The approved procedure for diagnosing all powertrain control system malfunctions is included in the *Strategy Based Diagnosis*. The preliminary checks and the Powertrain On-Board Diagnostic System Check must be performed to successfully diagnose and repair the powertrain systems.

To read and clear diagnostic trouble codes, use a scan tool.

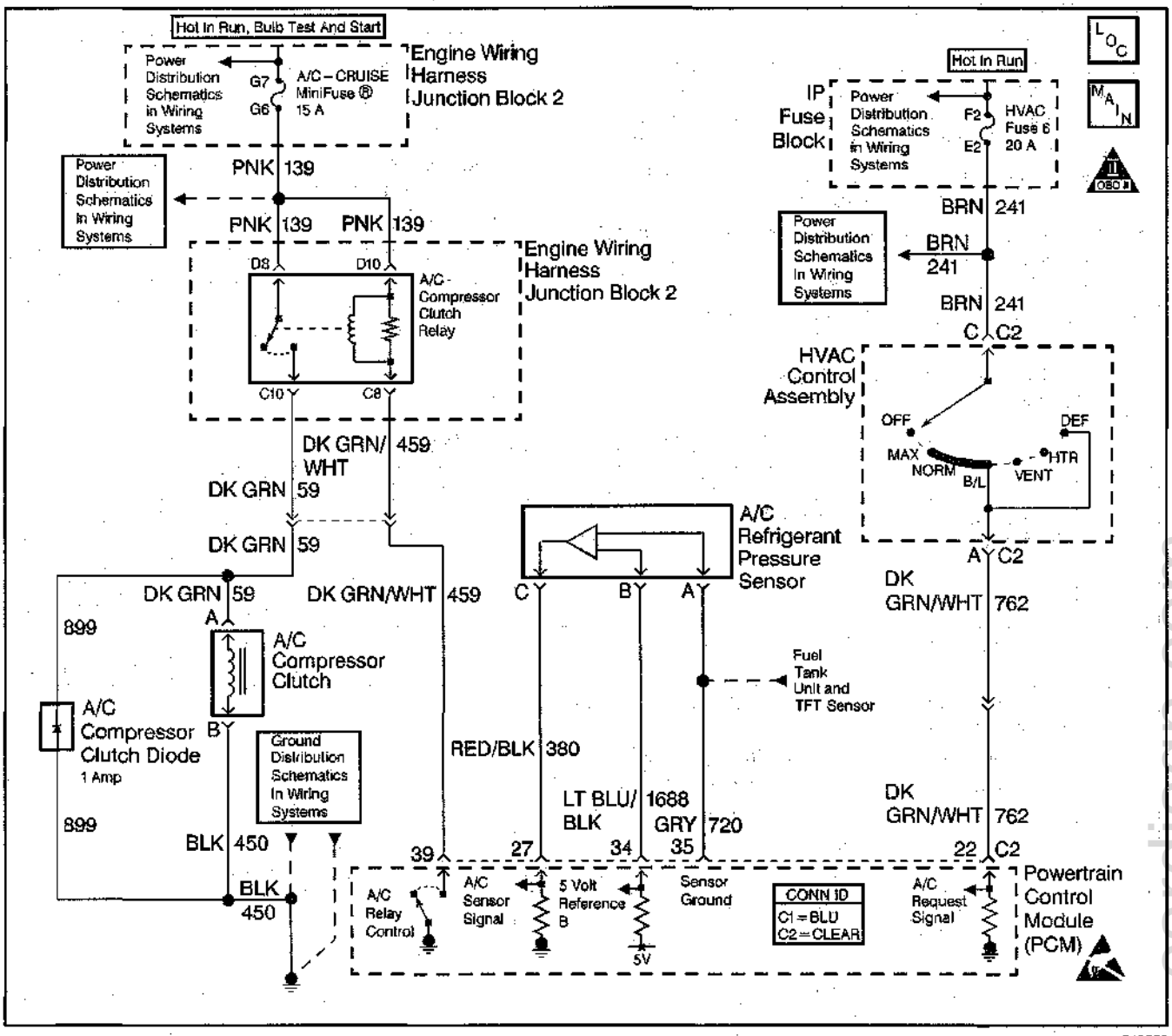
**Important:** Use a scan tool to clear diagnostic trouble codes from the PCM memory. Diagnostic trouble codes can also be cleared by turning OFF the ignition and disconnecting the battery power from the PCM for 30 seconds, but this method will also cause all diagnostic information in the PCM memory to be cleared and all the diagnostic tests will have to be re-run.

Since the PCM can have a failure which may affect only one circuit, following the approved diagnostic procedures will determine which circuit has a problem and where it is. If a diagnostic table indicates that the PCM connections or PCM is the cause of a problem and the PCM is replaced, but does not correct the problem, one of the following conditions may exist:

- There is a problem with the PCM connections. The diagnostic table will indicate that the PCM connections or PCM is the problem. The terminals may have to be removed from the PCM connector in order to check them properly.
- The EEPROM program is not correct for the application.
- Incorrect components may cause a malfunction and may or may not set a DTC.
- The problem is intermittent. This means that the problem is not present at the time the system is being checked. In this case, refer to the Symptoms portion of the manual and make a careful visual and physical inspection of all suspected components and wiring associated with the affected system.
- Shorted solenoid, relay coil, or harness. Solenoids and relays are turned ON and OFF by the PCM using internal electronic switches called drivers. Each driver is part of a group of seven called output driver modules. A shorted solenoid, relay coil, or harness will not damage the PCM but will cause the solenoid or relay to be inoperative. The J 34636 tester, or equivalent, provides a fast, accurate means of checking for a shorted coil or a short to battery voltage.

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## PCM Controlled A/C Circuit Diagnosis




### Circuit Description

When an A/C mode is selected, the HVAC control head supplies a battery positive voltage signal to the PCM A/C request input. The A/C compressor clutch relay is controlled by the PCM. The PCM provides a ground path for the A/C relay coil. When the A/C compressor relay is engaged battery positive voltage is supplied to the compressor clutch coil. The PCM will enable the A/C compressor clutch whenever the engine is running and the A/C has been requested unless one or more of the following conditions are present:

- Throttle angle is more than 90 percent.
- A/C head pressure is more than 414 psi (4.27 volts) or less than 34 psi (0.35 volt) (as determined by the A/C refrigerant pressure sensor).
- Ignition voltage is below 10.5 volts.
- Engine speed is more than 5440 RPM.
- ECT is more than 125°C (257°F).
- IAT is less than 5°C (41°F).

Any of the conditions described above will inhibit A/C compressor relay operation.

### Diagnostic Aids

Inspect for the following:

Inspect for conditions that will disable A/C operation:

- Throttle angle more than 90 percent.
- A/C head pressure more than 414 psi (4.27 volts) or less than 34 psi (0.35 volt) (as determined by the A/C refrigerant pressure sensor).
- Ignition voltage less than 10.5 volts.
- Engine speed more than 5440 RPM.
- ECT more than 125°C (257°F).
- IAT less than 5°C (41°F).

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### Test Description

The numbers below refer to step numbers on the diagnostic table:

2. Stored diagnostic trouble codes may disable the A/C compressor. This diagnostic table may lead to improper diagnosis and replacement of good parts if diagnostic trouble codes are present.
3. The A/C compressor clutch should engage if the appropriate conditions have been met.
4. The A/C compressor clutch should not be engaged with the engine running if an A/C mode is not selected at the control head.
6. Tests for an A/C request signal from the control head to the PCM.
12. Tests the ignition positive voltage circuit to the A/C relay.
13. Determines whether the A/C relay or the circuitry is at fault.
21. Determines if the PCM is turning the A/C relay ON due to a false A/C request.
22. Isolates the problem to the A/C control head or the PCM.
27. Determines if the A/C relay is malfunctioning or the A/C relay control circuit is grounded all the time.
35. This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is replaced, the new PCM must be programmed.

### PCM Controlled A/C Circuit Diagnosis

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| *2* | Are any powertrain DTCs stored? | — | Go to applicable DTCs | *Go to Step 3* |
| *3* | **Important:** Before continuing with diagnosis, the following conditions must be met:<br>• Intake air temperature more than 9°C (48°F).<br>• Engine coolant temperature less than 119°C (246°F).<br>1. With the A/C OFF, start and idle the engine.<br>2. Observe the A/C compressor.<br>Is the A/C compressor clutch engaged? | — | *Go to Step 21* | *Go to Step 4* |
| *4* | 1. Run the engine at 1000–1500 RPM.<br>2. Select an A/C mode on HVAC control head.<br>3. Observe the A/C compressor.<br>Is the A/C compressor clutch engaged? | — | Go to Diagnostic Aids | *Go to Step 5* |
| 5 | With an A/C mode still selected, observe A/C Request parameter on the scan tool.<br>Does A/C Request display Yes? | — | *Go to Step 9* | *Go to Step 6* |
| *6* | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. With an A/C mode still selected, measure voltage on the A/C request circuit at the PCM harness connector using a DMM that is connected to a good ground.<br>Is the voltage near the specified value? | B+ | *Go to Step 8* | *Go to Step 7* |
| 7 | Test the A/C request circuit for the following conditions:<br>• Open.<br>• Shorted to ground.<br>• Poor connection at the A/C control head or A/C programmer (as applicable). Refer to *Circuit Testing* and *Wiring Repairs* or *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 37* | Go to *A Diagnostic System Check* in HVAC |

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## PCM Controlled A/C Circuit Diagnosis (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 8 | Inspect the A/C request circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 37* | *Go to Step 35* |
| 9 | With a scan tool, observe the A/C refrigerant pressure parameter.<br>Does the scan tool indicate A/C pressure within the specified range? | 0.35-4.27 V | *Go to Step 12* | *Go to Step 10* |
| 10 | 1. Connect a *J 39500* refrigerant recovery, recycling, and recharging station to monitor high side refrigerant pressure. Refer to Heater, Ventilation and Air Conditioning.<br>2. Observe high side refrigerant pressure on the gauge.<br>Is pressure within the specified values? | 234-2854 kPa (34-414 psi) | *Go To Step 11* | Go to *Refrigerant Recovery and Recharging* in HVAC |
| 11 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM and the A/C refrigerant pressure sensor.<br>3. Measure the resistance of the following circuits between the PCM and the A/C refrigerant pressure sensor:<br>• The A/C refrigerant pressure sensor signal circuit<br>• The 5 volt reference B circuit<br>• The sensor ground circuit<br>4. If any resistance is higher than the specified value, locate and repair cause of high resistance in circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | 5 ohms | *Go to Step 37* | *Go to Step 18* |
| 12 | 1. Disconnect the A/C relay.<br>2. Turn ON the ignition.<br>3. Probe both ignition positive voltage circuits at the A/C relay harness connector using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate when probing both circuits? | — | *Go to Step 13* | *Go To Step 31* |
| 13 | Connect a fused jumper between the ignition positive voltage circuit and A/C compressor clutch feed circuit at the A/C relay connector.<br>Does the A/C compressor clutch engage? | — | *Go to Step 14* | *Go to Step 15* |
| 14 | Inspect for poor connections at A/C relay. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 37* | *Go to Step 32* |
| 15 | 1. Disconnect the A/C compressor clutch (leave the ignition positive voltage circuit and A/C compressor clutch feed circuit jumpered at the A/C relay connector).<br>2. Connect a test lamp between A/C compressor clutch feed circuit and the compressor ground circuit.<br>Does the test lamp illuminate? | — | *Go to Step 16* | *Go to Step 17* |
| 16 | Inspect for poor connections at the A/C compressor clutch. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs.*<br>Did you find and correct the condition? | — | *Go to Step 37* | *Go to Step 33* |
| 17 | Test for an open or short to ground in the A/C compressor clutch feed circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 37* | *Go to Step 34* |

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## PCM Controlled A/C Circuit Diagnosis (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 18 | 1. Leave the PCM and the A/C refrigerant pressure sensor disconnected.<br>2. Turn ON the ignition.<br>3. Measure the voltage on the A/C refrigerant pressure signal circuit using a DMM that is connected to a good ground.<br>Does the voltage measure at or near the specified value? | 0 V | *Go to Step 19* | *Go to Step 20* |
| 19 | 1. Inspect for the following conditions:<br>• The 5 volt reference B circuit for a poor connection at the PCM.<br>• The 5 volt reference B circuit for a poor connection at the A/C refrigerant pressure sensor.<br>• The A/C refrigerant pressure signal circuit for a poor connection at the PCM.<br>• The A/C refrigerant pressure signal circuit for a poor connection at the A/C refrigerant pressure sensor.<br>• The sensor ground circuit for a poor connection at the A/C refrigerant pressure sensor.<br>2. Repair as necessary. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 37* | *Go to Step 36* |
| 20 | Repair short to voltage in the A/C refrigerant pressure signal circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 37* | — |
| *21* | 1. Turn ON the ignition.<br>2. A/C OFF.<br>3. With a scan tool, observe A/C Request parameter.<br>Does the scan tool indicate Yes? | — | *Go To Step 22* | *Go To Step 24* |
| *22* | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Turn ON the ignition.<br>4. A/C OFF.<br>5. Measure the voltage between the A/C request circuit at the PCM harness connector using a DMM that is connected to a good ground.<br>Does the voltage measure near the specified value? | B+ | *Go To Step 23* | *Go to Step 35* |
| 23 | Test the A/C request circuit for a short to B+. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 37* | Go to *A Diagnostic System Check* in HVAC |
| 24 | 1. Disconnect the A/C relay.<br>2. Start the vehicle.<br>3. Observe the A/C compressor.<br>Is the A/C compressor clutch engaged? | — | *Go to Step 29* | *Go to Step 25* |
| 25 | Probe the A/C compressor clutch control circuit at the A/C relay harness connector using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 27* | *Go to Step 26* |
| 26 | Replace the A/C relay.<br>Did you complete the repair? | — | *Go to Step 37* | — |

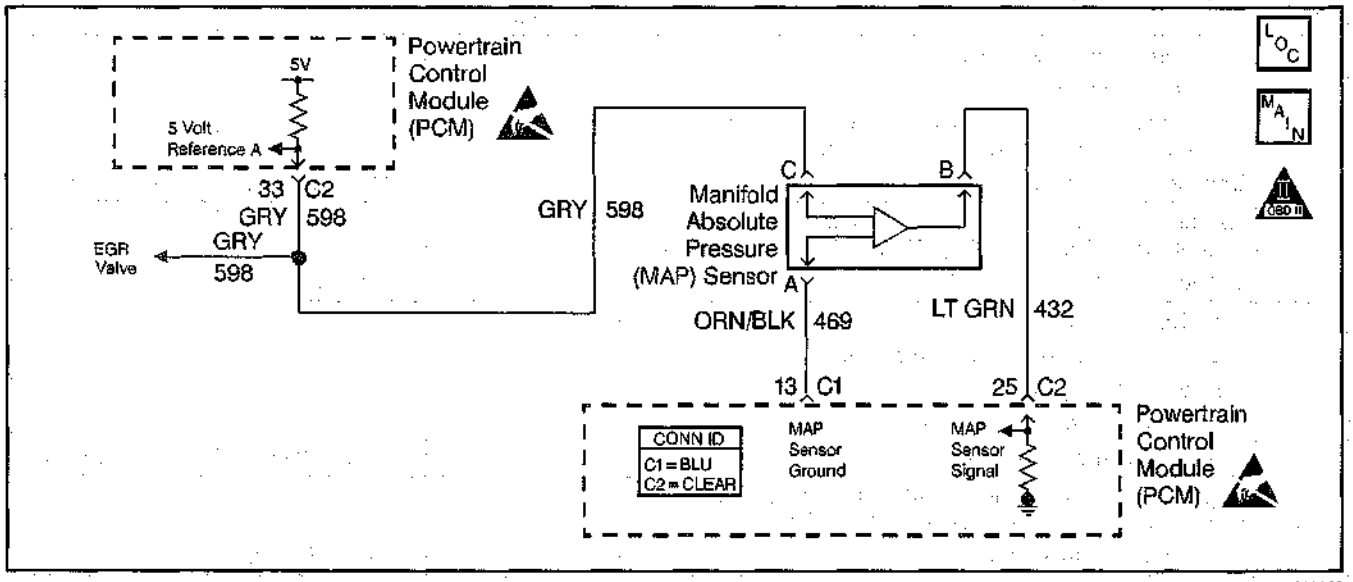
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## PCM Controlled A/C Circuit Diagnosis (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 27 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Probe the A/C relay control circuit at the PCM connector with a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 28* | *Go to Step 35* |
| 28 | Repair short to ground in the A/C compressor clutch relay control circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 37* | — |
| 29 | 1. Turn OFF the ignition.<br>2. Disconnect the A/C compressor clutch.<br>3. Start the engine.<br>4. Observe the A/C compressor.<br>Is the A/C compressor clutch engaged? | — | *Go To Step 33* | *Go to Step 30* |
| 30 | Repair short to voltage in the A/C compressor clutch feed circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 37* | — |
| 31 | Repair open or short to ground in the ignition positive voltage circuit to the A/C compressor relay. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 37* | — |
| 32 | Replace the A/C compressor relay.<br>Did you complete the replacement? | — | *Go to Step 37* | — |
| 33 | Repair the A/C compressor clutch. Refer to *Compressor Clutch Plate and Hub Assembly Removal (V5 - Conventional Mount)* in HVAC.<br>Did you complete the repair? | — | *Go to Step 37* | — |
| 34 | Repair open in the A/C compressor clutch ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | *Go to Step 37* | — |
| 35 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming.*<br>Did you complete the replacement? | — | *Go to Step 37* | — |
| 36 | Replace the A/C refrigerant pressure sensor.<br>Did you complete the replacement? | — | *Go to Step 37* | — |
| 37 | **Important:** Before continuing with diagnosis, the following conditions must be met:<br>• Intake air temperature more than 9°C (48°F).<br>• Engine coolant temperature less than 119°C (246°F).<br>1. With the A/C OFF, start and idle the engine.<br>2. Observe the A/C compressor.<br>Is the A/C compressor clutch engaged? | — | *Go to Step 21* | *Go to Step 38* |
| 38 | 1. Run the engine at 1000-1500 rpm.<br>2. Select an A/C mode on the HVAC control head.<br>3. Observe A/C compressor.<br>Is the A/C compressor clutch engaged? | — | System OK | *Go to Step 5* |

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## MAP Sensor Circuit Diagnosis




### Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2.0 volts at idle (high vacuum) to above 4.0 volts with the key on, engine not running, or engine running at wide open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run to determine engine vacuum level for other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively high, *DTC P0108 Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage* will be set. If the PCM detects a MAP signal voltage that is excessively low, *DTC P0107 Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage* will be set.

The PCM also uses the MAP sensor for throttle position sensor performance. If the PCM detects a TP in an out of range condition, when the MAP reading is above or below a calibrated amount then *DTC P1514 Throttle Body Performance* will be set.

### Diagnostic Aids

Inspect for the following:

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

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## MAP Sensor Circuit Diagnosis

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Inspect for the following conditions:<br>• MAP sensor seal missing or damaged.<br>• Vacuum hoses disconnected, damaged, incorrectly routed.<br>• Intake manifold vacuum leaks.<br>• Vacuum leaks at throttle body.<br>• Vacuum leaks at EGR valve flange and pipes.<br>• Positive crankcase ventilation valve faulty, missing, or incorrectly installed. Refer to *Crankcase Ventilation System Inspection.*<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 3* |
| 3 | 1. Disconnect the MAP sensor.<br>2. With a scan tool, observe the MAP voltage parameter.<br>Does the scan tool indicate voltage at or near the specified value? | 0.0V | *Go to Step 4* | *Go to Step 12* |
| 4 | 1. Connect a test lamp between battery positive voltage and the MAP sensor signal circuit.<br>2. Observe the MAP voltage parameter on the scan tool.<br>Does the scan tool indicate voltage at or near the specified value? | 4.95V | *Go to Step 5* | *Go to Step 8* |
| 5 | 1. Jumper the 5 volt reference A circuit and the MAP signal circuit together.<br>2. Observe the MAP voltage parameter on the scan tool.<br>Does the scan tool indicate voltage at or near the specified value? | 4.95V | *Go to Step 6* | *Go to Step 7* |
| 6 | 1. Test the sensor ground circuit for high resistance, an open or poor connection at the PCM. Refer to *Circuit Testing* or *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>2. Repair as necessary. Refer to *Wiring Repairs* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 10* |
| 7 | 1. Test the 5 volt reference A circuit for high resistance, an open or poor connection at the PCM. Refer to *Circuit Testing* or *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>2. Repair as necessary. Refer to *Wiring Repairs* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 9* |
| 8 | 1. Test the MAP signal circuit for high resistance, an open or poor connection at the PCM. Refer to *Circuit Testing* or *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>2. Repair as necessary. Refer to *Wiring Repairs* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 9* |

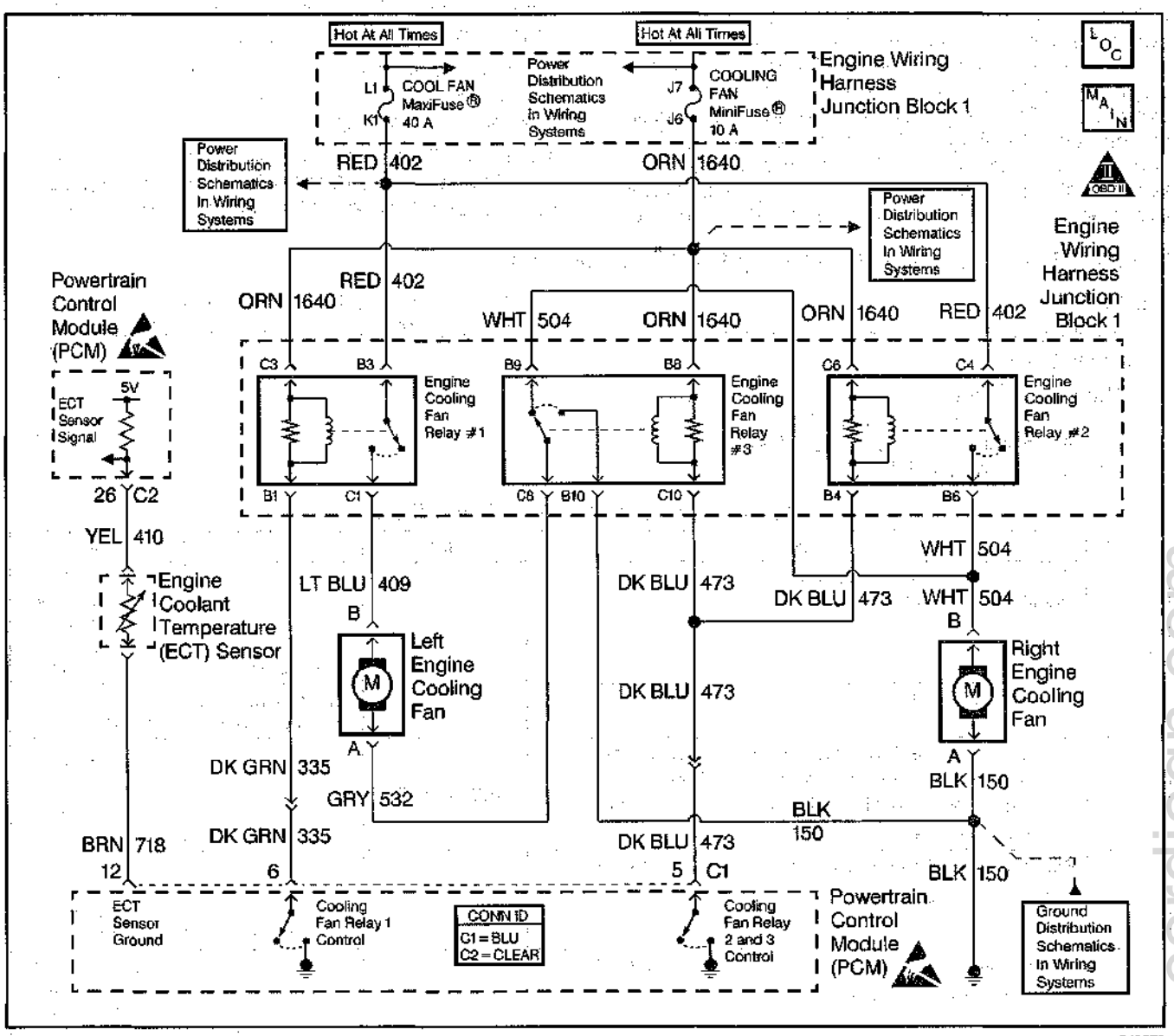
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## MAP Sensor Circuit Diagnosis (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 9 | 1. Test the MAP sensor signal circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>2. Repair as necessary. Refer to *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 13* |
| 10 | 1. Test for a poor connection at the MAP sensor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>2. Repair as necessary. Refer to *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 11* |
| 11 | Replace the MAP sensor. Refer to *MAP Sensor Replacement*.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 12 | Test the MAP signal circuit for a short to voltage or a short to the 5 volt reference A circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 13* |
| 13 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the repair? | — | *Go to Step 14* | — |
| 14 | With a scan tool, observe the MAP parameter while increasing engine RPM.<br>Does the MAP value change? | — | System OK | *Go to Step 2* |

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## Electric Cooling Fan Diagnosis (Description)




### Circuit Description:

The cooling fans are controlled by the PCM based on various inputs. Ignition voltage is supplied to all three cooling fan relay coils. The PCM controls cooling fan relay # 1 by providing the ground path. The PCM controls cooling fan relays # 2 and # 3 together by providing a ground path. The left and right cooling fans are connected in series. This will enable both fans on low speed when the fan #1 relay is energized. When all three fan relays are energized, both fans will operate at high speed. The high speed is possible because the fan relays are wired in a parallel circuit. When the PCM detects that certain DTCs are set, the PCM will enable the cooling fans.

The PCM will enable the engine cooling fans when certain Diagnostic Trouble Codes are set. The PCM will also enable the cooling fans after the ignition is turned off. When engine coolant temperature exceeds 140°C (284°F) and the ignition is turned off, the cooling fans will be enabled on low speed.

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### Diagnostic Aids

If the owner complained of an overheating problem, determine if the complaint was due to an actual boil over, or the warning indicator light illuminated, or the engine coolant temperature gauge indicated overheating. The gauge accuracy can also be checked by comparing the Engine Coolant Temperature (ECT) sensor reading using a scan tool and comparing its reading with the gauge reading. If the engine is actually overheating and the gauge indicated overheating, but the cooling fan is not coming ON, the Engine Coolant Temperature (ECT) sensor has probably shifted out of calibration and should be replaced.

If the engine is overheating and the cooling fans are ON, the cooling system should be checked, refer to *Engine Overheating*.

The PCM will command low speed fans ON at 108°C (226°F) and OFF at 103°C (217°F) and, high speed fans ON at 113°C (235°F) and OFF at 108°C (226°F).

## Electric Cooling Fan Diagnosis (Functional Check)

### Test Description

The numbers below refer to numbers on the diagnostic table.

2. The PCM will enable the engine cooling fans when certain Diagnostic Trouble Codes are set. Go to applicable DTC Table first before proceeding with this table.
3. Allow engine coolant temperature to cool below 100°C (212°F) before proceeding with diagnosis.

**Electric Cooling Fan Functional Check**

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Are any DTCs set? | — | Go to applicable DTC Table | *Go to Step 3* |
| 3 | 1. Engine coolant temperature must be below the specified value for all the fan diagnoses.<br>2. Turn ON the Ignition, with the engine and A/C OFF.<br>Are the cooling fans OFF? | 100°C (212°F) | *Go to Step 4* | Go to *Electric Cooling Fan Diagnosis (Table 1)* |
| 4 | With a scan tool, command the Low Speed Fans ON.<br>Are both cooling fans ON? | — | *Go to Step 5* | Go to *Electric Cooling Fan Diagnosis (Table 2)* |
| 5 | With a scan tool, command the High Speed Fans ON.<br>Do both cooling fans switch to high speed? | — | *Go to Step 6* | Go to *Electric Cooling Fan Diagnosis (Table 3)* |
| 6 | 1. With a scan tool, exit outputs.<br>2. Idle the engine leaving the A/C OFF.<br>Are the cooling fans ON? | — | *Go to Step 8* | *Go to Step 7* |
| 7 | Turn ON the A/C.<br>Are the cooling fans ON? | — | System OK | Go to *A Diagnostic Starting Point* |
| 8 | Does the scan tool indicate A/C request as YES? | — | Go to *A Diagnostic Starting Point* in HVAC. | *Go to Step 9* |
| 9 | **Important:** The replacement PCM must be programmed. Refer to *PCM Replacement/Programming*.<br>Replace the PCM.<br>Did you complete the repair? | — | System OK | — |

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## Electric Cooling Fan Diagnosis (Table 1)

### Electric Cooling Fan Table #1

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Cooling Fan Functional Check? | — | *Go to Step 2* | Go to *Electric Cooling Fan Diagnosis (Functional Check)* |
| 2 | Disconnect fan relay #1<br>Are both fans OFF? | — | *Go to Step 8* | *Go to Step 3* |
| 3 | Disconnect fan relay #3<br>Are both fans OFF? | — | *Go to Step 4* | *Go to Step 10* |
| 4 | 1. Disconnect the left fan.<br>2. Probe terminal B of the left fan connector using a *J 34142-B* Test Lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 11* | *Go to Step 5* |
| 5 | Probe terminal A of the left fan connector using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 12* | *Go to Step 6* |
| 6 | Probe the cooling fan relay 2 and 3 control circuit (473) at the cooling fan relay #3 connector location (C10) using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 7* | *Go to Step 13* |
| 7 | 1. Turn OFF the ignition.<br>2. Leave the test lamp installed.<br>3. Disconnect the PCM.<br>4. Turn ON the ignition, with the engine OFF.<br>Is the test lamp still illuminated? | — | *Go to Step 14* | *Go to Step 16* |
| 8 | Probe the cooling fan relay 1 control circuit (335) at the cooling fan relay #1 connector location (B1) using the test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 9* | *Go to Step 13* |
| 9 | 1. Turn OFF the ignition.<br>2. Leave the test lamp installed.<br>3. Disconnect the PCM.<br>4. Turn ON the ignition, with the engine OFF.<br>Is the test lamp still illuminated? | — | *Go to Step 14* | *Go to Step 16* |
| 10 | Repair the RH fan feed circuit (504) for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | *Go to Step 15* |
| 11 | Repair the LH fan feed circuit (409) for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 12 | Repair the short to voltage in the relay #3 switch feed circuit (532). Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 13 | Replace the cooling fan relay #1.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |

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**Electric Cooling Fan Table #1 (cont'd)**

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 14 | Repair the relay 2 and 3 control circuit (473) or the relay 1 control circuit (335) for a short to ground. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 15 | Replace the cooling fan relay #2.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 16 | **Important:** The replacement PCM must be programmed. Refer to *PCM Replacement/Programming.*<br>Replace the PCM.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |

## Electric Cooling Fan Diagnosis (Table 2)

**Electric Cooling Fan Table #2**

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Cooling Fan Functional Check? | — | *Go to Step 2* | Go to *Electric Cooling Fan Diagnosis (Functional Check)* |
| 2 | Did either fan turn ON when the Low Speed Fans were commanded ON? | — | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. Disconnect fan relay #3.<br>2. Turn ON the ignition.<br>Did the Left fan turn OFF? | — | *Go to Step 25* | *Go to Step 20* |
| 4 | 1. Disconnect fan relay #1.<br>2. Probe the relay 1 control circuit (335) at the relay #1 connector location (B1) using a *J 34142-B* Test Lamp that is connected to B+.<br>3. With a scan tool, command the Low Speed Fans ON.<br>Does the test lamp illuminate? | — | *Go to Step 5* | *Go to Step 12* |
| 5 | Probe both feed circuits (1640 and 402) at the relay #1 connector locations (B3 and C3) using a test lamp that is connected to a good ground.<br>Does test lamp illuminate for both circuits? | — | *Go to Step 6* | *Go to Step 21* |
| 6 | **Important:** Leave jumper in place for remainder of this table.<br>Connect a fused jumper wire between the switch feed circuit (402) and the LH fan feed circuit (409) at the relay #1 connector locations (B3 and C1).<br>Do both fans turn ON? | — | *Go to Step 22* | *Go to Step 7* |
| 7 | 1. Disconnect the left fan.<br>2. Probe fan harness connector terminal B with a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 8* | *Go to Step 23* |
| 8 | Connect a second fused jumper wire between the fan harness connector terminals.<br>Is the right fan ON? | — | *Go to Step 15* | *Go to Step 9* |

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## Electric Cooling Fan Table #2 (cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 9 | 1. Reconnect the left fan.<br>2. Disconnect fan relay #3.<br>3. Probe the switch feed circuit (532) at the fan relay #3 connector location (C8) using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 24* |
| 10 | Using the second jumper wire, jumper the switch ignition feed circuit (532) and the RH fan feed circuit (504) together at relay #3 connector locations (B9 and C8).<br>Do the fans come ON? | — | *Go to Step 25* | *Go to Step 11* |
| 11 | 1. Reconnect fan relay #3.<br>2. Disconnect the right fan.<br>3. Probe fan harness connector terminal B with a test lamp that is connected to a good ground.<br>Is the left fan ON? | — | *Go to Step 15* | *Go to Step 17* |
| 12 | 1. Test lamp still connected.<br>2. Turn OFF the ignition.<br>3. Disconnect the PCM.<br>4. Probe the cooling fan #1 relay control circuit at the PCM connector, with a fused jumper wire that is connected to a good ground.<br>Is the test lamp illuminated? | — | *Go to Step 19* | *Go to Step 20* |
| 13 | Inspect the PCM connections. Repair faulty connections as necessary. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | *Go to Step 26* |
| 14 | Repair the relay 1 control circuit (335) for an open or shorted to B+. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 15 | Inspect the fan motor ground circuit for a open or the fan motor connections and repair as necessary. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* or *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | *Go to Step 16* |
| 16 | Replace the fan motor.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 17 | Repair the RH fan feed circuit (504) for an open. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 18 | Replace the fan which was not operating.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 19 | Replace fan relay #2.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |

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**Electric Cooling Fan Table #2 (cont'd)**

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 20 | Repair the relay #3 switch feed circuit (532) for a short to ground. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | *Go to Step 25* |
| 21 | 1. Test for the following:<br>– Open on the feed circuit<br>– Short to ground on the feed circuit<br>– Either fan motor shorted to ground<br>2. Repair as necessary. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems or *Cooling Fan Motor Replacement - Electric* in Engine Cooling.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 22 | Replace fan relay #1.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 23 | Repair the LH fan feed circuit (409) for a open. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 24 | Repair the relay #3 switch feed circuit (532) for a open. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 25 | Replace fan relay #3.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 26 | **Important:** The replacement PCM must be programmed. Refer to *PCM Replacement/Programming.*<br>Replace the PCM.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |

## Electric Cooling Fan Diagnosis (Table 3)

**Electric Cooling Fan Table #3**

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Cooling Fan Functional Check? | — | *Go to Step 2* | Go to *Electric Cooling Fan Diagnosis (Functional Check)* |
| 2 | 1. With a scan tool, command the Low Speed Cooling Fans ON.<br>2. Command the High Speed Cooling Fans ON while observing the fans.<br>Did both fans operate with no change? | — | *Go to Step 8* | *Go to Step 3* |
| 3 | Did the left fan stop operating? | — | *Go to Step 9* | *Go to Step 4* |

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## Electric Cooling Fan Table #3 (cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 4 | 1. Disconnect fan relay #2.<br>2. Probe the relay 2 and 3 control circuit (473) at relay #2 connector location (B4) using a *J 34142-B* Test Lamp that is connected to B+.<br>3. Command the High Speed Cooling Fans ON using a scan tool.<br>Does the test lamp illuminate after several seconds? | — | *Go to Step 5* | *Go to Step 12* |
| 5 | Probe the coil feed circuit (1640) at relay #2 connector location (C6) using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 6* | *Go to Step 13* |
| 6 | Probe the switch feed circuit (402) at the relay #2 connector location (C4) using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 7* | *Go to Step 14* |
| 7 | Jumper the switch ignition feed circuit (402) and the RH fan feed circuit (504) together at the relay #2 connector locations (C4 and B6).<br>Is the right fan ON? | — | *Go to Step 15* | *Go to Step 16* |
| 8 | 1. Turn OFF the ignition.<br>2. Disconnect the PCM.<br>3. Disconnect fan relay #1.<br>4. Jumper the switch feed circuit (402) and the LH fan feed circuit (409) together at the relay #1 connector locations (B3 and C1).<br>5. Turn the ignition ON.<br>6. Probe the PCM harness connector for the cooling fan relay #2 and #3 control with a test lamp that is connected to a good ground.<br>Do the fans switch from low to high speed? | — | *Go to Step 22* | *Go to Step 17* |
| 9 | 1. Disconnect fan relay #3.<br>2. Probe the relay 2 and 3 control circuit (473) at the relay #3 connector location (C10) using a test lamp that is connected to B+.<br>3. Command the High Speed Cooling Fans ON using a scan tool.<br>Does the test lamp illuminate? | — | *Go to Step 10* | *Go to Step 18* |
| 10 | Probe the ground circuit (150) at the relay #3 connector location (B10) using a test lamp that is connected to B+.<br>Does the test lamp illuminate? | — | *Go to Step 11* | *Go to Step 19* |
| 11 | Probe the coil feed circuit (1640) at the relay #3 connector location (B8) using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 20* | *Go to Step 21* |
| 12 | Repair the relay 2 and 3 control circuit (473) for an open between fan relay #2 and the splice. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 13 | Repair the open in the relay #2 coil feed circuit (1640). Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |

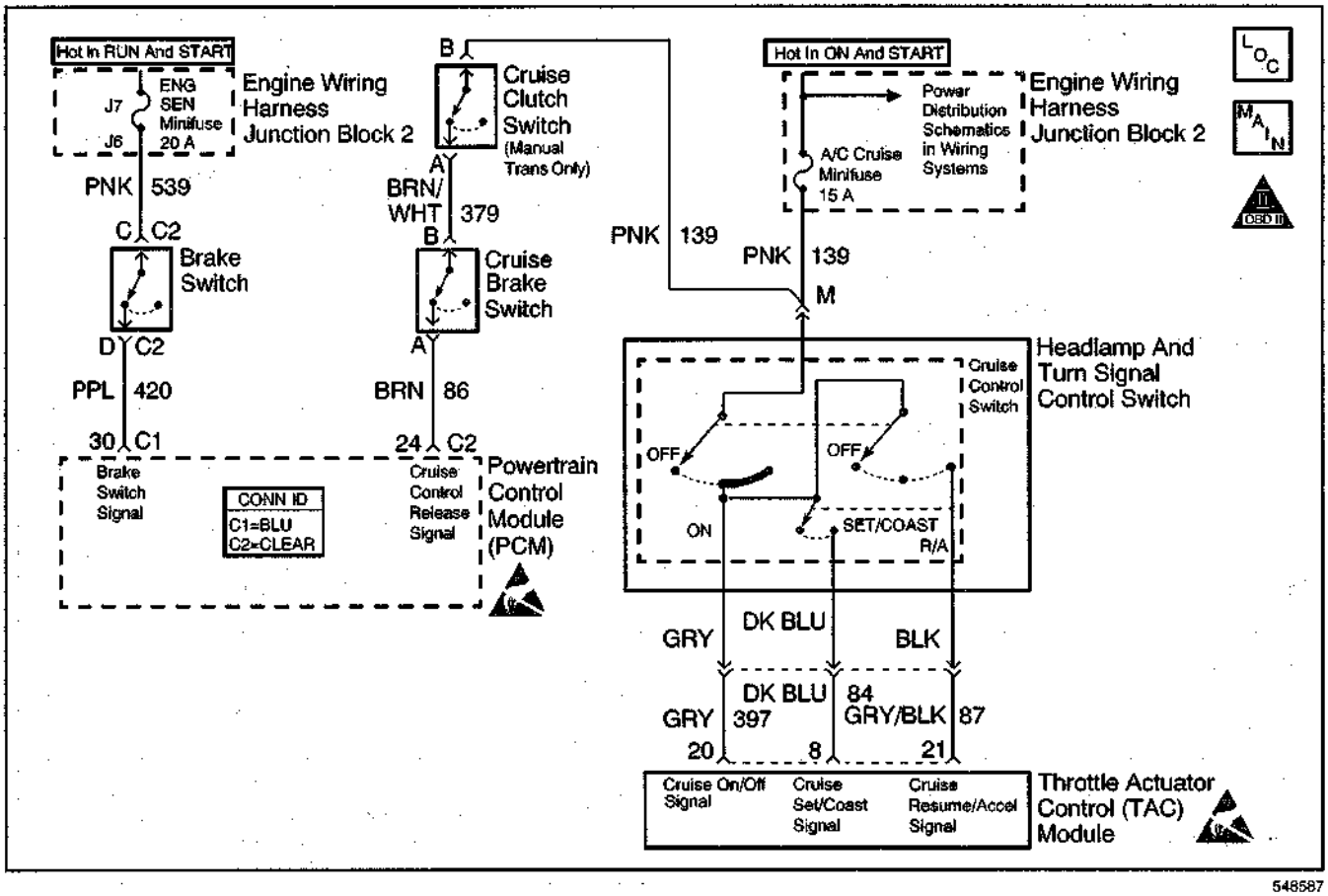
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## Electric Cooling Fan Table #3 (cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 14 | Repair the open in the relay #2 switch feed circuit (402). Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 15 | Replace the fan relay #2.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 16 | Repair the open in the RH fan feed circuit (504) between fan relay #2 and the splice. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 17 | Repair the fan 2 and 3 relay control circuit (473) for an open or for a short to B+. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 18 | Repair the open in the fan 2 and 3 relay control circuit (473) between fan relay #3 and the splice. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 19 | Repair the open in the ground circuit (150). Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 20 | Replace the fan relay #3.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 21 | Repair the open in relay #3 coil feed circuit (1640). Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |
| 22 | 1. Inspect the PCM connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>2. Repair faulty connections as necessary. Refer to *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | *Go to Step 23* |
| 23 | **Important:** The replacement PCM must be programmed. Refer to *PCM Replacement/Programming.*<br>Replace the PCM.<br>Did you complete the repair? | — | Go to *Electric Cooling Fan Diagnosis (Functional Check)* | — |

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## Cruise Control Diagnosis




548587

### Circuit Description

The Cruise Control System is a speed control system that maintains a desired vehicle speed under normal driving conditions. The cruise control system has the capability of the following:

- Cruise
- Coast
- Resume speed
- Accelerate
- Raise (Tap-up) the vehicle speed by 1.6 km/h (1 mph)
- Lower (Tap-down) the vehicle speed by 1.6 km/h (1 mph)

The PCM controls the cruise system. When the cruise control switch is in the ON position and you push the cruise SET/COAST switch, the PCM maintains the current vehicle speed. If the engine load varies, the PCM commands the throttle blade to the appropriate position in order to maintain the desired vehicle speed.

The cruise control system consists of the following components:

- Powertrain control module (PCM)
- Throttle actuator control (TAC) module
- Throttle body/TAC assembly
- Cruise control actuator lever

### Conditions for Enabling the Cruise System

- The cruise switch is in the ON position.
- The ignition voltage is between 9 and 16 volts.
- Ignition voltage is present to the cruise actuator lever.
- The vehicle speed is more than 39 km/h (24 mph).
- The engine speed is between 550 and 5900 RPM.
- The clutch or brake pedal is not depressed.
- The transmission is in a forward gear other than first.
- The vehicle is not in a traction control event.
- The engine is not in Engine Coolant Over Temperature-Fuel Disabled mode.
- The engine has been running for more than 5 seconds.

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### Conditions for Disabling the Cruise System

- The cruise switch is turned to the OFF position.
- Ignition voltage is interrupted to the cruise actuator lever.
- The vehicle speed is less than 39 km/h (24 mph).
- The clutch or brake pedal is depressed.
- The engine is in Engine Coolant Over Temperature-Fuel Disabled mode.
- The transmission is placed into neutral.
- A problem with the clutch or brake pedal switches or circuits that the PCM module interprets as the pedal is applied.

### Diagnostic Aids

Use the scan tool in order to monitor the Cruise Disengage History. This parameter lists the last 8 cruise disengage events. Refer to Cruise Disengage History table for a description of each condition.

The cruise control system disables for the current ignition cycle if an intermittent condition exists and DTC P0567 or DTC P0568 sets.

### Cruise Control Disengage Definitions

| Scan Tool Display | Definition |
|---|---|
| ALDL | The PCM detects the scan tool has sent a inhibit message via serial data. |
| Bad Memory | The cruise system has detected a RAM corruption. |
| Brake | The PCM detects one of the brake switches active (TCC Brake Switch/Cruise Control Brake Switch or Stop Lamp Switch). |
| Pedal Initialize | The PCM does not detect the brake switch active during an ignition cycle. (Auto Trans only) |
| Cancel | The PCM detects the cruise cancel switch has been depressed. |
| Clutch Switch | The PCM detects the clutch has been depressed. |
| Coast Disengage | The PCM senses the vehicle speed is greater than 8 km/h (5 mph) below the set speed or the coast button is depressed for longer than 3 seconds. |
| Coast Speed Low | The Set/Coast switch is pushed and held until vehicle speed drops below 32 km/h (20 mph). Vehicle speed below 32 km/h (20 mph) will disable the cruise system. |
| Eng Run Time | The PCM has detected the engine has not been running for longer than 5 seconds. |
| Eng Speed | The PCM has detected the engine speed is not between 550 and 5900 RPM. |
| TAC Inhibit | The PCM has detected that an Electronic Throttle Control fault is active. |
| DTC Set | The PCM has detected DTCs P0500, P0502, P0503, P0560, P0567, P0568, P0571, P0704, P0719, P0724, P0751, P0753, P0756, P0758, P0785 or P1574 are present. |
| Accel Rate | The vehicle acceleration is greater than the expected acceleration rate which is calculated by the PCM. |
| Decel Rate | The vehicle deceleration is greater than the expected deceleration rate which is calculated by the PCM. |
| High Speed | The PCM detects that the vehicle speed is greater than 225 km/h (140 mph). |
| Illegal CC Mode | The PCM will not allow cruise with the current position of the cruise switches. |
| INJ Disable | The PCM detect the Fuel Disable Mode is active. |
| Low Speed | The PCM detects that the vehicle speed is less than 39 km/h (24 mph) when cruise enable is attempted. |
| Man Neutral CC | The PCM has detected the transmission is in neutral. |
| MPH Limited | The PCM has detected that high speed fuel cutoff has been reached. |
| Cruise Off | The PCM does not detect that the cruise enable switch is active. |

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## Cruise Control Disengage Definitions (cont'd)

| Scan Tool Display | Definition |
|---|---|
| Over Set Speed | The TAC module detects that the vehicle speed is greater than the cruise memory speed by more than a predetermined amount or, the vehicle speed is greater than a predetermined value during a transient maneuver, such as, Resume, Accel, Tap-up or Tap-downs etc. |
| S/C On-Speed High | This parameter is displayed when the Set/Coast switch is applied (tap down vehicle speed) and the vehicle speed is greater than the cruise memory speed by more than a predetermined value. For example, if the cruise control system is set to maintain a vehicle speed of 48 km/h (30 mph) then the vehicle is accelerated to 80 km/h (50 mph) and you depress the Set/Coast again, the S/C On-Speed High message appears in the Cruise Control Disengage History. |
| Simul SC/RA Sw | The PCM detects the Set/Coast and Resume/Accel switches are active at the same time. |
| Traction Loss | The PCM module detects the vehicle is in a Traction Control event. |
| Under Set Speed | The PCM detects that the vehicle speed is less than the cruise memory speed by more than a predetermined amount or, the vehicle speed is less than a predetermined value during a transient maneuver, such as, Resume, Accel, Tap-up or Tap-downs etc. |
| First Gear | When the PCM detects the vehicle is in first gear. |
| Pedal Greater CC | The PCM senses the accelerator pedal is at a greater value than the commanded cruise position for more than 1 minute. |
| Ignition Volts | The PCM detect voltage out of the range of 9 to 16 volts. |
| Trans | The PCM detect the transmission is not in forward gear higher than 1st gear (auto trans) or the clutch is depressed (manual trans). |
| Wheel Speed Low | The PCM has detected the driven (rear) wheels are at a greater speed than the front wheels. |
| Wheel Speed High | The PCM has detected the driven (rear) wheels are at a lower speed than the front wheels. |
| MPH Governor | The PCM detects the vehicle has reached 190 km/h (118 mph). |
| RPM Governor | The PCM detects the engine has reached 5900 RPM. |

## Cruise Control System Check

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Is the A/C CRUISE fuse open? | — | *Go to Step 5* | *Go to Step 3* |
| 3 | 1. Turn ON the ignition.<br>2. With a scan tool, observe the brake, cruise release and TAC brake switch parameters.<br>3. Apply the brake.<br>Does the scan tool indicate RELEASED and switch to APPLIED when the brake pedal is depressed? | — | *Go to Step 4* | Go to applicable DTC |

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## Cruise Control System Check (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 4 | **Important:** This step is for manual transmission vehicles only. If the vehicle has an automatic transmission, refer to step 6.<br>With a scan tool, observe the clutch anticipate switch and the cruise release switch parameters while depressing the clutch pedal.<br>Does the scan tool indicate RELEASED and switch to APPLIED when the clutch pedal is depressed? | — | *Go to Step 6* | Go to applicable DTC |
| 5 | 1. Disconnect the 11 pin connector at the base of the steering column.<br>2. Probe the following circuits at the female end of the connector using a test lamp that is connected to B+.<br>• Switch feed (M)<br>• Cruise On/Off signal (L)<br>• Set/Coast signal (K)<br>• Resume/Accel signal (J)<br>Does the test lamp illuminate when touched to any of the circuits? | — | *Go to Step 19* | *Go to Step 21* |
| 6 | 1. Turn ON the ignition.<br>2. With a scan tool, observe the cruise switch parameter.<br>3. Turn the cruise switch ON and OFF.<br>Does the scan tool indicate OFF and switch to ON when the switch is turned ON? | — | *Go to Step 7* | *Go to Step 9* |
| 7 | 1. With a scan tool, observe the cruise set/coast parameter.<br>2. Push the cruise set/coast switch in.<br>Does the scan tool indicate ON when the switch was pushed in? | — | *Go to Step 8* | *Go to Step 12* |
| 8 | 1. With a scan tool, observe the cruise resume/accel parameter.<br>2. Push the cruise resume/accel switch in.<br>Does the scan tool indicate ON when the switch is pushed in? | — | Go to Diagnostic Aids | *Go to Step 14* |
| 9 | Does the cruise switch parameter indicate ON at all times? | — | *Go to Step 10* | *Go to Step 16* |
| 10 | 1. With a scan tool, observe the cruise switch parameter.<br>2. Disconnect the cruise switch.<br>Does the parameter switch to OFF when the switch is dicconnected? | — | *Go to Step 21* | *Go to Step 11* |
| 11 | Test the cruise On/Off signal circuit for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 24* |
| 12 | 1. Disconnect the 11 pin connector at the base of the steering column.<br>2. With a scan tool, observe the Set/Coast parameter.<br>3. Probe the Set/Coast signal circuit (K) at the female end of the connector using a test lamp that is connected to B+<br>Does the scan tool indicate ON when the test lamp is touched to the circuit? | — | *Go to Step 20* | *Go to Step 13* |
| 13 | Test for an open in the Set/Coast signal circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 23* |

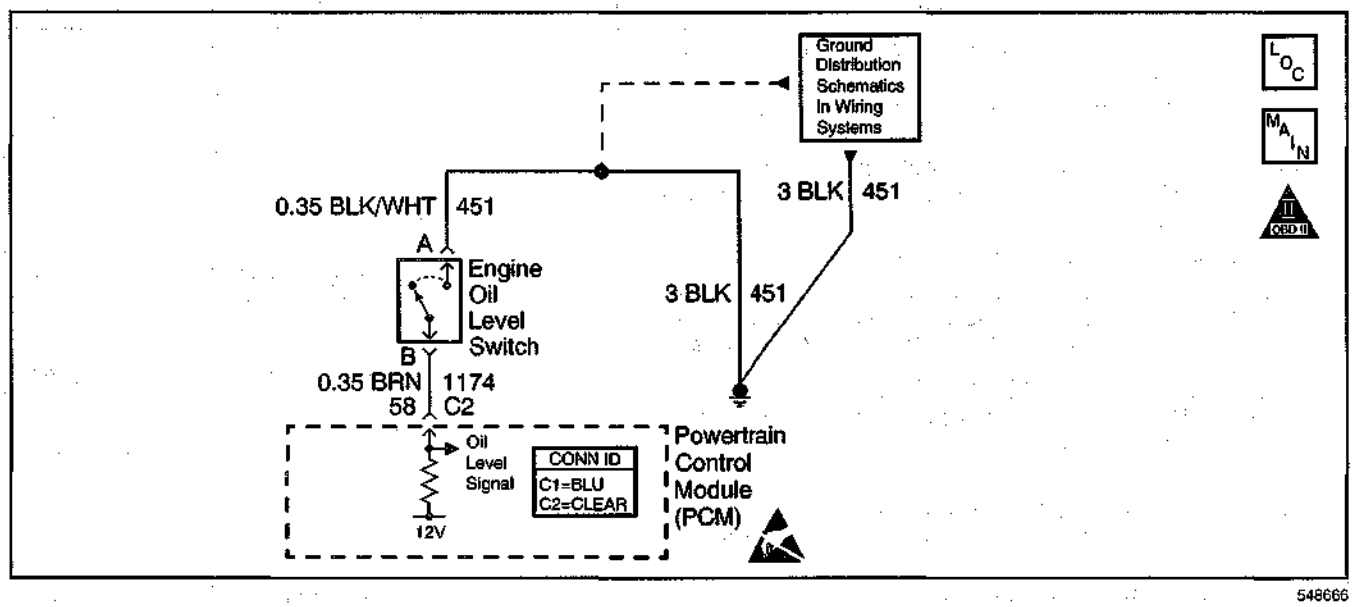
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## Cruise Control System Check (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 14 | 1. Disconnect the 11 pin connector at the base of the steering column.<br>2. With a scan tool, observe the Resume/Accel parameter.<br>3. Probe the Resume/Accel signal circuit (J) at the female end of the connector using a test lamp that is connected to B+<br>Does the scan tool indicate ON when the test lamp is touched to the circuit? | — | *Go to Step 20* | *Go to Step 16* |
| 15 | Test for an open in the Resume/Accel signal circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 23* |
| 16 | 1. Disconnect the 11 pin connector at the base of the steering column.<br>2. Turn ON the ignition.<br>3. Probe the switch feed (M) at the female end of the connector using a test lamp that is connected to ground.<br>Does the test lamp illuminate? | — | *Go to Step 17* | *Go to Step 22* |
| 17 | 1. With a scan tool, observe the Cruise Switch parameter.<br>2. Probe the Cruise On/Off signal circuit (L) at the female end of the connector using a test lamp that is connected to B+<br>Does the scan tool indicate ON when the test lamp is touched to the circuit? | — | *Go to Step 20* | *Go to Step 18* |
| 18 | Test for an open in the Cruise On/Off signal circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 23* |
| 19 | Test for a short to ground in the circuit which illuminated the test lamp. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 24* |
| 20 | Inspect for poor connections at the 11 pin connector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 21* |
| 21 | 1. Test the Steering column harness for opens, shorts or poor connections. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* or *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>2. If no problem is found replace the cruise switch. Refer to *Multifunction Turn Signal Lever Replacement - On Vehicle* in Steering Column.<br>Did you complete the repair? | — | System OK | — |
| 22 | Repair the open in the switch feed. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | System OK | — |
| 23 | Inspect for poor connections at the TAC module. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 24* |
| 24 | Replace the TAC module. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly).*<br>Did you complete the replacement? | — | System OK | — |

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## Engine Oil Level Sensor/Switch Diagnosis




548666

### Circuit Description

The engine oil level switch is a simple float switch that is grounded when the engine oil level is OK. The PCM tests the engine oil level switch circuit at startup. Before testing the state of the engine oil level switch, the PCM performs a test routine based on time and engine coolant temperature to ensure that the engine oil has drained back into the sump. To test for low oil level at startup, one of the following conditions must be present:

- If the engine coolant temperature was between 15°C (59°F) and 130°C (266°F) at the last key OFF, the engine coolant temperature at key ON must be at least 12°C (22°F) cooler than the engine coolant temperature at the last key OFF.
- If the engine coolant temperature was higher than 100°C (212°F) at the last key OFF, the time between last key OFF and the present key ON must be sufficient to allow the oil to drain back to the sump. The PCM will remain powered up for 10 seconds to ensure that the oil has drained back to the sump. If the key is turned back ON while the PCM is still powered up, the oil level will not be tested.

The low oil level lamp will be illuminated for approximately 7 minutes when the PCM tests for low oil level and the engine oil level switch indicates that a low oil level condition exists (Engine Oil Level switch circuit not grounded). When the ignition is first turned ON, the PCM commands the low oil level lamp ON for a brief period of time to test the bulb.

### Diagnostic Aids

For diagnosis of the instrument panel, perform the System Check in the Instrument Cluster section of Electrical Diagnosis.

Inspect for the following:

A switch stuck closed will indicate oil level parameter OK at all times even in a Low oil condition.

Engine oil level switch circuit: If the problem with the low oil level lamp can not be isolated using the Engine Oil Level Switch Diagnostic table, use the PCM Controlled Lamps Diagnostic table.

**Important:** Remove any debris from the connector surfaces before servicing a component. Inspect the connector gaskets when diagnosing or replacing a component. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion.

- Poor terminal connection.

  Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and faulty terminal to wire connection. Use a corresponding mating terminal to test for proper tension. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.

- Damaged harness.

  Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display may indicate the location of the fault. Refer to *Wiring Repairs* in Wiring Systems.

- Inspect the PCM and the engine grounds for clean and secure connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

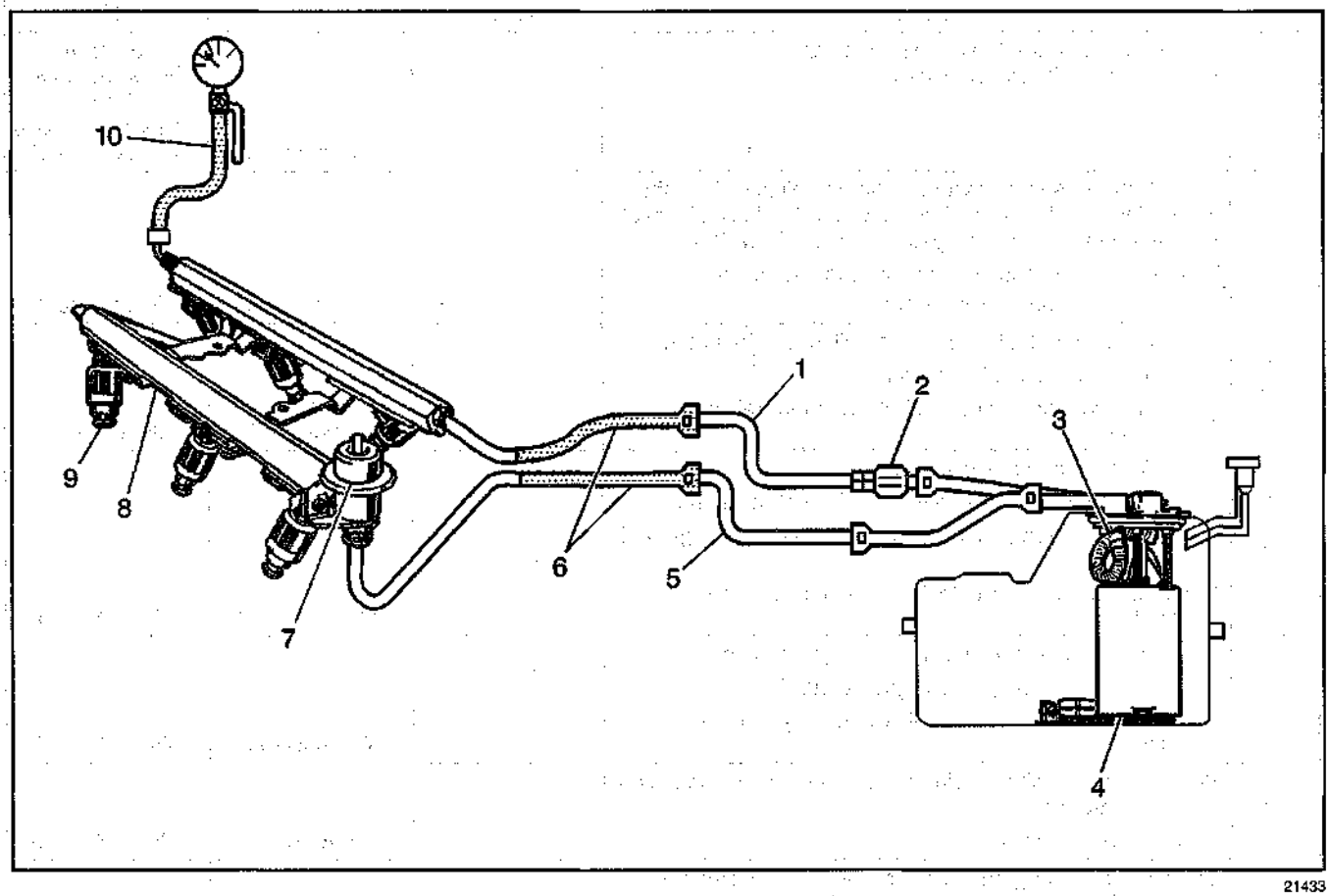
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## Oil Level Circuit Diagnosis

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** This table assumes that the oil level is at the proper level or the oil level was low and the Low Oil Level message never was displayed. Check for BCM DTCs.<br>With a scan tool, observe the Oil Level parameter.<br>Does the scan tool indicate OK? | — | *Go to Step 3* | *Go to Step 4* |
| 3 | 1. With a scan tool, observe the oil level parameter.<br>2. Disconnect the oil level switch.<br>Does the scan tool indicate LOW when the switch is disconnected? | — | Go to Diagnostic Aids | *Go to Step 7* |
| 4 | 1. Disconnect the oil level switch.<br>2. With a scan tool, observe the oil level parameter.<br>3. Install a fused jumper between the signal and ground circuits.<br>Does the scan tool indicate OK when the jumper is installed? | — | *Go to Step 11* | *Go to Step 5* |
| 5 | 1. Disconnect the jumper from the ground circuit.<br>2. Connect the jumper to a good ground.<br>Does the scan tool indicate OK when the jumper is installed? | — | *Go to Step 9* | *Go to Step 6* |
| 6 | Probe the signal circuit using a test lamp that is connected to a good ground.<br>Does the test lamp illuminate? | — | *Go to Step 8* | *Go to Step 10* |
| 7 | Test for a short to ground on the signal circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 14* |
| 8 | Test for a short to voltage on the signal circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 14* |
| 9 | Repair the open in the ground circuit. Refer to *Wiring Repairs* in Wiring Systems.<br>Did you complete the repair? | — | System OK | — |
| 10 | Test for an open in the signal circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 13* |
| 11 | Inspect for poor connections at the switch. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 12* |
| 12 | Replace the oil level switch.<br>Did you complete the repair? | — | System OK | — |
| 13 | 1. Inspect the PCM for poor connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.<br>2. Repair as necessary. Refer to *Connector Repairs* in Wiring Systems.<br>Did you find and correct the condition? | — | System OK | *Go to Step 14* |
| 14 | **Important:** The replacement PCM must be programmed.<br>Replace the PCM. Refer to *PCM Replacement/Programming*.<br>Did you complete the repair? | — | System OK | — |

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## Fuel System Pressure Test




21433

### Circuit Description

When the ignition is turned ON, the powertrain control module (PCM) will turn ON the in-tank fuel pump. The in-tank fuel pump will remain ON as long as the engine is cranking or running and the PCM is receiving reference pulses. If there are no reference pulses, the PCM will turn the in-tank fuel pump OFF 2 seconds after the ignition switch is turned ON or 2 seconds after the engine stops running. The in-tank fuel pump is an electric pump within an integral reservoir (4). The in-tank fuel pump supplies fuel through the fuel feed pipe (1), and in-line fuel filter (2) to the fuel rail assembly (8). The fuel pump is designed to provide fuel at a pressure above the pressure needed by the fuel injectors (9). A fuel pressure regulator (7), attached to the fuel rail, keeps the fuel available to the fuel injectors at a regulated pressure. Unused fuel is returned to the fuel tank by a separate fuel return pipe (5). The fuel pump flex pipe (3) functions as a conduit for transporting pressurized fuel from the fuel pump to the above cover fuel feed pipe. The fuel pump flex pipe also eliminates fuel pump generated pressure pulse noise, and eliminates clamps formerly needed for rubber hoses or nylon pipes. The fuel pressure gauge *J 34730-1A* (10). The fuel pipe return and feed hose assemblies are the pinch points used during the fuel system pressure test (6).

### Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. With the ignition ON and the fuel pump running, the fuel pressure indicated by the fuel pressure gage should be 333-376 kPa (48-55 psi). This pressure is controlled by the amount of pressure the spring inside the fuel pressure regulator can provide.
3. A fuel system that drops more than 5 psi in 10 minutes has a leak in one or more areas:
5. Fuel pressure that drops-off during acceleration, cruise or hard cornering may cause a lean condition. A lean condition can cause a loss of power, surging, or misfire. A lean condition can be diagnosed using a scan tool. If an extremely lean condition occurs, the oxygen sensorss will stop toggling. The oxygen sensor output voltages will drop below 500 mV. Also, the fuel injector width will increase.

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8. When the engine is at idle, the manifold pressure is low (high vacuum). This low pressure (high vacuum) is applied to the fuel pressure regulator diaphragm. The low pressure (high vacuum) will offset the pressure being applied to the fuel pressure regulator diaphragm by the spring inside the fuel pressure regulator. When this happens, the result is lower fuel pressure. The fuel pressure at idle will vary slightly as the barometric pressure changes, but the fuel pressure at idle should always be less than the fuel pressure noted in step 2 with the Engine OFF.
12. A rich condition may result from the fuel pressure being above 376 kPa (55 psi). A rich condition may cause a DTC P0132 or a DTC P0172 to set. Driveability conditions associated with rich conditions can include hard starting (followed by black smoke) and a strong sulfur smell in the exhaust.
13. This test determines if the high fuel pressure is due to a restricted fuel return pipe or if the high fuel pressure is due to a faulty fuel pressure regulator.
15. A lean condition may result from the fuel pressure being below 333 kPa (48 psi). A lean condition may cause a DTC P0131 or a DTC P0171 to set. Driveability conditions associated with lean conditions can include hard starting (when the engine is cold), hesitation, poor driveability, lack of power, surging, and misfiring.
16. Restricting the fuel return pipe with the fuel pipe shut-off adapter causes the fuel pressure to rise above the regulated fuel pressure. Using a scan tool to pressurize the system, the fuel pressure should rise above 376 kPa (55 psi) as the valve on the fuel pipe shut-off adapter connected to the fuel return pipe becomes partially closed.
22. Check the spark plug associated with a particular fuel injector for fouling or saturation in order to determine if that particular fuel injector is leaking. If checking the spark plug associated with a particular fuel injector for fouling or saturation does not determine that a particular fuel injector is leaking, use the following procedure.

## Fuel System Pressure Test

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you preform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | ***Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.***<br>1. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure*.<br>2. Turn OFF the air conditioning system.<br>**Important:** The fuel pump will run for approximately 2 seconds. Cycle the ignition as necessary in order to achieve the highest possible fuel level.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With the fuel pump running, measure the fuel pressure indicated on the fuel pressure gauge.<br>Does the fuel pressure measure within the specified value? | 333-376 kPa (48-55 psi) | *Go to Step 3* | *Go to Step 12* |
| 3 | The fuel pressure may vary slightly when the fuel pump stops running, the fuel pressure should stabilize and remain constant.ImportantNote the fuel pressure after the fuel pump stops running.<br>Does the fuel pressure drop more than the specified value in 10 minutes? | 34 kPa (5 psi) | *Go to Step 10* | *Go to Step 4* |
| 4 | With the fuel pressure gauge, relieve the fuel pressure to the specified higher value.<br>Does the fuel pressure drop more than the specified lower value within 10 minutes? | 69 kPa (10 psi)<br>14 kPa (2 psi) | *Go to Step 19* | *Go to Step 5* |
| 5 | Is the fuel pressure suspected of dropping-off during acceleration, cruise, or hard cornering? | — | *Go to Step 6* | *Go to Step 8* |

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## Fuel System Pressure Test (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 6 | Visually and physically inspect the following items for a restriction:<br>• The in-line fuel filter. Refer to *In-Line Fuel Filter Replacement*.<br>• The fuel feed pipe. Refer to *Fuel Hose/Pipes Replacement (Chassis)* or *Fuel Hose/Pipes Replacement (Engine Compartment)*.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 7* |
| 7 | 1. Remove the modular sender assembly. Refer to *Fuel Sender Assembly Replacement*.<br>2. Visually and physically inspect the following items:<br>• The fuel pump strainer for a restriction, correct position, and installation on the fuel sender assembly<br>• The fuel pump flex pipe for leaks.<br>• Verify the fuel pump is the correct fuel pump for this vehicle.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 19* |
| 8 | 1. Turn OFF the ignition, for 10 seconds.<br>**Important:** The fuel pump will run for approximately 2 seconds. Cycle the ignition as necessary in order to achieve the highest possible fuel level.<br>2. Turn ON the ignition.<br>3. Start the engine.<br>4. Let the engine run to a normal operating temperature.<br>Does the fuel pressure measurement drop less than the specified value? | 21-69 kPa (3-10 psi) | Go to Symptoms | *Go to Step 9* |
| 9 | 1. Disconnect the fuel pressure regulator vacuum hose.<br>2. With the engine idling, apply 12-14 inches of vacuum to the fuel pressure regulator.<br>Does the fuel pressure measurement drop within the specified value? | 21-69 kPa (3-10 psi) | *Go to Step 20* | *Go to Step 21* |
| 10 | 1. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure*.<br>2. Disconnect the fuel feed pipe and the fuel return pipe from the fuel rail. Refer to *Quick Connect Fitting(s) Service (Metal Collar)*.<br>3. Install the *J 37287* fuel pipe shut-off adapters between the fuel feed pipe and the fuel return pipe and the fuel rail.<br>4. With the *J 37287* fuel pipe shut-off adapters, open the valve.<br>5. Turn ON the ignition, with the engine OFF.<br>6. With a scan tool pressurize the fuel system.<br>7. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure*.<br>8. With a scan tool, command the fuel pump ON.<br>9. Wait for the fuel pressure to build.<br>***Notice:*** Do not allow the fuel pressure to exceed 450 kPa (65 psi). Fuel pressure in excess of 450 kPa (65 psi) may damage the Fuel Pressure Regulator.<br>10. With the fuel pipe shut-off adapter, close the fuel feed valve.<br>Does the fuel pressure remain constant? | — | *Go to Step 19* | *Go to Step 11* |

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## Fuel System Pressure Test (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 11 | 1. With the fuel pipe shut-off adapter, open the fuel feed valve.<br>2. With a scan tool, pressurize the fuel system.<br>3. Wait for the fuel pressure to build.<br>4. With the fuel pipe shut-off adapter, close the fuel return valve.<br>Does the fuel pressure remain constant? | — | *Go to Step 21* | *Go to Step 22* |
| *12* | Does the fuel pressure measure above the specified value? | 376 kPa (55 psi) | *Go to Step 13* | *Go to Step 15* |
| *13* | 1. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure.*<br>2. Disconnect the fuel pipe shut-off adaptor, from the fuel rail return pipe. Refer to *Quick Connect Fitting(s) Service (Metal Collar).*<br>3. Attach a length of flexible fuel hose to the fuel rail return outlet passage.<br>4. Place the open end of the flexible hose into an approved gasoline container.<br>5. Turn OFF the ignition, for 10 seconds.<br>6. Turn ON the ignition, with the engine OFF.<br>7. Measure the fuel pressure with the fuel pump running.<br>Does the fuel pressure measure within the specified value? | 333-376 kPa (48-55 psi) | *Go to Step 23* | *Go to Step 14* |
| 14 | Visually and physically inspect the fuel rail outlet passages for a restriction.<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 21* |
| *15* | Does the fuel pressure measure above the specified value? | 0 kPa (0 psi) | *Go to Step 16* | *Go to Step 17* |
| *16* | 1. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure.*<br>2. Disconnect the fuel return pipe from the fuel rail. Refer to *Quick Connect Fitting(s) Service (Metal Collar).*<br>3. Install the *J 37287* fuel pipe shut-off adapter between the fuel return pipe and the fuel rail.<br>4. With the fuel pipe shut-off adapter, open the valve.<br>5. Turn ON the ignition.<br>6. With a scan tool, pressurize the fuel system.<br>7. Place the bleed hose of the fuel pressure gauge into an approved gasoline container.<br>8. With the fuel pressure gauge, Bleed off the air.<br>***Notice:*** Do not allow the fuel pressure to exceed 450 kPa (65 psi). Fuel pressure in excess of 450 kPa (65 psi) may damage the Fuel Pressure Regulator.<br>9. With the fuel pipe shut-off valve, slowly close the fuel return valve.<br>Does the fuel pressure rise above the specified value? | 333-376 kPa (48-55 psi) | *Go to Step 21* | *Go to Step 7* |
| 17 | Perform Fuel pump relay circuit diagnostic. Refer to *Fuel Pump Electrical Circuit Diagnosis.*<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 18* |

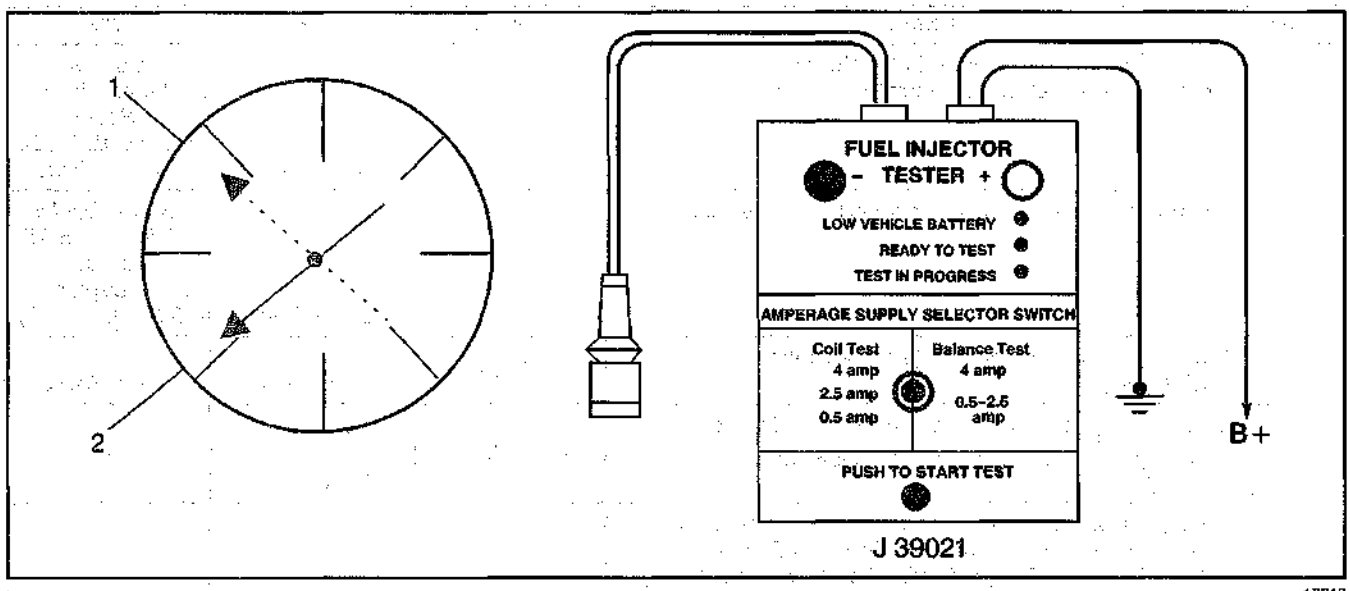
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## Fuel System Pressure Test (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 18 | Visually and physically inspect the following items:<br>• The in-line fuel filter for obstructions. Refer to *In-Line Fuel Filter Replacement.*<br>• The fuel feed pipe for a restriction. Refer to *Fuel Hose/Pipes Replacement (Chassis).*<br>• The fuel pump strainer for obstructions. Refer to *Fuel Pump Strainer Replacement.*<br>• The fuel pump flex pipe for leaks. Refer to *Fuel Sender Assembly Replacement.*<br>Did you find and correct the condition? | — | *Go to Step 24* | *Go to Step 19* |
| 19 | Replace the modular fuel sender assembly. Refer to *Fuel Sender Assembly Replacement.*<br>Did you complete the repair? | — | *Go to Step 24* | — |
| 20 | Locate and repair the loss of vacuum to the fuel pressure regulator.<br>Did you complete the repair? | — | *Go to Step 24* | — |
| 21 | Replace the fuel pressure regulator. Refer to *Fuel Pressure Regulator Replacement.*<br>Did you complete the repair? | — | *Go to Step 24* | — |
| 22 | Locate and replace any leaking fuel injectors. Refer to *Fuel Injector Replacement.*<br>Did you complete the repair? | — | *Go to Step 24* | — |
| 23 | Locate and correct the restriction in the fuel return pipe.<br>Did you complete the repair? | — | *Go to Step 24* | — |
| 24 | ***Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.***<br>1. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure.*<br>2. Turn OFF the air conditioning system.<br>**Important:** The fuel pump will run for approximately 2 seconds. Cycle the ignition as necessary in order to achieve the highest possible fuel level<br>3. Turn ON the ignition, with the engine OFF.<br>4. With the fuel pump running, measure the fuel pressure.<br>Does the fuel pressure measure within the specified value? | 333-376 kPa (48-55 psi) | *Go to Step 25* | *Go to Step 11* |
| 25 | **Important:** The fuel pressure may vary slightly when the fuel pump stops running, the fuel pressure should stabilize and remain constant. when the fuel pump stops running, measure the pressure.<br>Does the fuel pressure drop more than the specified value in 10 minutes? | 34 kPa (5 psi) | *Go to Step 10* | System OK |

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## Fuel Injector Balance Test




**Legend**

(1) First Reading

(2) Second Reading

### Injector Balance Test Example

| Cylinder | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1st Reading | 330 kPa (48 psi) | 330 kPa (48 psi) | 330 kPa (48 psi) | 330 kPa (48 psi) | 330 kPa (48 psi) | 330 kPa (48 psi) |
| 2nd Reading | 165 kPa (24 psi) | 124 kPa (18 psi) | 152 kPa (22 psi) | 186 kPa (27 psi) | 165 kPa (24 psi) | 165 kPa (24 psi) |
| Amount of Drop | 165 kPa (24 psi) | 206 kPa (30 psi) | 179 kPa (26 psi) | 145 kPa (21 psi) | 165 kPa (24 psi) | 165 kPa (24 psi) |
| Average Range: 162–183 kP a (23.5–26.5 psi) | Injector OK | Faulty injector - too much fuel drop | Injector OK | Faulty injector - too little fuel drop | Injector OK | Injector OK |

### Test Description

The numbers below refer to the step numbers on the diagnostic table

***Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.***

4. The engine coolant temperature must be below the operating temperature in order to avoid irregular fuel pressure readings due to Hot Soak fuel boiling.
5. The fuel pressure should be within the specified range. If the fuel pressure is not within the specified range.
6. The fuel pressure should reach a steady value. If the fuel pressure does not reach a steady value.
7. If the pressure drop value for each fuel injector is within 10 kPa (1.5 psi) of the average pressure drop value, the fuel injectors are flowing properly. Calculate the pressure drop value for each fuel injector by subtracting the second pressure reading from the first pressure reading. Refer to the Injector Balance Test Example.

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## Fuel Injector Balance Test

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Did you perform the Fuel Injector Coil Test Procedure? | — | *Go to Step 3* | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* |
| 3 | Is the engine coolant temperature above the specified value? | 94°C (201°F) | *Go to Step 4* | *Go to Step 5* |
| 4 | Allow the engine to cool below the specified value.<br>Is the engine coolant temperature below the specified value? | 94°C (201°F) | *Go to Step 5* | — |
| 5 | ***Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.***<br>1. Install the fuel pressure gauge.<br>2. Energize the fuel pump using the scan tool.<br>3. Place the bleed hose of the fuel pressure gauge into an approved gasoline container.<br>4. Bleed the air out of the fuel pressure gauge.<br>5. Using a scan tool pressurize the fuel system.<br>6. Wait for the fuel pressure to build.<br>**Important:** The fuel pump will run for approximately 2 seconds. Repeat Step 5 as necessary in order to achieve the highest possible fuel pressure.<br>7. Observe the reading on the fuel pressure gauge.<br>Is the fuel pressure within the specified limits? | 333–376 kPa (48–55 psi) | *Go to Step 6* | Go to *Fuel System Pressure Test* |
| 6 | Turn the fuel pump OFF.<br>Does the fuel pressure remain constant? | — | *Go to Step 7* | Go to *Fuel System Pressure Test* |

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## Fuel Injector Balance Test (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 7 | 1. Connect the *J 39021* fuel injector tester to a fuel injector.<br>2. Set the amperage supply selector switch on the fuel injector tester to the Balance Test 0.5-2.5 amp position.<br>3. Turn the fuel pump ON then OFF in order to pressurize the fuel system.<br>4. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the 1st pressure reading.<br>5. Energize the fuel injector by depressing the Push to Start Test button on the fuel injector tester.<br>6. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure gauge needle has stopped moving. This is the 2nd pressure reading.<br>7. Repeat steps 1 through 6 for each fuel injector.<br>8. Subtract the 2nd pressure reading from the 1st pressure reading for one fuel injector. The result is the pressure drop value.<br>9. Obtain a pressure drop value for each fuel injector.<br>10. Add all of the individual pressure drop values. This is the total pressure drop.<br>11. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop.<br>Does any fuel injector have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value? | 10 kPa (1.5 psi) | *Go to Step 8* | Go to *Symptoms* |
| 8 | ***Notice:*** Do Not repeat any portion of this test before running the engine in order to prevent the engine from flooding.<br>Re-test any fuel injector that does not meet the specification. Refer to the procedure in step 7.<br>Does any fuel injector still have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value? | 10 kPa (1.5 psi) | *Go to Step 9* | Go to *Symptoms* |
| 9 | Replace the faulty fuel injectors. Refer to *Fuel Injector Replacement.*<br>Is the action complete? | — | System OK | — |

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## Fuel Injector Balance Test with Tech 2

### Circuit Description

The scan tool first energizes the fuel pump and then the injectors for a precise amount of time allowing a measured amount of fuel into the manifold. This causes a drop in system fuel pressure that can be recorded and used to compare each injector.

### Test Description

The numbers below refer to the step numbers in the diagnostic table.

***Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.***

3. The engine coolant temperature must be below the operating temperature in order to avoid irregular fuel pressure readings due to Hot Soak fuel boiling.
4. Tests the fuel system for the ability to reach a specified fuel pressure range.
5. Tests the fuel system for the abilty to maintain a specified fuel pressure range.
6. If the pressure drop value for each fuel injector is within 10 kPa (1.5 psi) of the average pressure drop value, the fuel injectors are flowing properly. Calculate the pressure drop value for each fuel injector by subtracting the second pressure reading from the first pressure reading.

**Fuel Injector Balance Test with Tech 2**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | Did you perform the Fuel Injection coil test. | — | *Go to Step 3* | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)* or *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* |
| *3* | **Important:** Do not preform this test if the engine coolant temperature is above 94°C (201°F).<br>Install a scan tool.<br>Does the scan tool indicate that the ECT parameter is less than the specified value? | 94°C (201°F) | *Go to Step 4* | — |

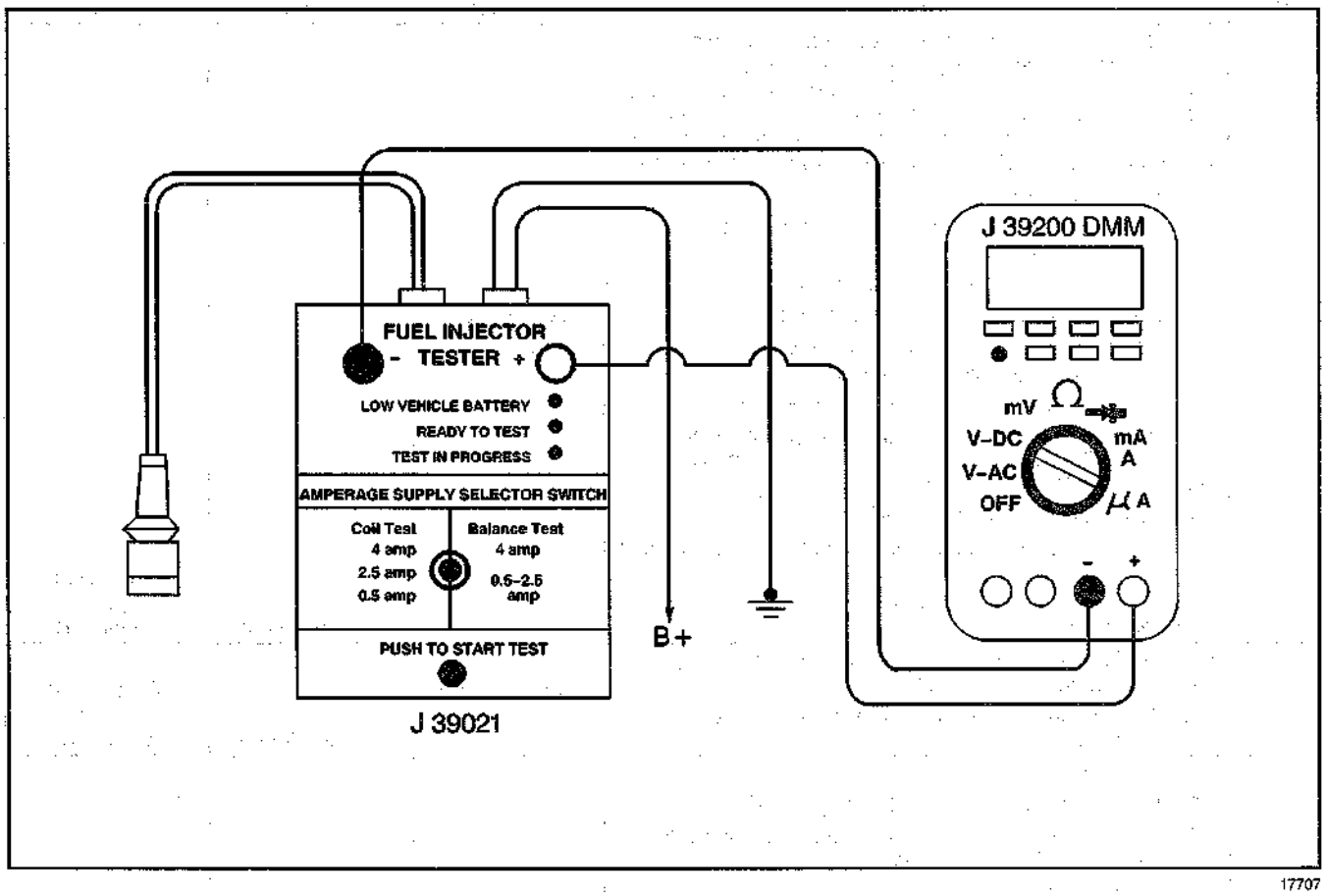
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**Fuel Injector Balance Test with Tech 2 (cont'd)**

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 4 | ***Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.***<br>1. Turn OFF the ignition.<br>2. Connect the *J 34730-1A* fuel pressure gauge to the fuel pressure test port.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, Command the fuel pump ON.<br>5. Place the bleed hose of the fuel pressure gauge into an approved gasoline container.<br>6. Bleed the air out of the fuel pressure gauge.<br>**Important:** The fuel pump will run for approximately 2 seconds. Repeat as necessary in order to achieve the highest possible fuel pressure.<br>7. Command the fuel pump ON.<br>8. Observe the reading on the fuel pressure gauge while the fuel pump is running.<br>Does the fuel pressure measure within the specified Value? | 333–380 kPa (48–55 psi) | *Go to Step 5* | Go to *Fuel System Diagnosis* |
| 5 | After the fuel pump stops, the fuel pressure may vary slightly, then should hold steady.<br>Does the fuel pressure remain constant within the specified value? | 333-380 kPa (48-55 psi) | *Go to Step 6* | Go to *Fuel System Diagnosis* |
| 6 | 1. Turn OFF the ignition.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, select Fuel injector Balance within the Special Functions menu.<br>4. Select an injector to be tested.<br>5. Press Enter. This will prime the fuel pump.<br>6. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the 1st pressure reading.<br>7. Energize the fuel injector by depressing the Pulse Injector button on the scan tool. This will energize the injector and decrease the fuel pressure.<br>8. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure gauge needle has stopped moving. This is the 2nd pressure reading.<br>9. Press Enter again to bring you back to the Select Injector screen.<br>10. Repeat for each fuel injector.<br>11. Subtract the 2nd pressure reading from the 1st pressure reading for one fuel injector. The result is the pressure drop value.<br>12. Obtain a pressure drop value for each fuel injector.<br>13. Add all of the individual pressure drop values. This is the total pressure drop.<br>14. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop.<br>Does any fuel injector have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value? | 10 kPa (1.5 psi) | *Go to Step 7* | Go to *Symptoms* |
| 7 | Replace the faulty fuel injectors. Refer to *Fuel Injector Replacement.*<br>Is the replacement complete? | — | *Go to Step 8* | — |
| 8 | Does any driveabilty condition still exist? | — | Go to applicable diagnostic | System OK |

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## Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)




### Test Description

The below refer to the step numbers in the diagnostic table.

***Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.***

2. The engine coolant temperature affects the ability of the fuel injector tester to detect a faulty fuel injector. If the engine coolant temperature is NOT Between 10°C–35°C (50°F–95°F).
3. The first second of the voltage displayed by the DMM may be inaccurate due to the initial current surge. Therefore, record the lowest voltage displayed by the DMM after the first second of the test. The voltage displayed by the DMM should be within the specified range (refer to the Example). The voltage displayed by the DMM may increase throughout the test as the fuel injector windings warm and the resistance of the fuel injector windings changes. An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector.

| Resistance Ohms | Voltage Specification at 10°C–35°C (50°F–95°F) | |
|---|---|---|
| 11.4-12.6 | 5.7-6.6 | |
| Fuel injector number | Voltage Reading | Pass/Fail |
| 1 | 6.3 | P |
| 2 | 5.9 | P |
| 3 | 6.2 | P |
| 4 | 6.1 | P |
| 5 | 4.8 | F |
| 6 | 6.0 | P |

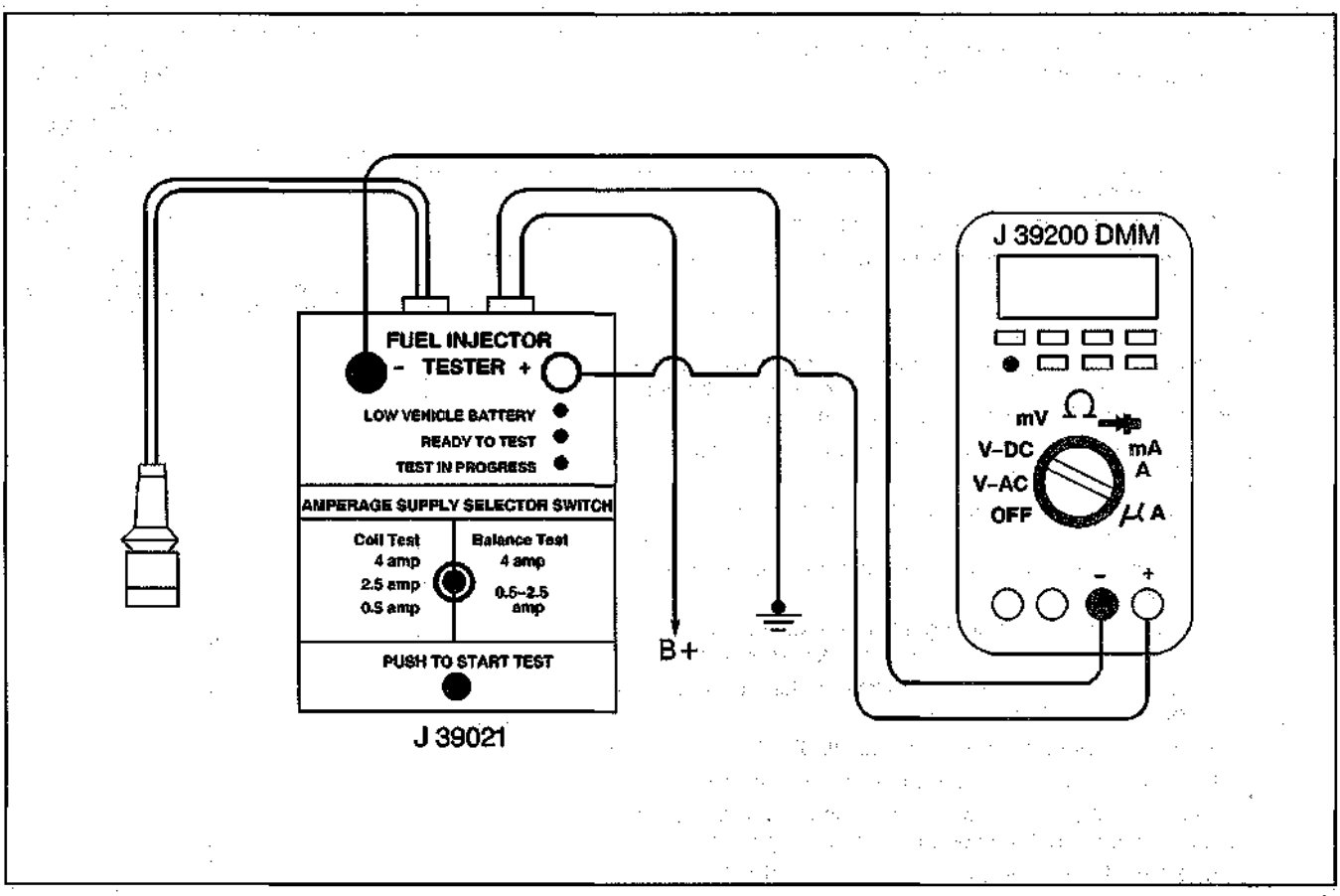
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## Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Connect the scan tool.<br>2. Check the engine coolant temperature.<br>Is the engine coolant temperature between the specified limits? | 10°C-35°C (50°F-95°F) | *Go to Step 3* | Go to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)* |
| 3 | 1. Turn the ignition OFF.<br>***Notice:*** In order to prevent flooding of a single cylinder and possible engine damage, relieve the fuel pressure before performing the fuel injector coil test procedure.<br>2. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure.*<br>3. Access the fuel injector electrical connectors as required.<br>4. Connect the *J 39021* fuel injector tester to B+ and ground.<br>5. Set the amperage supply selector switch on the fuel injector tester to the Coil Test 0.5 amp position.<br>6. Connect the leads from the DMM to the fuel injector tester. Refer to the illustration.<br>7. Set the DMM to the tenths scale (0.0).<br>8. Connect the fuel injector tester to a fuel injector.<br>**Important:** Check the engine coolant temperature again in order to ensure that the correct chart is being used.<br>9. Press the Push to Start Test button on the fuel injector tester.<br>10. Observe the voltage reading on the DMM.<br>**Important:** The voltage reading may rise during the test.<br>11. Record the lowest voltage observed after the first second of the test.<br>12. Repeat the procedure for the remaining fuel injectors.<br>Did any fuel injector have an erratic voltage reading or a voltage reading outside of the specified limits? | 5.7-6.6 volts | *Go to Step 4* | Go to *Fuel Injector Balance Test* |
| 4 | Replace the fuel injectors. Refer to *Fuel Injector Replacement.*<br>Is the action complete? | — | Go to *Fuel Injector Balance Test* | — |

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## Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)




### Test Description

The numbers below refer to the step numbers in the diagnostic table.

***Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.***

2. The engine coolant temperature affects the ability of the fuel injector tester to detect a faulty fuel injector. If the engine coolant temperature is NOT Outside 10°C-35°C (50°F-95°F), go to Fuel Injector Coil Test Procedure - engine coolant tamperature Between 10°C- 35°C (50°F-95°F).
3. The first second of the voltage displayed by the DMM may be inaccurate due to the initial current surge. Therefore, record the lowest voltage displayed by the DMM after the first second of the test. The voltage displayed by the DMM may increase throughout the test as the fuel injector windings warm and the resistance of the fuel injector windings changes. An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector. From the voltages recorded, identify the highest voltage, excluding any voltages above 9.5 volts. Subtract each voltage that is not above 9.5 volts from the highest voltage. Record each subtracted value (refer to the Example). The subtracted value for any fuel injector must not exceed 0.6 volt. A fuel injector with a subtracted value that is more than 0.7 volt is faulty. Replace the fuel injector. A fuel injector with a recorded voltage above 9.5 volts is also faulty. Replace the fuel injector.

| Highest Voltage Reading | | Acceptable Subtracted Value Above/Below 10°C–35°C (50°F–95°F) | |
|---|---|---|---|
| 7.1 Volts | | 0.6 V | |
| Injector Number | Voltage | Subtracted Value | Pass/Fail |
| 1 | 9.8 | — | F |
| 2 | 6.6 | 0.5 | P |
| 3 | 6.9 | 0.2 | P |
| 4 | 5.8 | 1.3 | F |
| 5 | 7.0 | 0.1 | P |
| 6 | 7.1 | 0.0 | P |

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## Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | 1. Connect the scan tool.<br>2. Check the engine coolant temperature.<br>Is the engine coolant temperature outside the specified limits? | 10°C-35°C (50°F-95°F) | *Go to Step 3* | Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F).* |
| 3 | 1. Turn the ignition OFF.<br>***Notice:*** In order to prevent flooding of a single cylinder and possible engine damage, relieve the fuel pressure before performing the fuel injector coil test procedure.<br>2. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure.*<br>3. Access the fuel injector electrical connectors as required.<br>4. Connect the *J 39021* fuel injector tester to B+ and ground.<br>5. Set the amperage supply selector switch on the fuel injector tester to the Coil Test 0.5 amp position.<br>6. Connect the leads from the DMM to the fuel injector tester. Refer to the illustration.<br>7. Set the DMM to the tenths scale (0.0).<br>8. Connect the fuel injector tester to a fuel injector.<br>**Important:** Check the engine coolant temperature again in order to ensure that the correct chart is being used.<br>9. Press the Push to Start Test button on the fuel injector tester.<br>10. Observe the voltage reading on the DMM.<br>**Important:** The voltage reading may rise during the test.<br>11. Record the lowest voltage observed after the first second of the test.<br>12. Repeat the procedure for the remaining fuel injectors.<br>13. Identify the highest voltage reading recorded other than those above 9.5 volts.<br>14. Subtract any other voltage reading recorded from the highest voltage reading recorded.<br>15. Repeat step 14 for all the remaining fuel injectors.<br>Is any value that resulted from subtraction more than the specified value? | 0.6 volts | *Go to Step 4* | Go to *Fuel Injector Balance Test* |
| 4 | Replace any fuel injector that had any of the following:<br>• A subtracted value exceeding 0.6 volts.<br>• An initial reading above 9.5 volts.<br>• An erratic reading.<br>Refer to *Fuel Injector Replacement.*<br>Is the action complete? | — | Go to *Fuel Injector Balance Test* | — |

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## Fuel Tank Leak Check

***Caution: Place a dry chemical (Class B) fire extinguisher near the area before performing a Fuel Tank Leak Check. Before removing the fuel tank for a suspected leak, make sure that the fuel pipes or the tubes are not leaking onto the tank. Once removed, make sure that the fuel is not leaking around the fuel sender O-ring. Failure to follow these precautions may result in personal injury.***

**Important:** This check requires a fuel sender assembly, a fuel filler cap, and a fuel sender gasket to be installed in the fuel tank.

1. Relieve fuel system pressure. Refer to *Fuel Pressure Relief Procedure*.
2. Remove the fuel tank. Refer to *Fuel Tank Pressure Sensor Replacement*.
3. Cap the fuel feed pipe, the fuel return pipe, and the EVAP pipe on the fuel sender assembly.
4. Install a piece of fuel line on vent pipe.
5. Submerge the fuel tank in water or apply a soap solution to the outside of the fuel tank.
6. Apply 31–38 kPa (4½–5½ psi) air pressure to the piece of hose on the fuel tank vent pipe. Air bubbles appearing from the fuel tank indicate a leak.
7. Replace the fuel tank if it is leaking. Refer to *Fuel Tank Pressure Sensor Replacement*.

## Alcohol/Contaminants-in-Fuel Diagnosis

Alcohol concentrations greater than 10 percent in fuel can be detrimental to fuel system components and may cause driveability problems such as hesitation, lack of power, stall, no start, etc.

The problems may be due to fuel system corrosion and subsequent fuel filter plugging, deterioration of rubber components, and/or air-fuel mixture leaning.

Various types and concentrations of alcohol are used in commercial fuel. Some alcohol is more detrimental to fuel system components than others. If an excessive amount of alcohol in the fuel is suspected as the cause of a driveability condition, the following procedure may be used to detect the presence of alcohol in the fuel.

### Testing Procedure

The fuel sample should be drawn from the bottom of the tank so that any water present in the tank will be detected. The sample should be bright and clear. If the sample appears cloudy, or contaminated with water (as indicated by a water layer at the bottom of the sample), this procedure should not be used, and the fuel system should be cleaned.

1. Using a 100 ml specified cylinder with 1 ml graduation marks, fill the cylinder with fuel to the 90 ml mark.
2. Add 10 ml of water in order to bring the total fluid volume to 100 ml and install a stopper.
3. Shake the cylinder vigorously for 10 to 15 seconds.
4. Carefully loosen the stopper in order to release the pressure.
5. Re-install the stopper and shake the cylinder vigorously again for 10 to 15 seconds.
6. Put the cylinder on a level surface for approximately 5 minutes in order to allow adequate liquid separation.

If alcohol is present in the fuel, the volume of the lower layer (which would now contain both alcohol and water) will be greater than 10 ml. For example, if the volume of the lower layer is increased to 15 ml, this indicates at least 5 percent alcohol in the fuel. The actual amount of alcohol may be somewhat greater because this procedure does not extract all of the alcohol from the fuel.

## Fuel Quality Diagnosis

Fuel quality may cause driveability problems such as hesitation, lack of power, stall, no start, etc.

Certain driveability problems can be related to fuel quality. Fuel testing is limited. Therefore, all other system checks must be performed (e.g. Powertrain System, Fuel System, Ignition System, Emission System) before fuel quality is diagnosed. If these checks fail to solve the problem, gain information from the customer about when the condition occurs, when and where the fuel was purchased, and which octane level was used. Ask the customer to change fuel brands. If the symptom persists, perform the Fuel System Diagnosis Alcohol in Fuel test. If this is not conclusive, drain the tank and refill with a known good quality fuel.

Due to increasing awareness towards vehicle emissions (Evaporative and Exhaust) and their impact on the environment, federal regulations are limiting certain characteristics of fuel. These limitations are causing driveability problems that are extremely difficult to diagnose. In order to make a diagnosis, a basic understanding of fuel and its effects on the vehicles fuel system must be gained.

### Octane

Octane is a measure of a fuel's ability to resist spark knock. Spark knock occurs in the combustion chamber just after the spark plug fires, when the air/fuel mixture in the cylinder does not completely burn. The remaining mixture spontaneously combusts due to temperature and pressure. This secondary explosion causes a vibration that is heard as a knock (ping). Fuel with a high octane number has a greater resistance to spark knock. This vehicle requires 87 octane (VIN K) and 91 (VIN 1) (supercharged) octane ([R+M]/2 method) in order to ensure proper performance of the fuel control system. Using fuel with an octane rating lower can create spark knock, which would cause the PCM to retard ignition timing to eliminate the knock. In a case such as this, poor engine performance and reduced fuel economy could result. Also, in severe knock cases, engine damage may occur.

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### Volatility

Volatility is a fuels ability to change from a liquid state to a vapor state. Since liquid gasoline will not burn, it must vaporize before entering the combustion chamber. The rate at which gasoline vaporizes determines the amount of evaporative emissions released from the fuel system, and therefore has made volatility an environmental concern. The federal government has lowered the maximum allowable volatility, but certain driveability conditions have resulted.

Volatility can be determined through three different tests: the Vapor-Liquid Ratio, the Distillation Curve, and the Reid Vapor Pressure Test (RVP). The Vapor-Liquid Ratio test determines what temperatures must exist to create a vapor-liquid ratio of 20. The distillation curve is a graph showing the relationship between temperature and the percentage of fuel evaporated. The fuel components that boil at relatively low temperatures (below about 90°F) are known as light ends and those that boil at about 300°F are known as heavy ends. The light ends are important for cold starting and cold weather driveability. Heavy ends provide engine power and are important for hot weather driveability. It is the proper mixture of these components that provide proper operation across a wide range of temperatures. However, the distillation curve of a gasoline usually requires laboratory testing. The Reid Vapor Pressure (RVP) test measures the pressure (psi) vaporized fuel exerts within a sealed container when heated to 100°F. Volatility increases proportional to RVP. While RVP can easily be measured in the field, it may be misleading because it is possible for two fuels with the same RVP to have different distillation curves, and therefore, different driveability characteristics.

As stated, improper volatility can create several driveability problems. Low volatility can cause poor cold starts, slow warm ups, and poor overall cold weather performance. It may also cause deposits in the crankcase, combustion chambers and spark plugs. Volatility that is too high could cause high evaporative emissions and purge canister overload, vapor lock, and hot weather driveability conditions. Since volatility is dependent on temperature, different fuels are used during certain seasons of the year, thus creating problems during sudden temperature changes.

### Fuel System Deposits

Fuel system deposits can cause various driveability problems. Deposits usually occur during hot soaks after key OFF. Poor fuel quality or driving patterns such as short trips followed by long cool down periods can cause injector deposits. This occurs when the fuel remaining in the injector tip evaporates and leaves deposits. Leaking injectors can increase injector deposits. Deposits on fuel injectors affect their spray pattern, which in turn could cause reduced power, unstable idle, hard starts and poor fuel economy.

Intake valve deposits can also be related to fuel quality. While most fuels contain deposit inhibitors, some do not and the effectiveness of deposit inhibitors varies by manufacturer. If intake valve deposits occur, fuel may be suspected. These deposits can cause symptoms such as excessive exhaust emissions, power loss and poor fuel economy.

### Sulfur Content

The sulfur content in fuel is also regulated to a certain standard. Premium grades of fuel generally have a lower sulfur content than the less expensive blends. A high sulfur content can promote the formation of acidic compounds that could deteriorate engine oil and increase engine wear. It could also produce excessive exhaust emissions or a rotten egg smell from the exhaust system.

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## EVAP Control System Diagnosis

Refer to *EVAP System Overview*.

### System Description

The EVAP canister purge valve allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the purge valve (purge ON). The EVAP purge valve control is pulse width modulated (PWM) or Turned ON and OFF several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

The EVAP Vent valve is used to seal the EVAP system during diagnostic tests. The fuel tank pressure sensor is used to monitor vacuum in the system during the diagnostic tests.

A stuck closed EVAP canister purge valve, Stuck open EVAP vent valve, disconnected or damaged EVAP Purge line or vent hose, leaking fuel cap, or fill neck should set a DTC P0440. A small leak in the EVAP system should set a DTC P0442 An EVAP vent valve stuck closed, a restricted vent hose, or a blocked EVAP canister should set a DTC P0446. A continuous purge condition with no purge commanded by the PCM (EVAP purge valve stuck open or leaking) should set a DTC P1441. Refer to the DTC tables for further diagnostic procedures regarding the EVAP system.

### Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister
- Damaged or disconnected source vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
- Poor connection at the PCM
- Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness. Inspect the wiring harness to the EVAP vent valve, the EVAP purge valve, and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched or plugged vacuum source, EVAP purge, or fuel tank vapor line. Verify that the lines are not restricted.
- Use the following procedure to check for a carbon release condition that could plug the system.
  1. Turn OFF the ignition.
  2. Remove the EVAP canister purge valve. Refer to *EVAP Canister Purge Valve Replacement*.
  3. Lightly tap the canister purge valve on a clean work area looking for carbon particles exiting either of the vacuum ports.
  4. If no carbon release is evident, reinstall the components and continue with the DTC P0440 diagnostic table. If carbon is being released from either component, continue with this service procedure.
  5. Remove the charcoal canister from the vehicle.
  6. Ensure that the main cylinder valve is turned off on the *J 41413* EVAP purge/pressure diagnostic station.
  7. Disconnect the black hose that connects the nitrogen cylinder to the *J 41413* EVAP purge/pressure diagnostic station at the pressure regulator by unscrewing the knurled nut on the regulator. No tools are required to remove the black hose from the regulator.
  8. Using a section of vacuum line, connect one end over the open threaded fitting of the EVAP purge/pressure diagnostic station pressure regulator.
  9. Connect the remaining end to the purge valve end of the EVAP purge line at the vehicle and turn on the main nitrogen cylinder valve. Continue to blow any debris from the purge line for 15 seconds.
  10. Return the *J 41413* EVAP pressure/purge diagnostic station to its original condition by reinstalling the black hose that was disconnected in step 7.
  11. Replace the following components:
      - The EVAP canister purge valve. Refer to *EVAP Canister Purge Valve Replacement*.
      - The EVAP canister. Refer to *EVAP Canister Replacement*.

### Test Description

The numbers below refer to the step numbers on the diagnostic table:

1. The Powertrain On-Board Diagnostic (OBD) System Check prompts you to complete some of the basic checks and store the Freeze Frame and Failure Records Data on the scan tool if applicable.
2. If a vent valve or EVAP purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction that caused the DTC to set will very likely correct the condition.
3. Inspects for a fuel tank pressure sensor stuck high condition. The fuel tank pressure must be relieved by removing the canister line from the purge valve. The fuel fill cap will not relieve the fuel tank pressure due to a check valve in the filler neck. The check valve seals when pressure is applied to prevent vapors from escaping through the filler neck. The scan tool should read within 1.0 inch H2O of the specified value.
4. Inspects for a large leak in the EVAP system.

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5. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes. The EVAP station is pressurizing a sensor that normally reads vacuum. The scan tool reads high pressure at 0 volts and high vacuum at 5 volts. the scan tool can only read a max pressure of 6.0 inches of H2O (0 volts). However the EVAP service station can pressurize the system to much higher pressures. The scan tool value should be within 0.5 of the specified value.
6. Inspects for a stuck closed EVAP vent valve. The value should decrease to within 1.0 in Hg of the specified value.
7. Inspects for a leaking or stuck open EVAP canister purge valve. The scan tool should read within 1.0 inch HG of the specified value.
8. Ensures that sufficient source vacuum is present at the EVAP canister purge valve/solenoid.
14. Inspects for a small leak in the EVAP system.

## EVAP Control System Diagnosis

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 1 | Did you perform the Powertrain On-Board Diagnostic (OBD) System Check? | — | *Go to Step 2* | Go to *A Powertrain On Board Diagnostic (OBD) System Check* |
| 2 | **Important:** Visually/Physically inspect for the following conditions:<br>• Vacuum or purge lines disconnected. Refer to *Emission Hose Routing Diagram.*<br>• Loose or missing fuel fill cap.<br>Did *DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit* or *DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit* also set? | — | Go to applicable DTC | *Go to Step 3* |
| 3 | 1. Turn OFF the ignition.<br>2. Disconnect the canister purge line from the EVAP canister purge valve.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe the fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 0 in H2O | *Go to Step 4* | *Go to Step 9* |
| 4 | **Important:** Before continuing with diagnosis, zero the EVAP pressure and vacuum (inches of H2O) Gauges on the *J.41413* EVAP pressure/seal diagnostic station.<br>1. Turn OFF the ignition.<br>2. Reconnect all EVAP hardware that was previously disconnected.<br>3. Install the *J 41415-40* fuel tank cap adapter to the fuel fill neck and fuel fill cap.<br>4. Connect the EVAP station to the fuel tank cap adaptor.<br>5. Turn ON the ignition, with the engine OFF.<br>6. With a scan tool, capture Fail Record data for DTC P0440 and clear DTCs.<br>7. With a scan tool, command the vent valve ON (closed) to seal the system.<br>**Important:** Do not exceed the pressure in the specified value.<br>8. With the EVAP station, attempt to pressurize the system to the specified value by slowly turning the rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the EVAP station with the rotary switch in the OFF/HOLD position.<br>Did you achieve the specified value? | 5 in. H2O | *Go to Step 5* | Go to *DTC P0440 Evaporative Emission (EVAP) System* |
| 5 | 1. With the EVAP station, maintain the fuel tank pressure at the specified value. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>2. With a scan tool, observe the fuel tank pressure parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 5 in H2O | *Go to Step 6* | *Go to Step 11* |

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## EVAP Control System Diagnosis (cont'd)

| Step | Action | Values | Yes | No |
|---|---|---|---|---|
| 6 | With a scan tool, command the vent valve OFF (open) to relieve the pressure.<br>Does the pressure decrease to near the specified value within 2 minutes with the rotary switch in the OFF/HOLD position? | 5 in. H2O | *Go to Step 7* | Go to *DTC P0446 Evaporative Emission (EVAP) Vent System Performance* |
| 7 | 1. Connect the inch Hg vacuum hose on the EVAP station to the canister side of the purge valve.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With a scan tool, select the Seal option to seal the EVAP system.<br>4. Start the engine.<br>5. Run the engine from 1200-1500 RPM and observe vacuum level.<br>Does the vacuum level measure above the specified value? | 0 in. Hg | *Go to Step 8* | *Go to Step 12* |
| 8 | 1. With a scan tool, increase purge to 100 percent.<br>2. Run the engine from 1200-1500 RPM and observe vacuum level.<br>Does the vacuum level measure above the specified value? | 15 in. Hg | *Go to Step 14* | *Go to Step 13* |
| 9 | 1. Turn OFF the ignition.<br>2. Disconnect the EVAP canister line from the fuel tank or EVAP canister.<br>3. Turn ON the ignition, with the engine OFF.<br>4. With a scan tool, observe Fuel Tank Pressure Parameter.<br>Does the scan tool indicate fuel tank pressure near the specified value? | 0 in H2O | *Go to Step 10* | Go to *DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage* |
| 10 | Check for a kinked or restricted canister purge line between the EVAP canister purge valve and EVAP canister.<br>Did you find and correct the condition? | 0 in. H2O | *Go to Step 14* | — |
| 11 | Visually/Physically inspect for the following conditions:<br>• Restricted fuel tank vapor line.<br>• Restricted EVAP purge line.<br>Did you find and correct the condition? | — | *Go to Step 14* | Go to *DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage* |
| 12 | Check for no source vacuum to the EVAP purge valve.<br>Did you find and correct the condition? | — | *Go to Step 14* | — |
| 13 | **Important:** Check for carbon release into the EVAP system. Refer to Diagnostic Aids.<br>Locate and repair cause of no source vacuum to the EVAP purge valve.<br>Did you find and correct the condition? | — | *Go to Step 14* | *Go to Step 12* |
| 14 | 1. Reconnect all EVAP hardware that was previously disconnected.<br>2. Turn ON the ignition, with the engine OFF.<br>3. With scan tool, select the Seal option to seal the EVAP system.<br>**Important:** Do not exceed the pressure in the specified value.<br>4. With the EVAP station, pressurize the system to the first specified (higher) value by slowly turning the rotary switch to the PRESSURE position. Monitor the pressure with the gauge on the cart with the rotary switch in the OFF/HOLD position.<br>Does the EVAP pressure decrease to less than the second specified (lower) value within 2 minutes with the rotary switch in the OFF/HOLD position? | 15 in H2O<br>10 in H2O | Go to *DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected* | System OK |

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## Inspection/Maintenance Status Reset Procedures

### System Status For Satisfying the Federal Inspection/Maintenance (I/M) Regulations

The scan tool System Info menu includes the System Status selection.

Several states require that the vehicle pass on-board (OBD II system) tests for the major diagnostics prior to having a vehicle I/M emission inspection. Some areas may require that the vehicle pass the OBD II system tests and the I/M emission inspection in order to renew license plates.

Using a scan tool, the technician can observe the System Status (Complete or Not Complete) in order to verify that the vehicle meets the criteria which complies with the local area requirements. Using the System Status display, monitor any of the following systems or a combination of the systems (depending on vehicle make and model) for I/M Readiness:

- Catalyst
- Heated oxygen sensor (HO2S)
- Heated oxygen sensor (HO2S) heater
- Exhaust gas recirculation (EGR)
- Evaporative emission (EVAP)
- Secondary Air Injection System (AIR)

**Important:** The System Status display indicates only if the PCM has completed the required tests (DTCs). The System Status display does not necessarily mean that the test has passed. If a failure indication is present for a DTC associated with one of the above systems, that test has failed. Diagnosis and repair are necessary in order to meet the I/M requirement. Verify that the vehicle passes all of the diagnostic tests associated with the displayed System Status prior to returning the vehicle to the customer.

Following a DTC Info Clear, battery disconnect, or a control module replacement, all of the System Status information will be set to Not Complete.

Refer to the diagnostic support information associated with each DTC in order to obtain the Conditions for Running the DTC. The vehicle operating conditions that the system must meet in order for a DTC to run are the Conditions for Running the DTC.

The System Status table shows the DTCs that must run in order for the System Status to indicate a system test has been Completed.

**System Status**

| System Status | DTCs Used to Set System Status |
|---|---|
| Catalyst | P0420 |
| HO2S | P0133, P0153, P1133, P1134, P1153, and P1154 |
| HO2S Heater | P0135, P0147, and P0155 |
| EGR System | P0401 |
| EVAP System | P0440, P0442, P0446, P1441, or the Service Bay Test |
| AIR System | — |

#### Scan Tool Tests

The scan tool for some systems depending upon the vehicle make and model include the Service Bay Tests. Use the Service Bay Tests in order to test certain systems and reset the System Status to Complete. The EVAP Service Bay Test is included for this vehicle. Refer to *Service Bay Test* for important preliminary instructions.

## Service Bay Test

The Service Bay Test is included on the scan tool for some systems, depending upon the vehicle make and model. The EVAP Service Bay Test is used to test the EVAP system and indicate the failed DTC codes or to state that the EVAP system passed. The EVAP Service Bay Test may be used to test the EVAP system after repairs are completed. This test takes some time to run.

**Important:** Ensure that the vehicle meets the following requirements before performing the EVAP Service Bay Test. Failure to meet the necessary requirements may cause inaccurate test results.

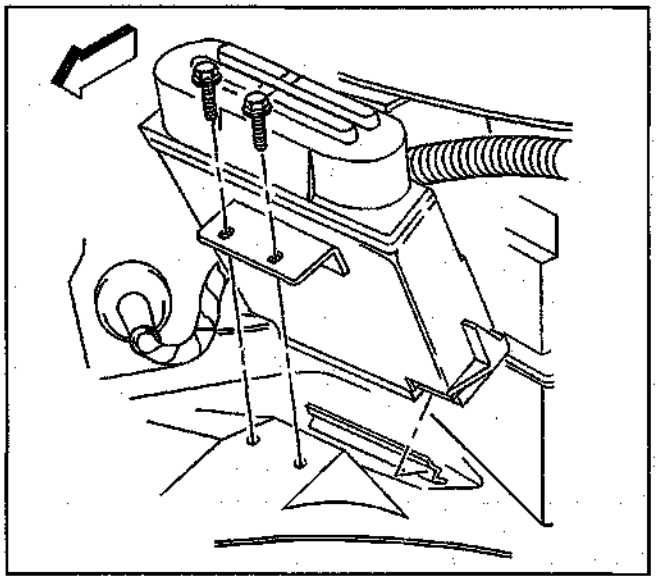
The EVAP Service Bay Test can be performed when the vehicle meets the following conditions:

- The Powertrain On-Board Diagnostic (OBD) System Check has been performed, ensuring that no DTC has set.
- The battery voltage is 5–18 volts.
- The fuel level is 15–85 percent of capacity, or approximately 1/4–3/4 full.
- The ignition is on and the engine coolant temperature (ECT) is 5°C – 70°C (40°F – 158°F).
- The IM Ready Flag must not be on.
- The startup intake air temperature (IAT) is 4°C – 30°C (30°F – 86°F).
- The vehicle speed is less than 3 mph.
- The throttle angle is less than 2 percent.
- The BARO is more than 75 kPa.

Follow the instructions on the scan tool after ensuring the above conditions have been met.

If any of the above conditions are not met upon activating the Service Bay Test, exit and run the test when the above conditions have been achieved.

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## Repair Instructions

### PCM Replacement/Programming

***Notice:*** In order to prevent possible electrostatic discharge damage to the PCM, do not touch the connector pins or soldered components on the circuit board.

Service of the PCM should normally consist of either replacement of the PCM or EEPROM programming. If the diagnostic procedures call for PCM Replacement, check the PCM first to see if it is the correct part. If the PCM is faulty, remove it and install the new service PCM.

The new service PCM will not be programmed. You must program the new PCM. DTC P0602 indicates the EEPROM is not programmed or has malfunctioned.

***Notice:*** In order to prevent possible electrostatic discharge damage to the PCM, do not touch the connector pins or soldered components on the circuit board.

***Notice:*** Turn the ignition OFF when installing or removing the PCM connectors and disconnecting or reconnecting the power to the PCM (battery cable, PCM pigtail, PCM fuse, jumper cables, etc.) in order to prevent internal PCM damage.

**Important:** When replacing the production PCM with a service PCM (controller), it is important to transfer the broadcast code and production PCM number to the service PCM label. Do not record on PCM cover. This will allow positive identification of PCM parts throughout the service life of the vehicle.

***Notice:*** Turn the ignition OFF when installing or removing the PCM connectors and disconnecting or reconnecting the power to the PCM (battery cable, PCM pigtail, PCM fuse, jumper cables, etc.) in order to prevent internal PCM damage.

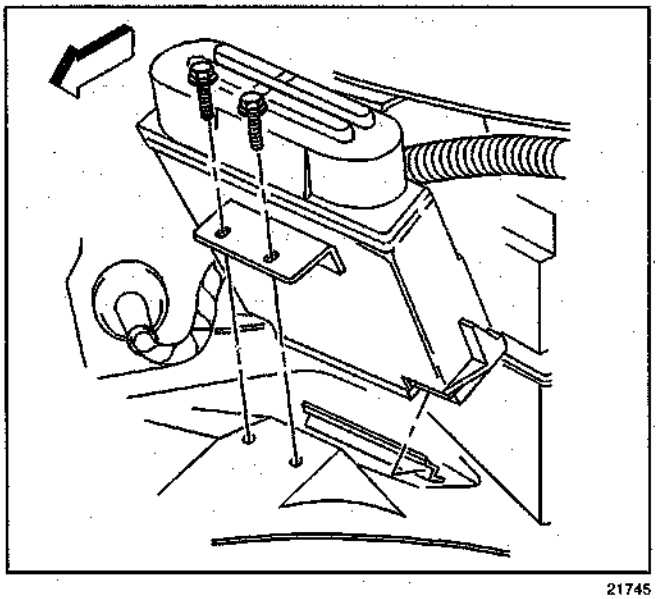
#### Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the PCM from the mounting hardware.
3. Disconnect the harness connectors from the PCM.
4. Remove the PCM from the engine compartment.

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### Installation Procedure

1. Connect the harness connectors to the PCM.
2. Position and install the PCM into the vehicle.
3. Connect the negative battery cable.
4. If you are installing a new PCM, program the new PCM EEPROM.



21745

### EEPROM Programming

1. Set-up - Ensure that the following conditions have been met:
   - The battery is fully charged.
   - The ignition is ON.
   - The connection at the DLC is secure.
2. Program the PCM using the latest software matching the vehicle. Refer to up-to-date Techline equipment users instructions.
3. If the PCM fails to program, proceed as follows:
   - Ensure that all PCM connections are OK.
   - Check the Techline equipment for the latest software version.
   - Attempt to program the PCM. If the PCM still cannot be programmed properly, replace the PCM. You must program the replacement PCM.

### Functional Check

1. Perform the On-Board Diagnostic System Check.
2. Start the engine and the engine run for one minute.
3. Use the scan tool in order to scan for the DTCs.

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## CKP System Variation Learn Procedure

The crankshaft position system variation compensating values are stored in the PCM non-volatile memory after a learn procedure has been performed. If the actual crankshaft position system variation does not match the crankshaft position system variation compensating values stored in the PCM, DTC P0300 may set, refer to Diagnostic Aids for DTC P0300.

The Crankshaft Position System Variation Learn Procedure should be performed if any of the following conditions are true:

- DTC P1336 is set.
- The PCM has been replaced.
- The engine has been replaced.
- The crankshaft has been replaced.
- The crankshaft harmonic balancer has been replaced.
- The crankshaft position sensor has been replaced.

***Caution: Set the vehicle parking brake and block the drive wheels when performing the Crankshaft Position System Variation Learning Procedure in order to prevent personal injury. Release the throttle immediately when the engine starts to decelerate. Once the learn procedure is completed, the PCM will return the engine control to the operator and the engine will respond to the throttle position.***

**Important:** Begin the crankshaft position system variation learn procedure with the ignition OFF. Do not turn ON the ignition or start the vehicle unless instructed to do so by the scan tool.

The scan tool crankshaft position system variation learn function will be inhibited if any powertrain DTCs other than DTC P1336 are set before or during the crankshaft position system variation learn procedure. Clear DTCs before attempting to perform the crankshaft position system variation learn procedure. If any DTCs reset, the DTCs must be diagnosed and repaired before the crankshaft position system variation learn procedure can be successfully completed.

The crankshaft position system variation learn function will be inhibited if the PCM detects a malfunction involving the camshaft position signal circuit, the 3X reference circuit, or the 18X reference circuit.

- If the scan tool indicates that a problem with the camshaft position signal exists, refer to *DTC P0341 Camshaft Position (CMP) Sensor Performance.*
- If the scan tool indicates that a problem with the 3X crank signal exists, refer to *DTC P1374 Crankshaft Position (CKP) High to Low Resolution Frequency Correlation.*
- If the scan tool indicates that a problem with the 18X crank signal exists, refer to *DTC P0336 Crankshaft Position (CKP) Sensor Circuit.*

The scan tool crankshaft position system variation learn function will not be enabled until engine coolant temperature is more than 70°C (158°F).

Selecting the crankshaft position system variation learn procedure on the scan tool will command the PCM to enable CKP system variation learn fuel cutoff and allow the crankshaft position system compensating values to be stored in the PCM. The PCM must detect an engine speed of 5150 RPM (CKP system variation learn fuel cutoff) during the crankshaft position system variation learn procedure to store the crankshaft position system compensating values and complete the procedure.

1. Set the parking brake.
2. Block the drive wheels.
3. Close the hood.
4. Start the engine and allow engine coolant temperature to reach at least 70°C (158°F).
5. Turn OFF the ignition.
6. Select and enable the crankshaft position variation learn procedure with the scan tool.
7. Start the vehicle
8. Ensure that the transaxle is in Park.
9. Apply the service brake pedal firmly and hold.
10. Increase accelerator pedal position until CKP system variation learn fuel cutoff is reached. CKP system variation learn fuel cutoff is reached at 5150 RPM. Immediately release the accelerator pedal when fuel cutoff is reached.
11. The crankshaft position system variation compensating values are learned when RPM decreases back to idle. If the procedure terminates, refer to Important above for instructions.
12. Observe DTC status for DTC P1336.
13. If the scan tool indicates that DTC P1336 ran and passed, the crankshaft position system variation learn procedure is complete. If the scan tool indicates DTC P1336 failed or not run, check for other DTCs. If no DTCs other than P1336 are set, repeat the crankshaft position system variation learn procedure as necessary.

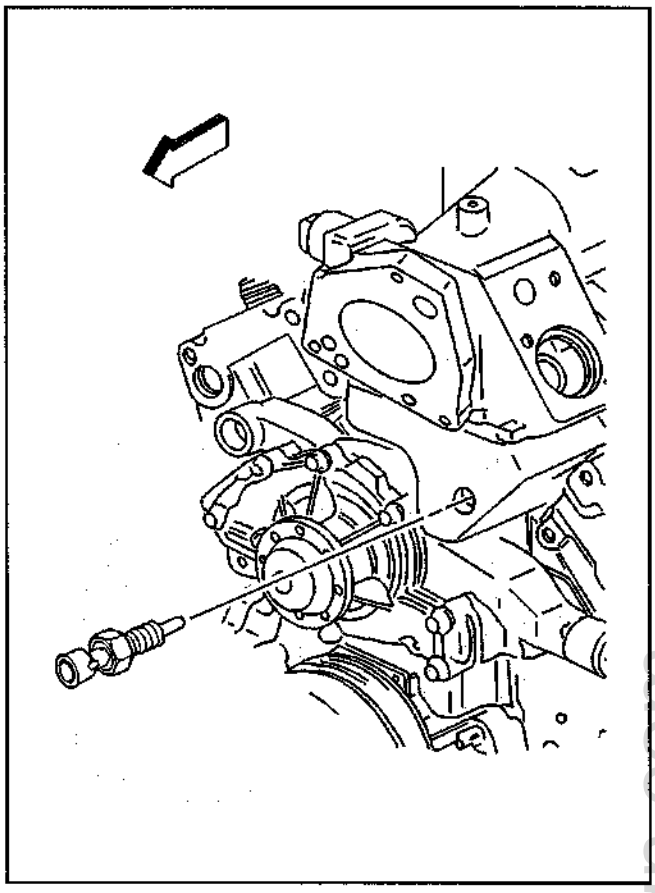
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## ECT Sensor Replacement

### Removal Procedure

**Important:** Care must be taken when handling the Engine Coolant Temperature sensor. Damage to the engine coolant temperature sensor will affect proper operation of the fuel injection system.

1. Drain the radiator coolant. Refer to *Draining and Filling Cooling System (3.8 L)* in Engine Cooling.
2. Disconnect the ECT sensor electrical connector.
3. Using a 19 mm deep well socket, remove the sensor.



21671

### Installation Procedure

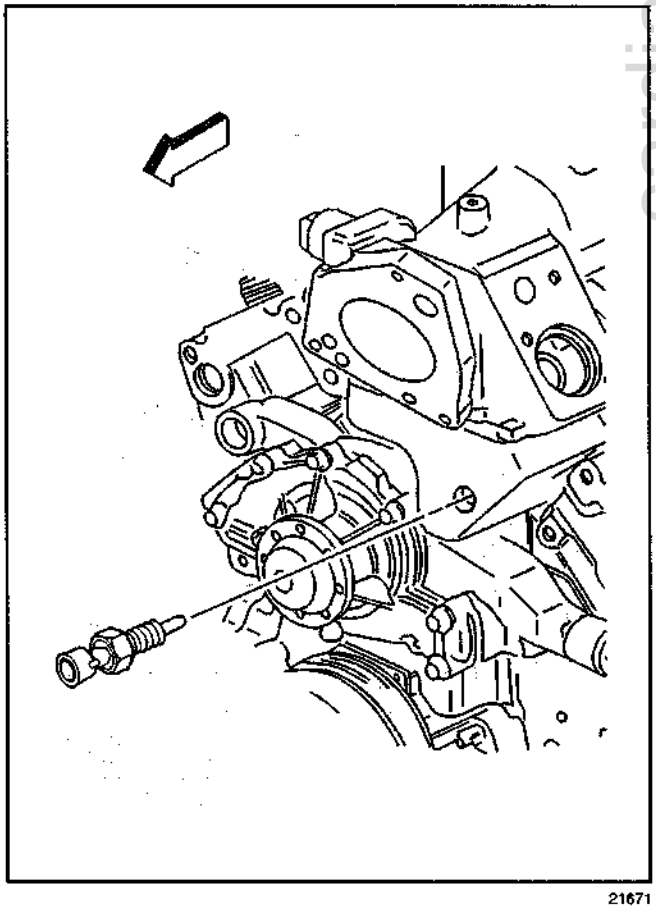
1. Coat engine coolant temperature sensor threads with sealer P/N 1052080 or equivalent.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Hand start the ECT sensor into the engine.

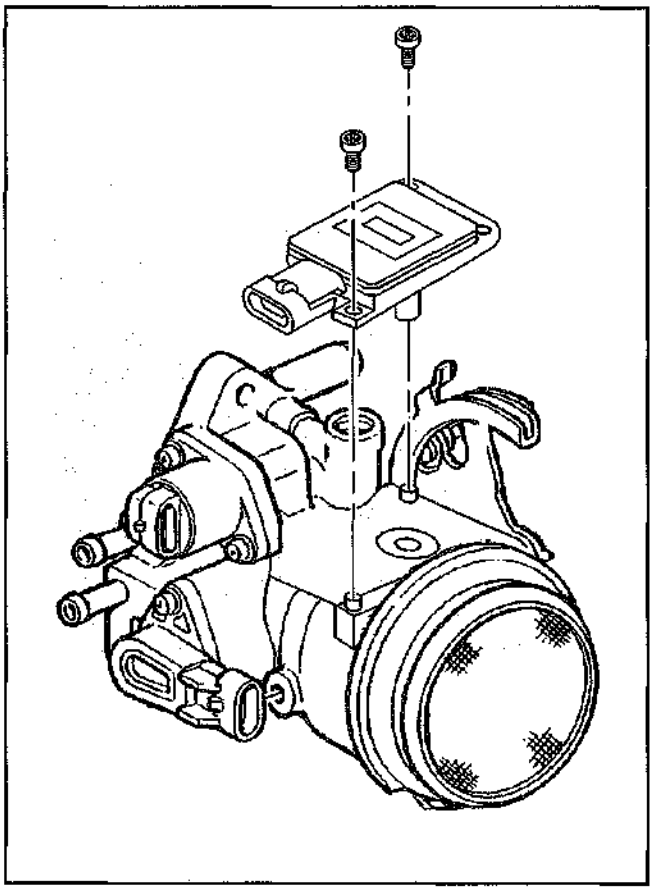
   **Tighten**

   Tighten the ECT sensor to 12.5 N·m (9.2 lb ft).
3. Connect the ECT sensor electrical connector.
4. Refill radiator with coolant. Refer to *Draining and Filling Cooling System (3.8 L)* in Engine Cooling.
5. Start the engine and inspect for a coolant leak.



21671

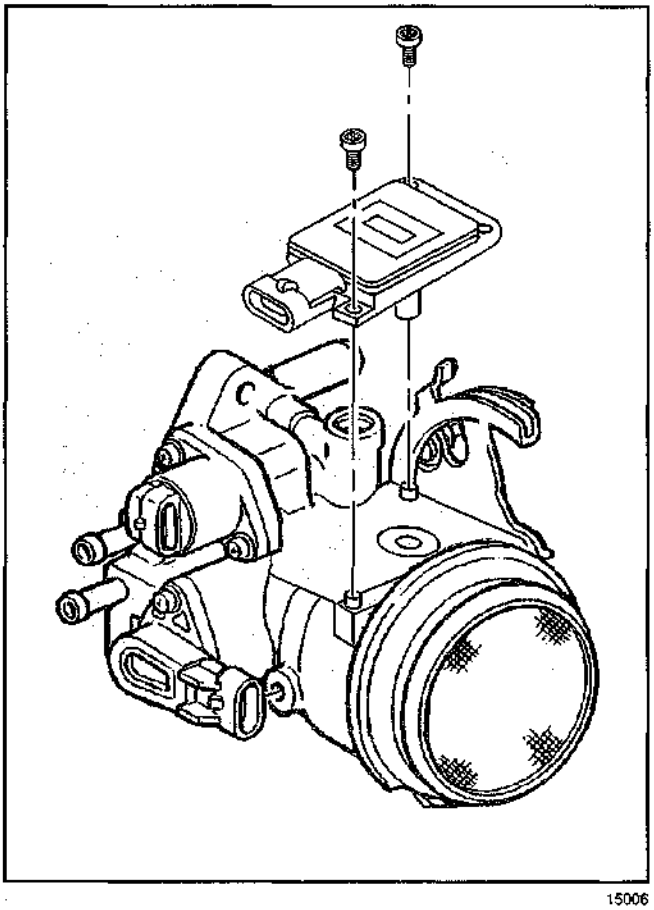
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15006

## MAF Sensor Replacement

### Removal Procedure

1. Disconnect the MAF sensor electrical connector.
2. Remove the MAF sensor fasteners.
3. Remove the MAF sensor from the throttle body.


15006

### Installation Procedure

1. Carefully position the MAF sensor to the throttle body.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Install the MAF sensor fasteners.

   **Tighten**

   Tighten the MAF sensor fasteners to 3 N·m (27 lb in).

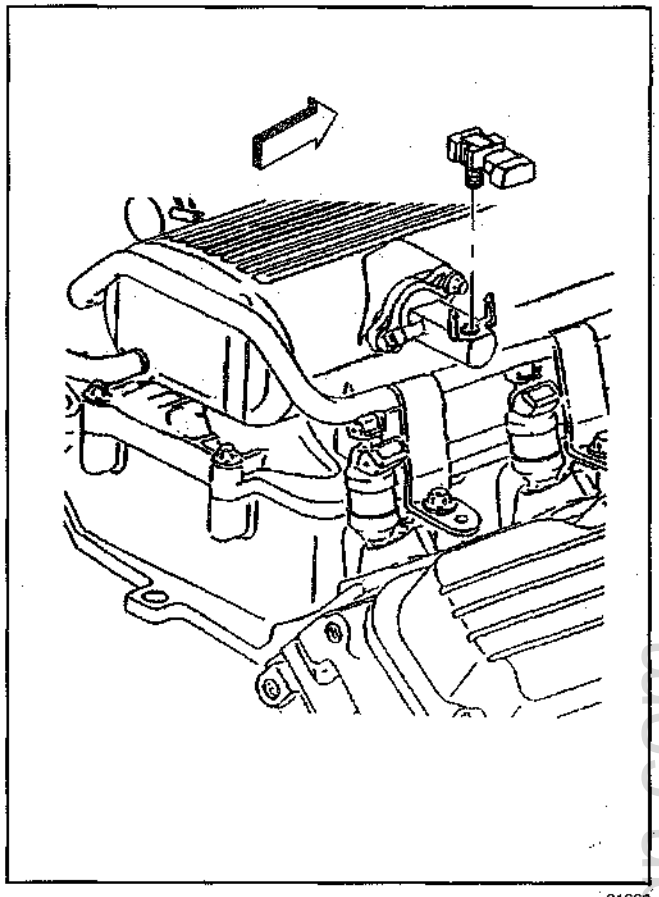
3. Connect the MAF sensor electrical connector.

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## MAP Sensor Replacement

### Removal Procedure

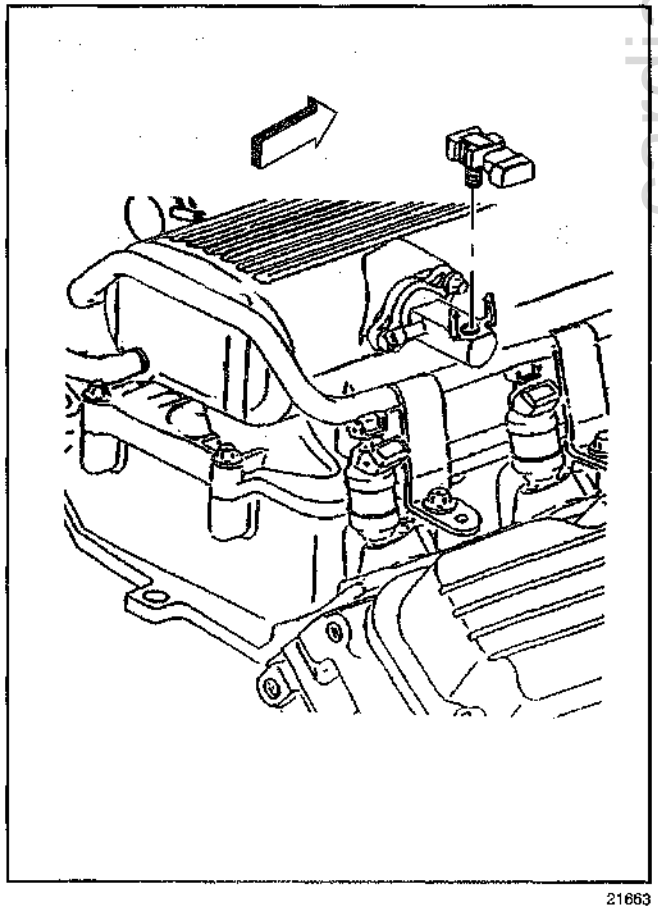
1. Disconnect the MAP sensor electrical connector.
2. Carefully open the MAP sensor retaining tabs just enough to remove the MAP sensor from the vacuum source.
3. Pull the MAP sensor straight out of vacuum source.



21663

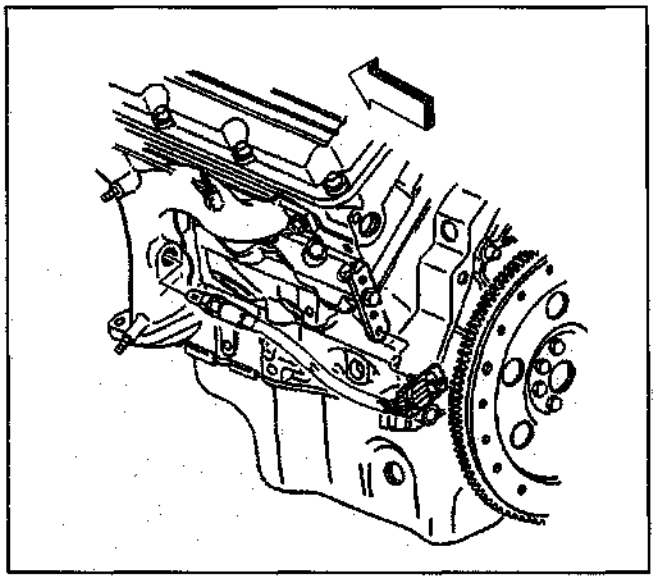
### Installation Procedure

1. Ensure that the seal is correctly installed on MAP sensor and that the seal is not damaged.
2. Install the MAP sensor to the vacuum source. Ensure the retaining tabs engage.
3. Connect the MAP sensor electrical connector.

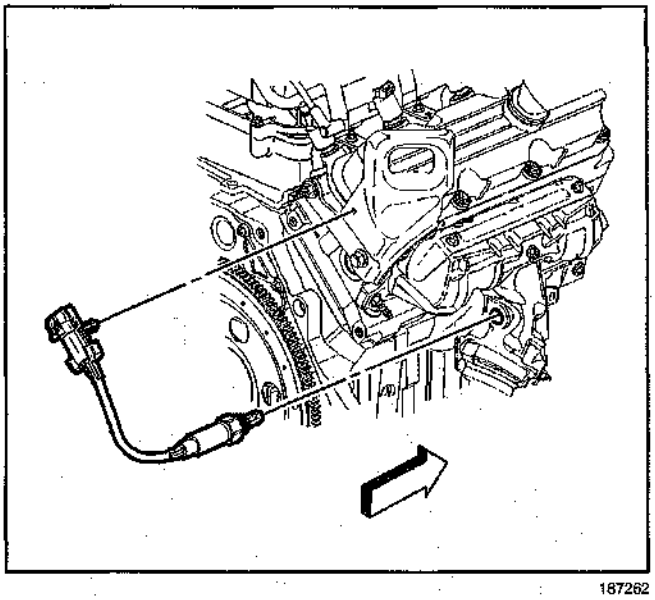


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26514



187262

## Heated Oxygen Sensor (HO2S) Replacement

### Bank 1 HO2S 1 and Bank 2 HO2S 1

***Notice:*** The Heated Oxygen Sensors each use a permanently attached pigtail and connector. This pigtail should not be removed from the heated oxygen sensor. Damage or removal of the pigtail or connector could affect proper operation of the heated oxygen sensor.

### Removal Procedure

**Important:** Take care when handling the heated oxygen sensor. The in-line electrical connector and louvered end must be kept free of grease, dirt or other contaminants. Also, avoid using cleaning solvents of any type. Do not drop or roughly handle the heated oxygen sensor/catalyst monitor. A dropped sensor is a bad sensor.

The heated oxygen sensor may be difficult to remove when the engine temperature is below 48°C (120°F). Excessive force may damage threads in the exhaust manifold or exhaust pipe.

1. Raise and support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Disconnect the HO2S electrical connector.
3. Carefully back out the heated oxygen sensor.

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### Installation Procedure

**Important:** A special anti-seize compound is used on the heated oxygen sensor threads. The compound consists of graphite suspended in fluid and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will already have the compound applied to the threads. If a sensor is removed from an engine and if for any reason is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

1. Coat threads of heated oxygen sensor/catalyst monitor with anti-seize compound P/N 5613695, or equivalent if necessary.

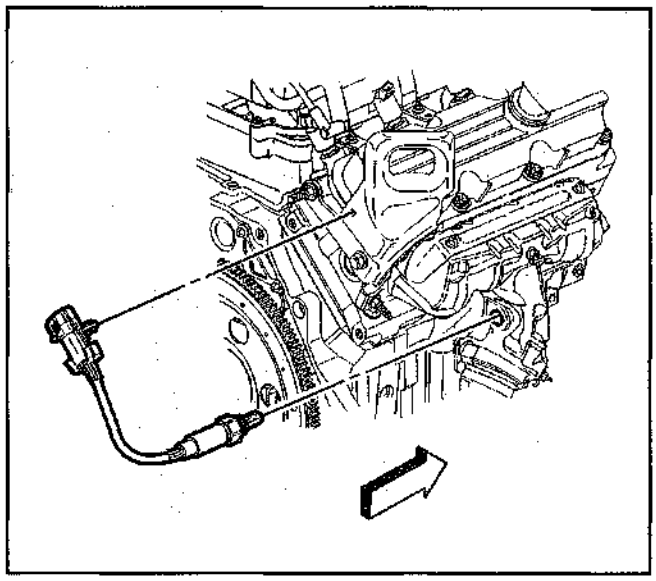
***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Hand start the heated oxygen sensor.

   **Tighten**

   Tighten the heated oxygen sensor to 42 N·m (31 lb ft).

3. Connect the HO2S electrical connector.


187262

### Bank 1 HO2S 2

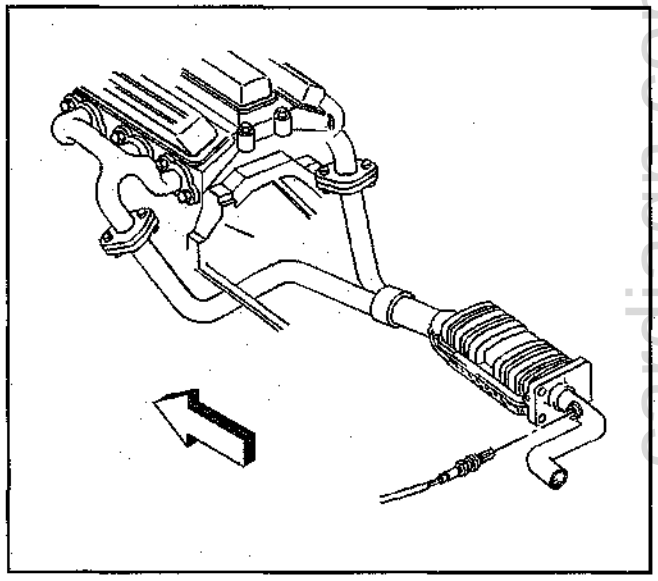
***Notice:*** The Heated Oxygen Sensors each use a permanently attached pigtail and connector. This pigtail should not be removed from the heated oxygen sensor. Damage or removal of the pigtail or connector could affect proper operation of the heated oxygen sensor.

### Removal Procedure

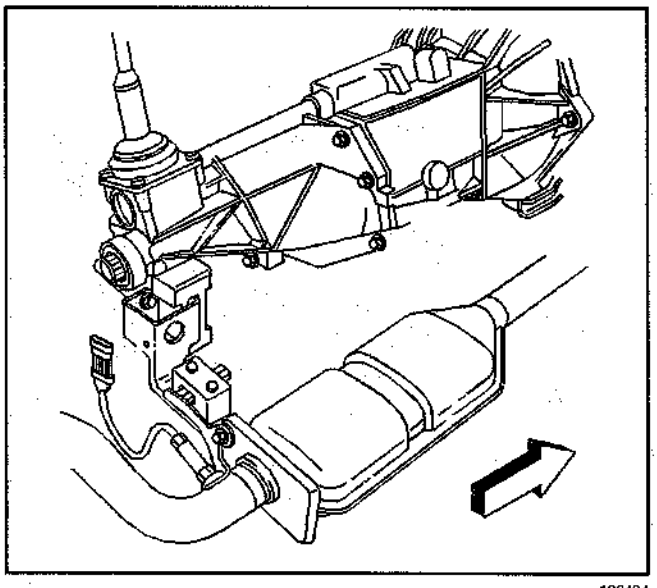
**Important:** Take care when handling the heated oxygen sensor. The in-line electrical connector and louvered end must be kept free of grease, dirt or other contaminants. Also, avoid using cleaning solvents of any type. Do not drop or roughly handle the heated oxygen sensor/catalyst monitor. A dropped sensor is a bad sensor.

The heated oxygen sensor may be difficult to remove when engine temperature is below 48°C (120°F). Excessive force may damage threads in exhaust manifold or exhaust pipe.

1. Raise and support the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Disconnect the HO2S electrical connector.
3. Carefully back out the heated oxygen sensor.


196425

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196434

### Installation Procedure

**Important:** A special anti-seize compound is used on the heated oxygen sensor threads. The compound consists of graphite suspended in fluid and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or service sensors will already have the compound applied to the threads. If a sensor is removed from an engine and if for any reason is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

1. Coat threads of heated oxygen sensor/catalyst monitor with anti-seize compound P/N 5613695, or equivalent if necessary.

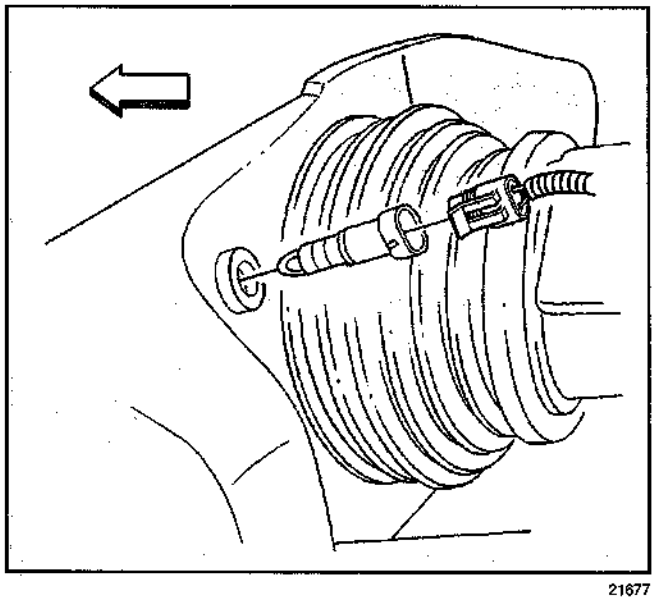
***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Hand start the heated oxygen sensor.

   **Tighten**

   Tighten the heated oxygen sensor to 42 N·m (31 lb ft).

3. Connect the HO2S electrical connector.



21677

## IAT Sensor Replacement

### Intake Air Temperature (IAT) Sensor

The IAT sensor is mounted in the air intake resonator.

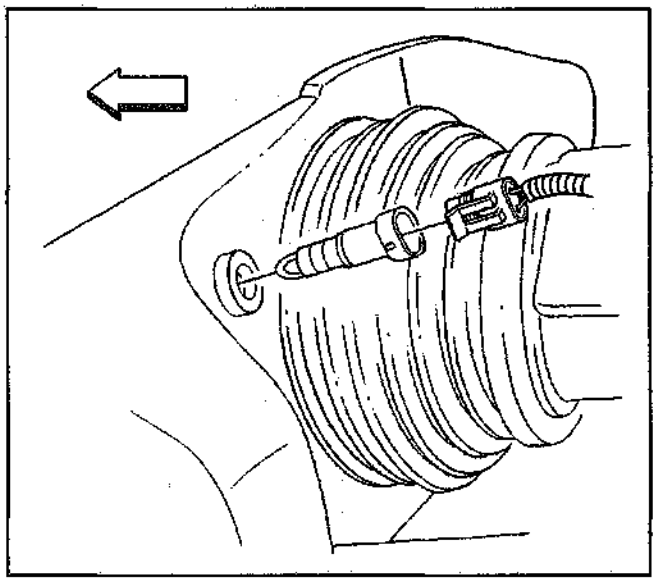
### Removal Procedure

1. Disconnect the IAT sensor electrical connector.
2. Carefully remove the IAT sensor (snaps into place).

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### Installation Procedure

1. Install the IAT Sensor into the air intake resonator (snaps into place).
2. Connect the IAT sensor electrical connector.

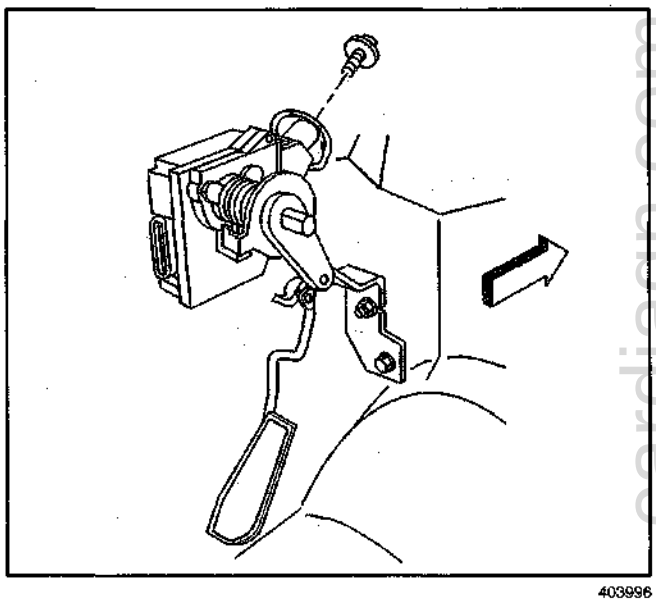


21677

## Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)

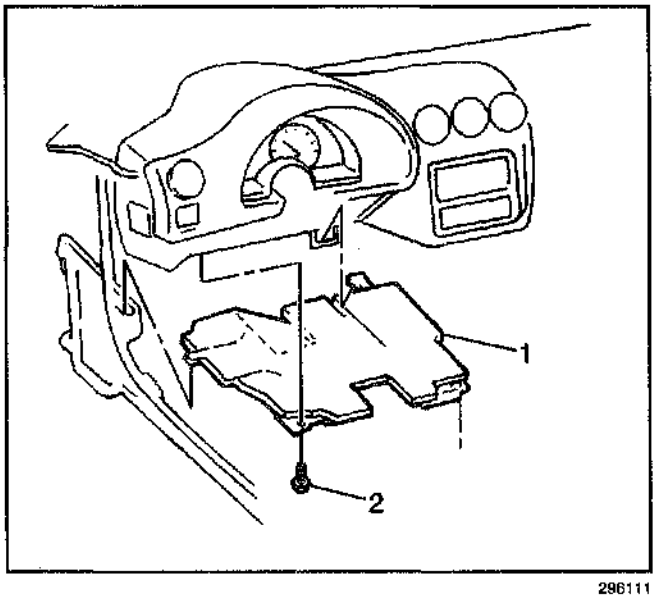
### Removal Procedure

1. Remove the exterior retaining bolt and discard.



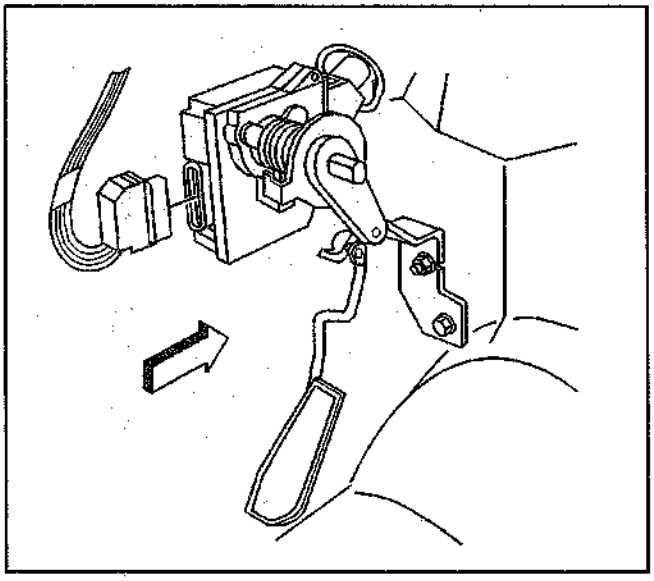
403996

2. Remove the left instrument panel insulator. Refer to *Closeout/Insulator Panel Replacement - Left* in Instrument Panel, Gages and Console.

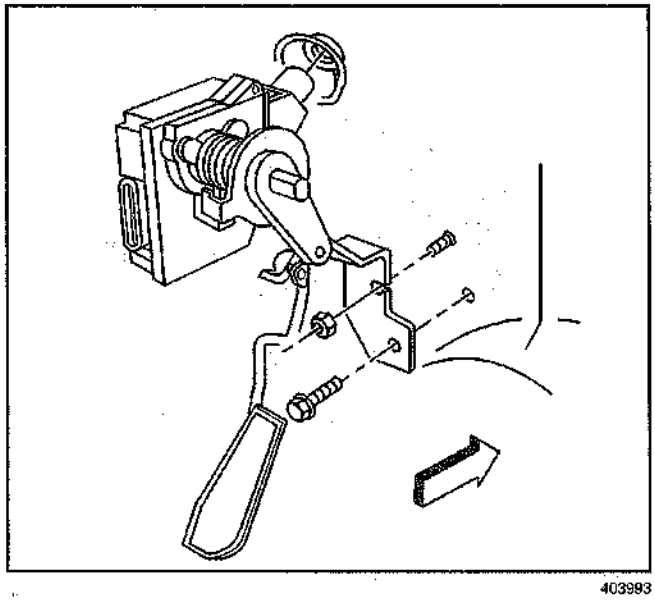



296111

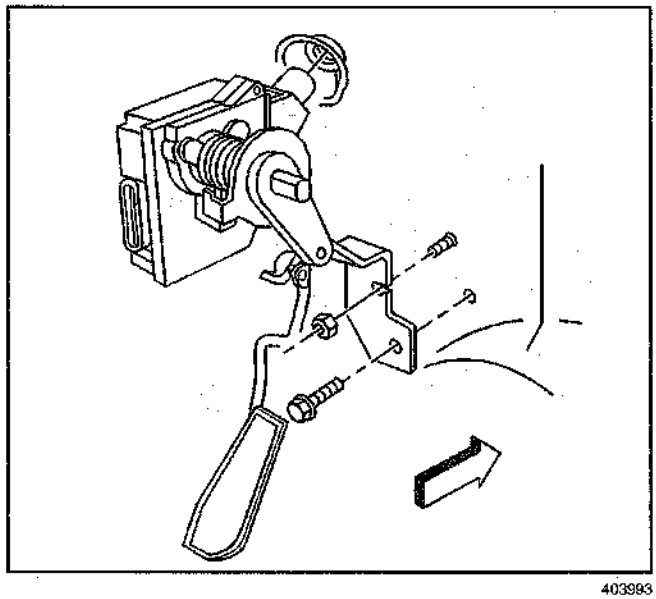
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403994

3. Disconnect the harness from the TAC module.


403993

4. Remove the interior retaining bolt and nut.
5. Remove the pedal/TAC module assembly from the vehicle.


403993

## Installation Procedure

1. Install the pedal/TAC module assembly to the vehicle.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

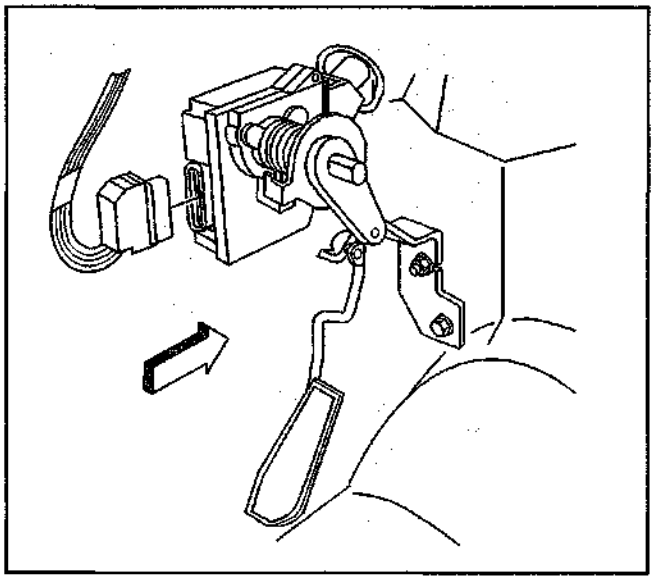
2. Install the interior retaining bolt and nut.

   **Tighten**

   Tighten the bolt to 25 N·m(19 lb ft) and tighten the nut to 20 N·m(15 lb ft).

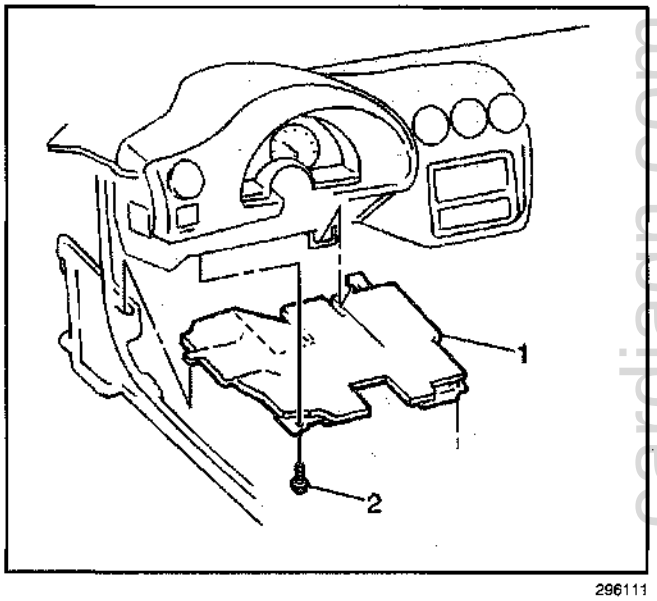
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3. Connect the harness to the TAC module.



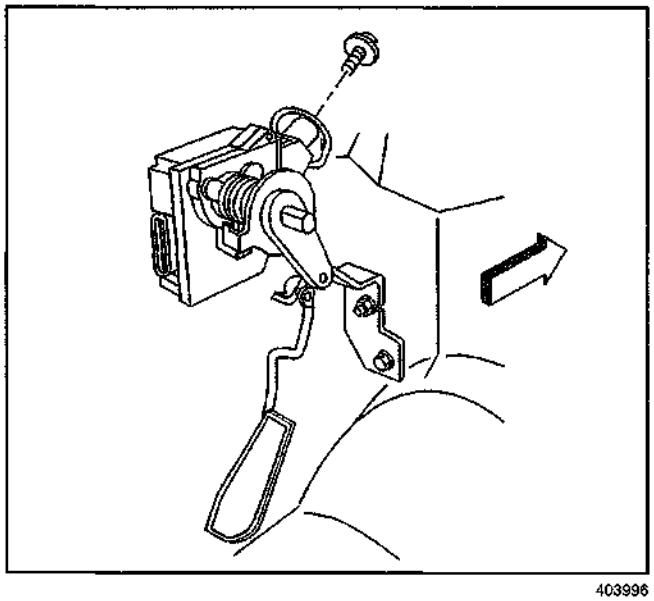
403994

4. Install the left instrument panel insulator. Refer to *Closeout/Insulator Panel Replacement - Left* in Instrument Panel, Gages and Console.



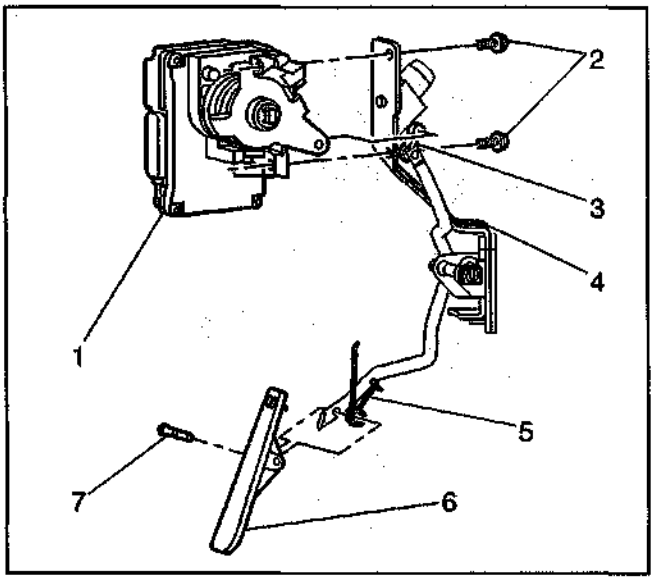

296111

5. Install the new exterior retaining bolt.
   **Tighten**
   Tighten the bolt to 8 N·m(10 lb ft).



403996

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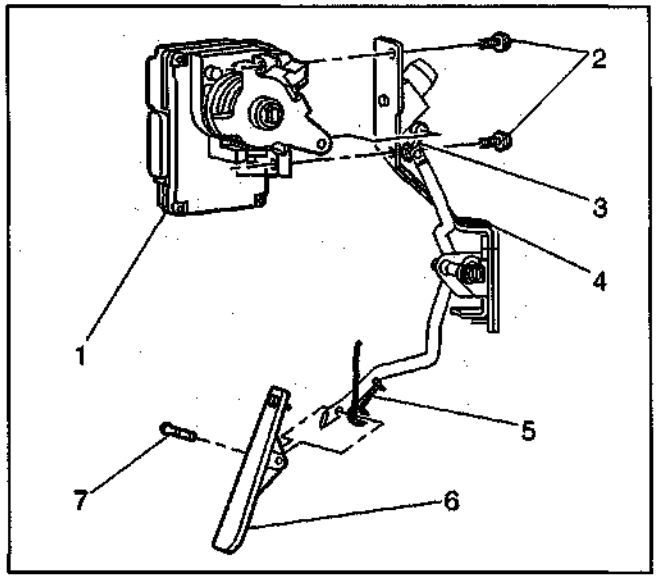


579466

## Accelerator Controls Pedal Replacement (Bracket and Rod Assembly)

### Removal Procedure

1. Remove the TAC module and bracket assembly from the vehicle. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)*.
2. Disconnect the plastic link (3) from the TAC module arm and discard.
3. Remove the bolts (2) retaining the TAC module (1) to the bracket (4).
4. Remove the TAC module (1) from the bracket (4).



579466

### Installation Procedure

**Important:** When the Bracket and Pedal assembly is replaced, the APP Min Reset must be preformed using the scan tool output function.

1. Install the bracket (4) to the TAC module (1).

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Install the bolts (2) that retain the TAC module (1) to the bracket (4).

   **Tighten**

   Tighten the bolts to 6 N·m(53 lb in).

**Important:** This link (3) must not be damaged at installation.

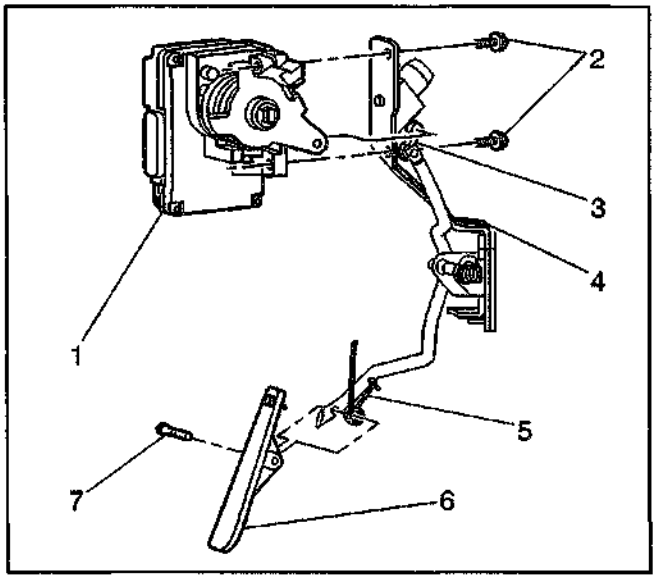
3. Connect the plastic link (3) to the TAC module arm.
4. Install the TAC module (1) and bracket assembly (4) to the vehicle. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)*.
5. Perform the APP Min Reset using the scan tool.

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## Accelerator Controls Pedal Replacement (Pad, Spring and Pin)

### Removal Procedure

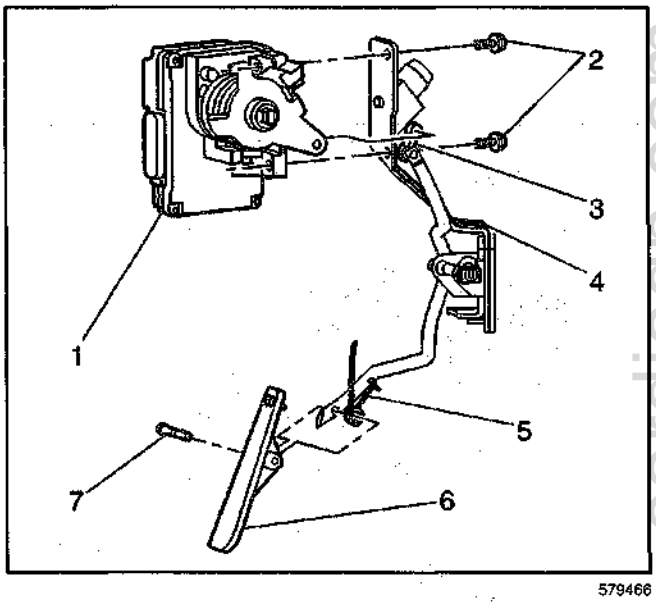
1. Remove the TAC module and bracket assembly from the vehicle. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)*.
2. Disconnect the pad spring (5) from the rod.
3. Remove the pin (7) from the pad (6) and rod.
4. Remove the pad (6) and pad spring (5) from the rod.



579466

### Installation Procedure

1. Install the pad (6) and pad spring (5) to the rod.
2. Install the pin (7) to the pad (6) and rod.
3. Connect the pad spring (5) to the rod.
4. Install the TAC module and bracket assembly to the vehicle. Refer to *Accelerator Controls Pedal Replacement (TAC Module and Bracket Assembly)*.



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## Throttle Body Assembly Replacement

### Removal Procedure

***Notice:*** Do Not use solvent of any type when cleaning the gasket surfaces on the intake manifold and the throttle body assembly, as damage to the gasket surfaces and throttle body assembly may result.

Use care in cleaning the gasket surfaces on the intake manifold and the throttle body assembly, as sharp tools may damage the gasket surfaces.

1. Drain the radiator coolant. Refer to *Draining and Filling Cooling System (3.8 L)* in Engine Cooling.
2. Remove the air intake duct form the throttle body.
3. Disconnect the MAF sensor electrical connector.
4. Disconnect the throttle body/TAC electrical connector.
5. Remove the throttle body/TAC retaining bolt and nuts.

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6. Remove the throttle body/TAC assembly from the intake.
7. Remove and discard the gasket.

### Installation Procedure

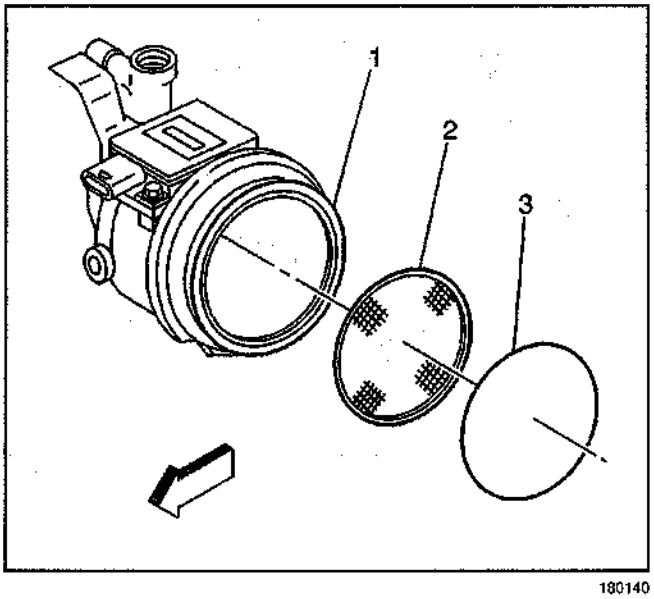
1. Install the new gasket to the intake.
2. Install the throttle body/TAC assembly to the Intake.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

3. Reinstall the retaining bolt and nuts

   **Tighten**

   Tighten the throttle body retaining bolt and nut to 10 N·m (89 lb in).
4. Reconnect the throttle body/TAC electrical connector.
5. Reconnect the MAF electrical connector
6. Reinstall the air intake duct to the throttle body/TAC assembly.
7. Refill the radiator in order to replace the lost coolant. Refer to *Draining and Filling Cooling System (3.8 L)* in Engine Cooling.



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## Throttle Body Air Inlet Screen Replacement

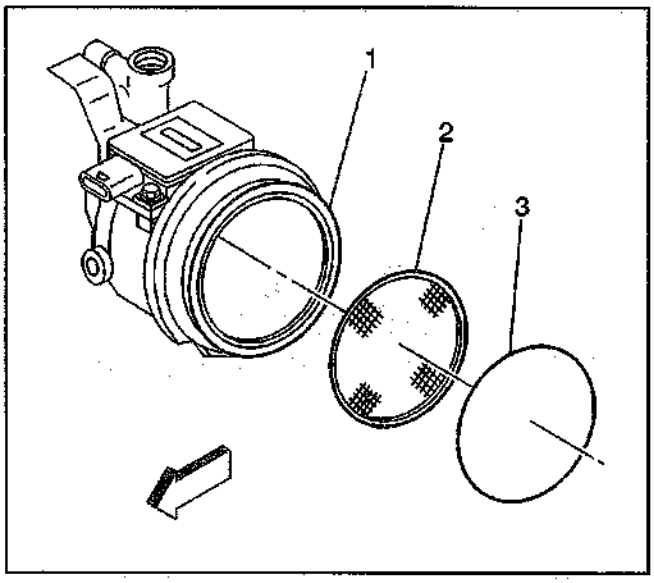
### Removal Procedure

1. Remove the air intake tube.
2. Remove the snap ring (3).
3. Remove the throttle body air inlet screen (2) from the throttle body (1).

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### Installation Procedure

1. Install the throttle body air inlet screen (2) to the throttle body (1).
2. Install the snap ring (3).
3. Install the air intake tube.



180140

## Fuel Pressure Relief Procedure

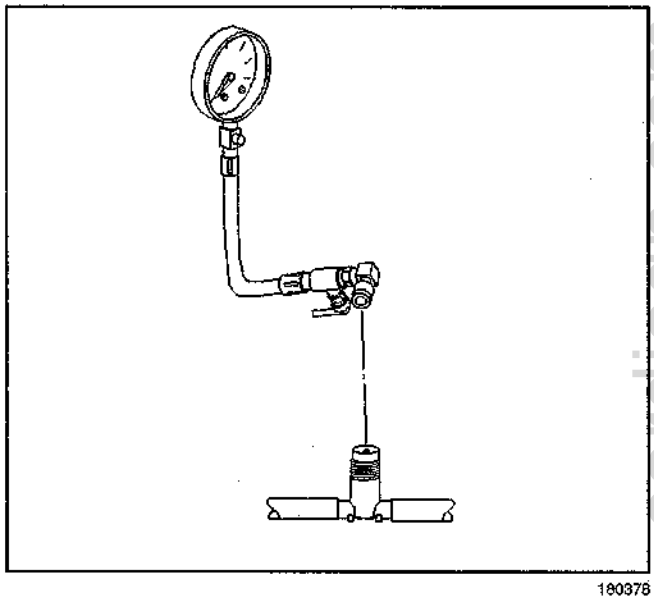
### Relief Procedure

#### Tools Required

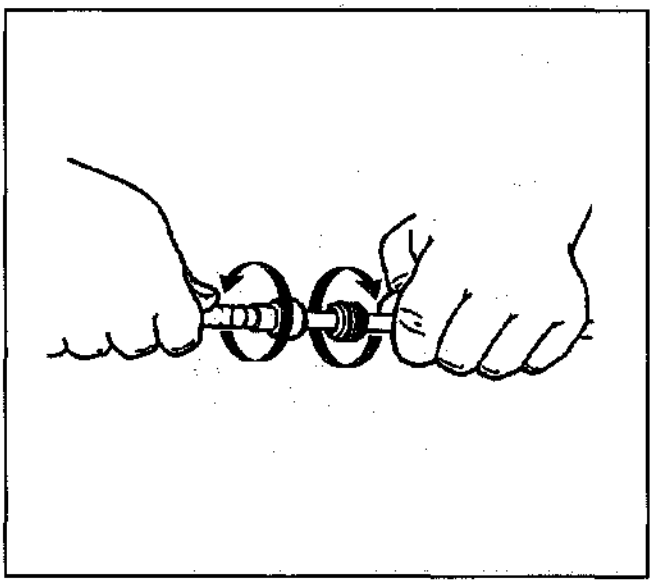
*J 34730-1A* Fuel Pressure Gauge

***Caution: Refer to Battery Disconnect Caution in Cautions and Notices.***

1. Disconnect the negative battery terminal. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
2. Loosen the fuel filler cap to relieve tank vapor pressure.
3. Connect fuel pressure gauge *J 34730-1A* to the fuel pressure connection. Wrap a shop towel around the fuel pressure connection while connecting the fuel pressure gauge in order to avoid spillage.
4. Install the bleed hose into an approved container and open the valve to bleed the system pressure. The fuel connections are now safe for servicing.
5. Drain any fuel remaining in the fuel pressure gauge into an approved container.


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12775

## Quick Connect Fitting(s) Service (Metal Collar)

### Removal Procedure

#### Tools Required

*J 37088-A* Fuel Line Quick-Connect Separator

***Caution: Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.***

***Caution: Relieve the fuel system pressure before servicing fuel system components in order to reduce the risk of fire and personal injury.***

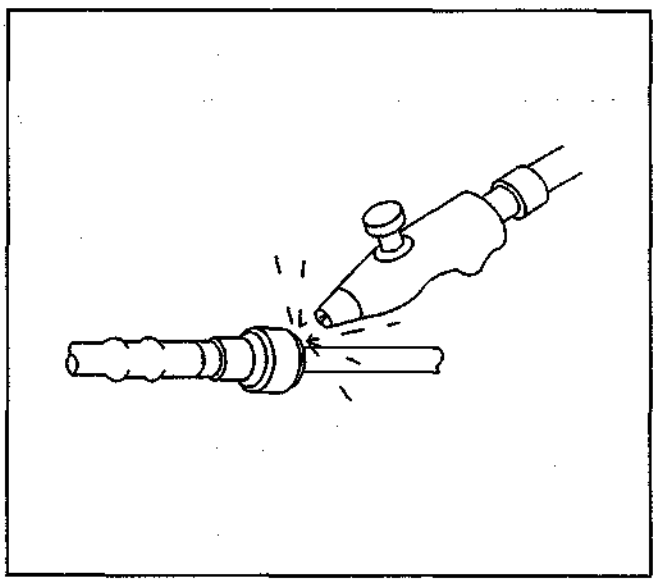
***After relieving the system pressure, a small amount of fuel may be released when servicing the fuel lines or connections. In order to reduce the chance of personal injury, cover the regulator and the fuel line fittings with a shop towel before disconnecting. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.***

***Notice:*** Before attempting any On-Vehicle Service, place a dry chemical (Class B) fire extinguisher near work area.

***Notice:*** Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.

**Important:** Always maintain cleanliness when servicing fuel system components.

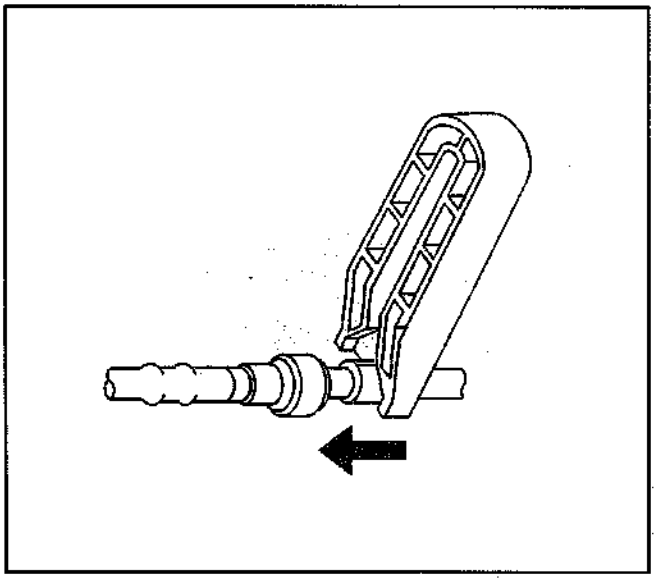
1. Relieve the fuel system pressure. Refer to *Fuel Pressure Relief Procedure*.
2. Grasp both sides of the fitting. Twist the female connector ¼ turn in each direction to loosen any dirt within the fitting.
3. Blow dirt out of the fitting using compressed air.



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4. Choose the correct tool from *J 37088-A* Tool Set for the size of the fitting. Insert the tool into the female connector, then push inward to release the locking tabs.

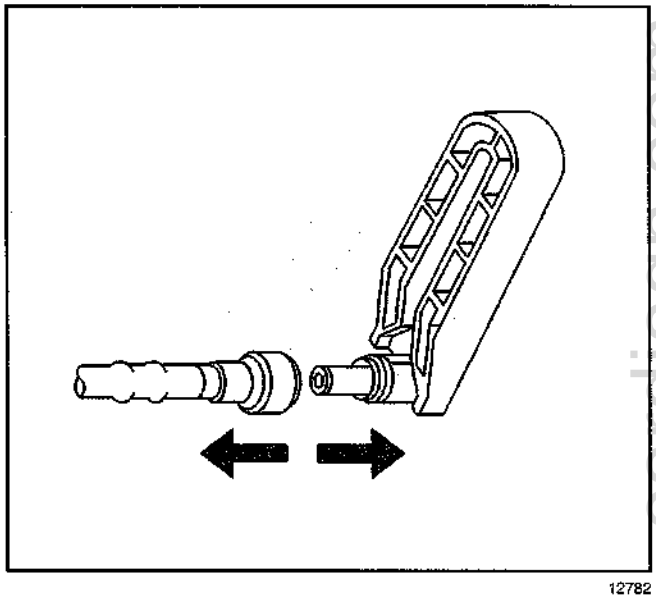


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5. Pull the connection apart.

***Notice:*** If it is necessary to remove rust or burrs from a fuel pipe, use emery cloth in a radial motion with the fuel pipe end in order to prevent damage to the O-ring sealing surface.

6. Using a clean shop towel, wipe off the male pipe end.
7. Inspect both ends of the fitting for dirt and burrs. Clean or replace the components as required.



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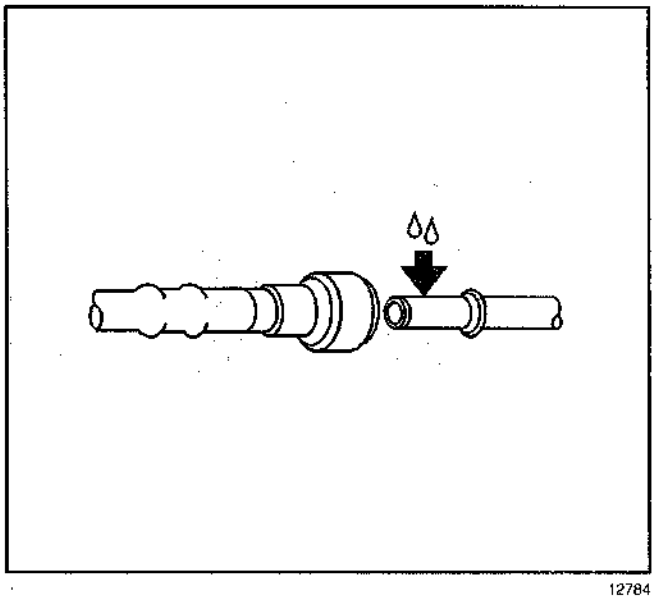
## Installation Procedure

***Caution: In order to reduce the risk of fire and personal injury, before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends.***

***This will ensure proper reconnection and prevent a possible fuel leak.***

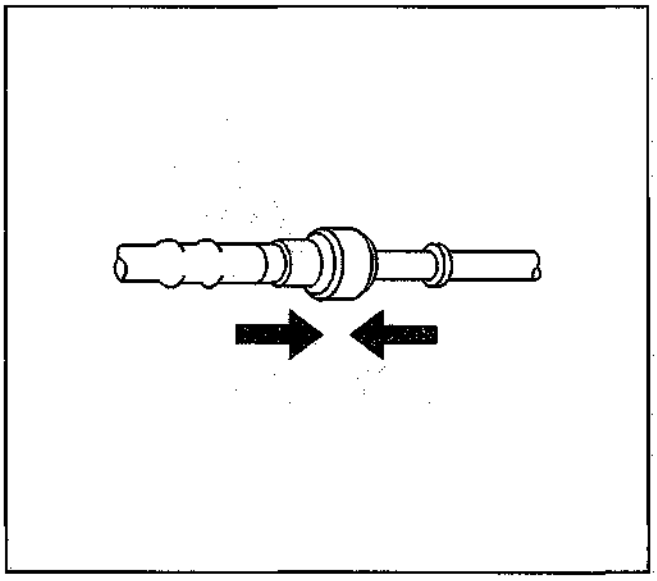
***During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.***

1. Apply a few drops of clean engine oil to the male pipe end.



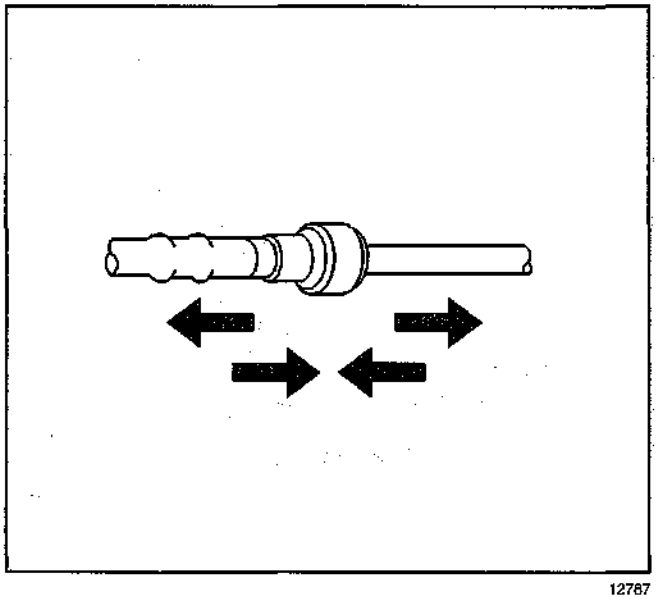
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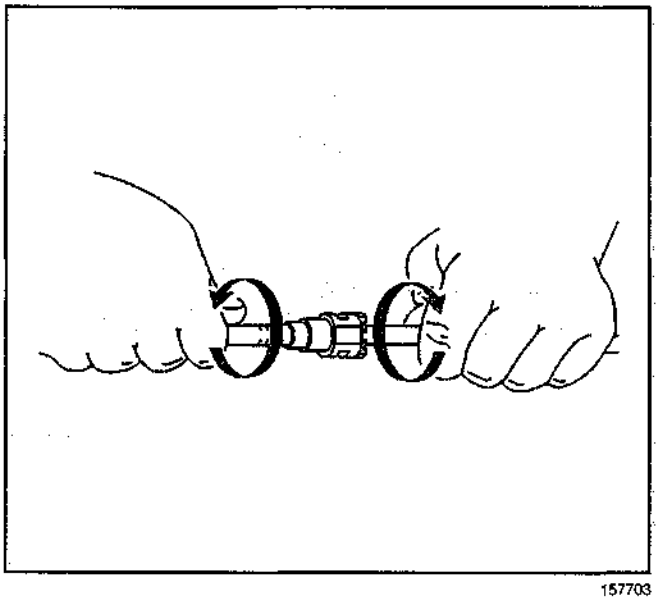
12786

2. Push both sides of the fitting together to cause the retaining tabs to snap into place.



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3. Once installed, pull on both sides of the fitting to make sure the connection is secure.
4. Tighten the fuel filler cap.
5. Reconnect the negative Battery Cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in engine electrical.
6. Inspect for leaks.
   6.1. Turn ON the ignition for 2 seconds.
   6.2. Turn OFF the ignition for 10 seconds.
   6.3. Turn ON the ignition.
   6.4. Check for fuel leaks.



157703

## Quick Connect Fitting(s) Service (Plastic Collar)

### Removal Procedure

***Caution: Relieve the fuel system pressure before servicing fuel system components in order to reduce the risk of fire and personal injury.***

***After relieving the system pressure, a small amount of fuel may be released when servicing the fuel lines or connections. In order to reduce the chance of personal injury, cover the regulator and the fuel line fittings with a shop towel before disconnecting. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.***

***Caution: Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.***

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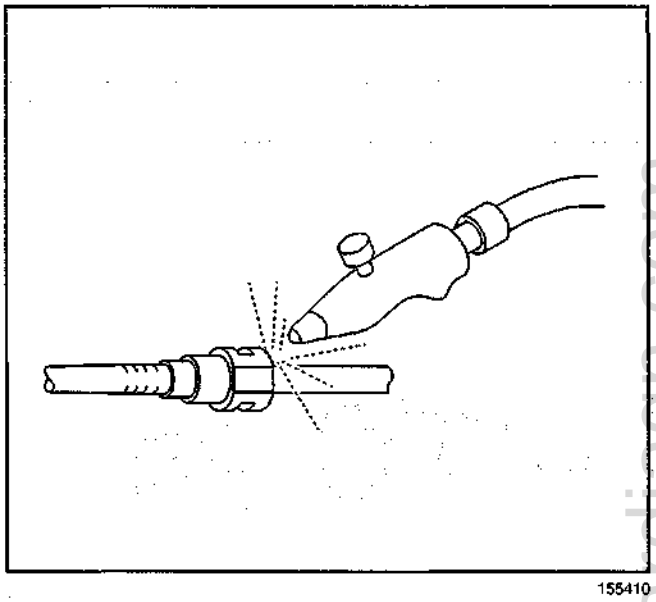
***Notice:*** Before attempting any On-Vehicle Service, place a dry chemical (Class B) fire extinguisher near work area.

***Notice:*** Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.

**Important:** Always maintain cleanliness when servicing fuel system components.

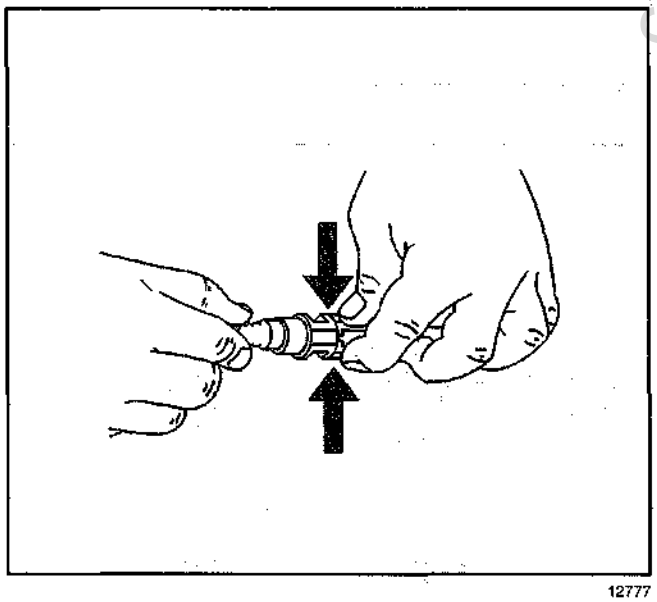
Relieve the fuel system pressure. Refer to *Fuel Pressure Relief Procedure.*

1. Grasp both sides of the quick-connect fitting. Twist quick-connect fitting 1/4 turn in each direction to loosen any dirt within fitting.
2. Repeat for other fuel pipe fitting.
3. Blow out dirt from quick-connect fittings at both ends, using compressed air.



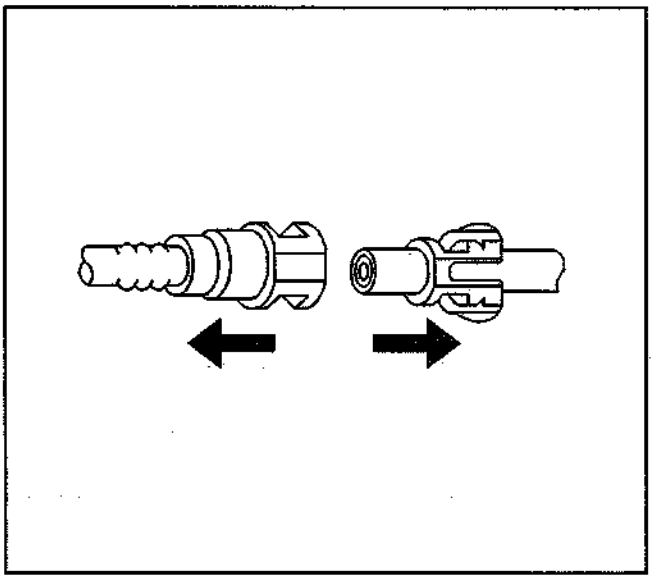
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4. Squeeze plastic tabs of male end connector.



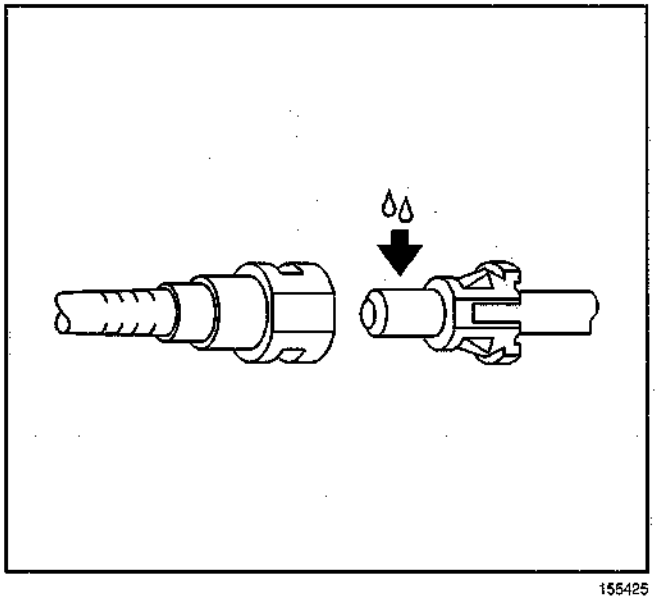
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5. Pull connection apart.
   Repeat for the other fitting.
6. Wipe off the male pipe end using a clean shop towel.
7. Clean or replace components/assemblies as required.



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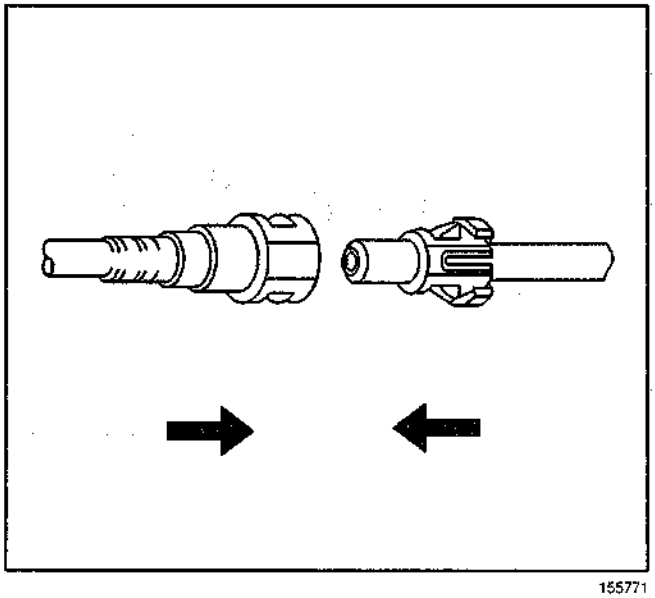
### Installation Procedure

***Caution: In order to reduce the risk of fire and personal injury, before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends.***

***This will ensure proper reconnection and prevent a possible fuel leak.***

***During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.***

1. Apply a few drops of clean oil to the male pipe end.

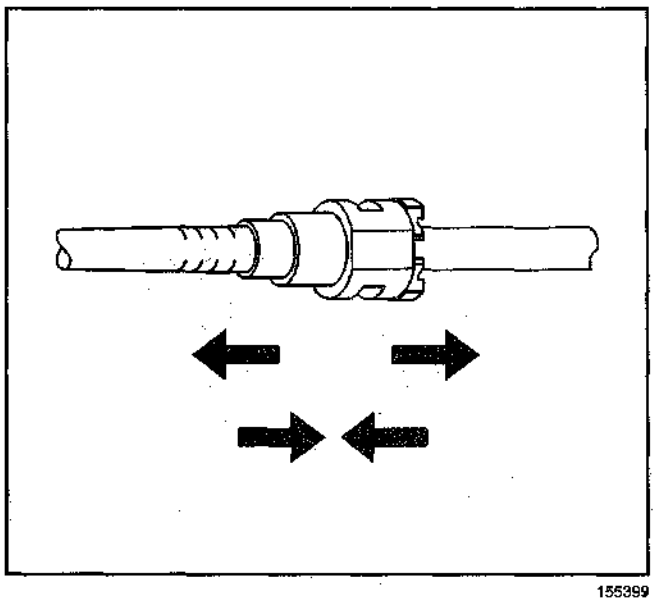


155771

2. Push both sides of the quick-connect fitting together in order to cause the retaining tabs/fingers to make sure snap into place.

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3. Pull on both sides of the quick connect fitting in order to make sure the connection is secure.
4. Tighten the fuel filler cap.
5. Reconnect negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
6. Inspect for fuel leaks.
   6.1. Turn ON the ignition for 2 seconds.
   6.2. Turn OFF the ignition for 10 seconds.
   6.3. Turn ON the ignition.
   6.4. Check for leaks.


155399

## In-Line Fuel Filter Replacement

### Removal Procedure

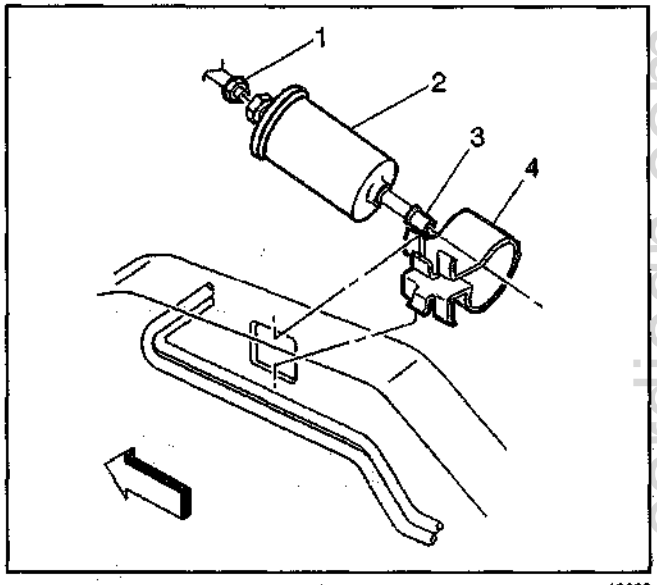
***Notice:*** Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.

**Important:** Always maintain cleanliness when servicing fuel system components.

**Important:**

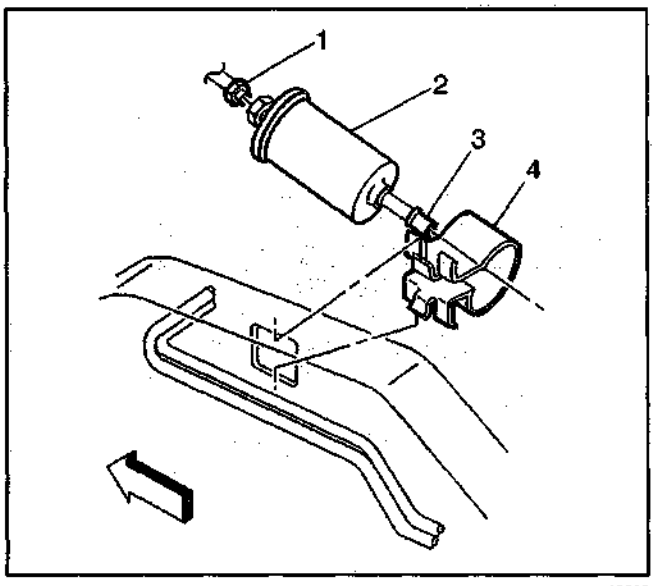
- There is no service interval for fuel filter replacement. Only replace a restricted fuel filter.
- Inspect the fuel tank internally and clean the fuel tank if you find a restricted fuel filter.

1. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure.*
2. Raise the vehicle. Go to *Lifting and Jacking the Vehicle* in General Information.
3. Clean all the fuel filter connections and the surrounding areas before disconnecting the fuel pipes in order to avoid possible contamination of the fuel system.
4. Disconnect the quick-connect fitting at the fuel filter inlet (3). Refer to *Quick Connect Fitting(s) Service (Plastic Collar).*
5. Disconnect the threaded fitting (1) from the fuel filter outlet.
6. Slide the fuel filter (2) from the bracket (4).
7. Inspect the fuel pipe O-ring for cuts, nicks, swelling, or distortion. Replace the O-ring if necessary.



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### Installation Procedure

***Notice:*** Always re-attach the fuel lines and fuel filter with all original type fasteners and hardware.

Do not repair sections of fuel pipes.

**Important:** If fuel line bundle attaching hardware is damaged or broken replace it.

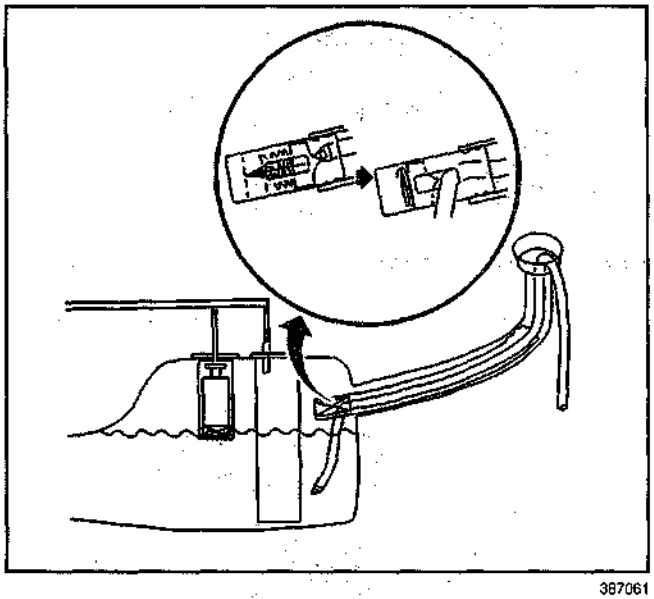
1. Slide the fuel filter (2) into the bracket (4).
2. Reconnect the threaded fitting (1) to the fuel filter outlet.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

**Tighten**

Tighten the fuel filter fitting to 30 N·m (22 lb ft).

3. Reconnect the quick-connect fitting to the fuel filter inlet (3). Refer to *Quick Connect Fitting(s) Service (Plastic Collar).*
4. Lower the vehicle.
5. Tighten the fuel filler cap.
6. Reconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
7. Inspect for leaks.
   - 7.1. Turn ON the ignition for 2 seconds.
   - 7.2. Turn OFF the ignition for 10 seconds.
   - 7.3. Turn ON the ignition.
   - 7.4. Check for fuel leaks.


387061

## Fuel Tank Draining Procedure

### Tools Required

- *J 42960-1* Fuel Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

1. Remove the fuel filler cap.
2. Install the *J 42960-2* fuel flapper door holder into the fuel fill pipe in order to hold the door open.
3. Insert the *J 42960-1* fuel drain hose into the fuel tank until the hose reaches the bottom of the fuel tank.
4. Use an air operated pump device in order to drain as much fuel through the fuel fill pipe as possible.

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## Fuel Tank Replacement

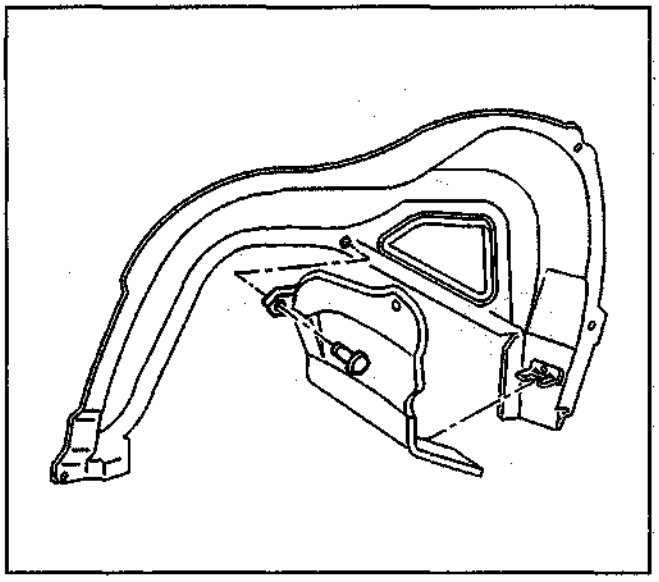
### Removal Procedure

**Tools Required**

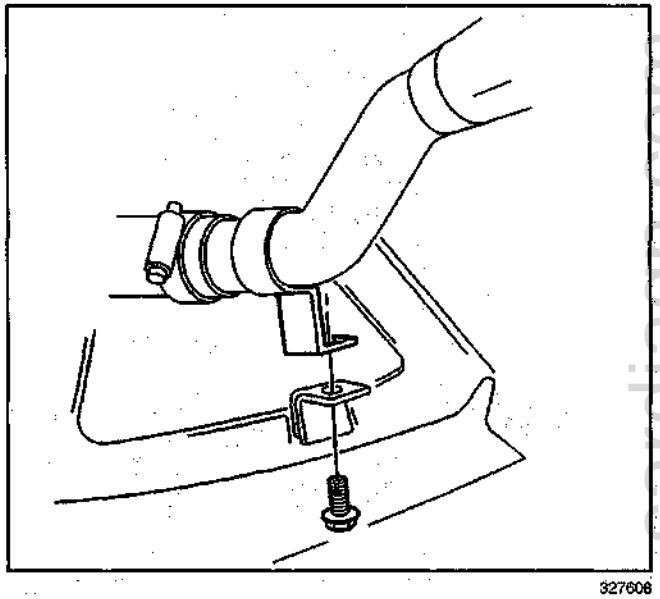
- *J 34730-1A* Fuel Pressure Gauge
- *J 39765* Fuel Sender Lock Nut Wrench
- *J 42960-1* Fuel Tank Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

***Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.***

1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure.*
3. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure.*
4. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
5. Remove the fuel fill pipe shield.
6. Remove the fuel tank fill pipe support bracket bolt.
7. Remove the exhaust system from the catalytic converter back. Refer to *Muffler Replacement* in Engine Exhaust.
8. Remove the exhaust pipe heat shield and the exhaust muffler heat shield. Refer to *Exhaust Pipe and Muffler Heat Shields Replacement* in Engine Exhaust.

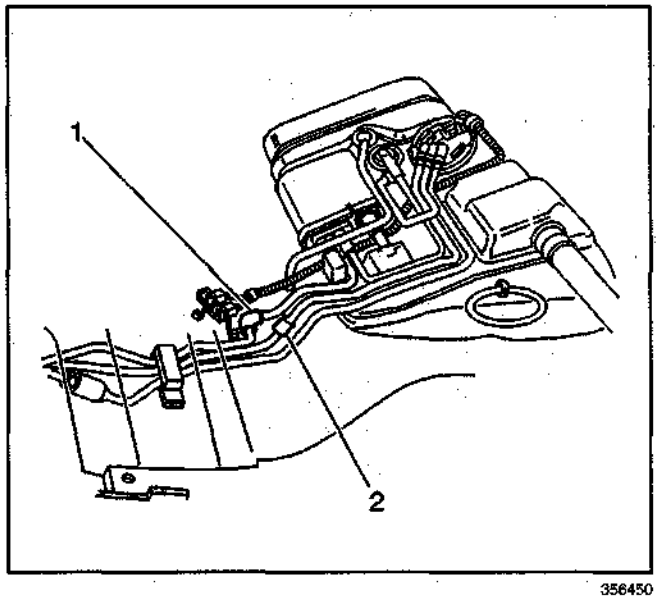


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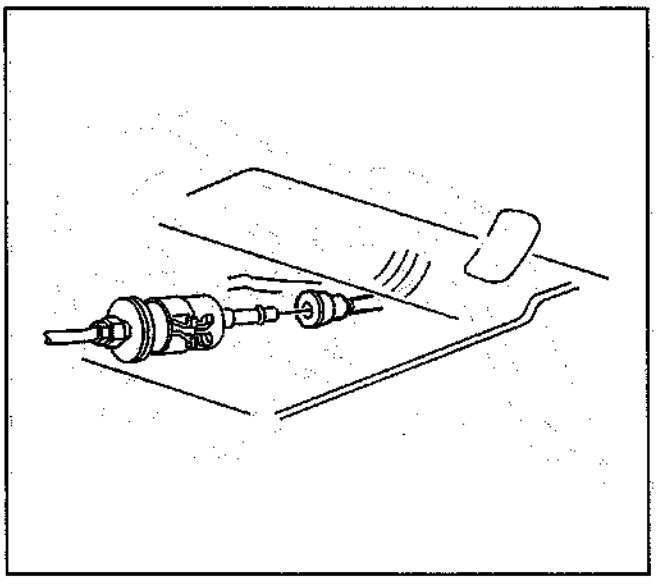
327606

9. Clean all fuel pipe connections and surrounding areas before disconnecting the fuel pipes in order to avoid possible contamination of the fuel system.
10. Disconnect the fuel return pipe (2) at the rear quick-connect fitting.
11. Disconnect the EVAP purge pipe (1) at the rear quick-connect fitting.

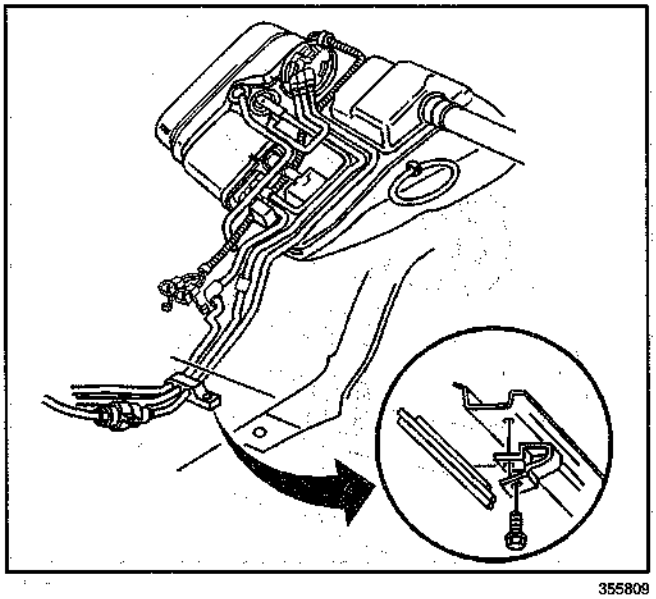



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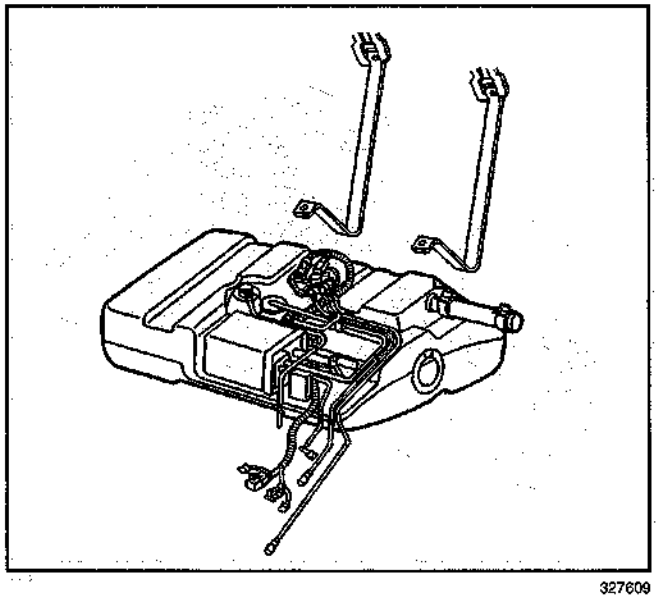
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12. Disconnect the fuel feed pipe at the fuel filter inlet.
13. Cap the fuel pipes in order to prevent possible fuel system contamination.


355809

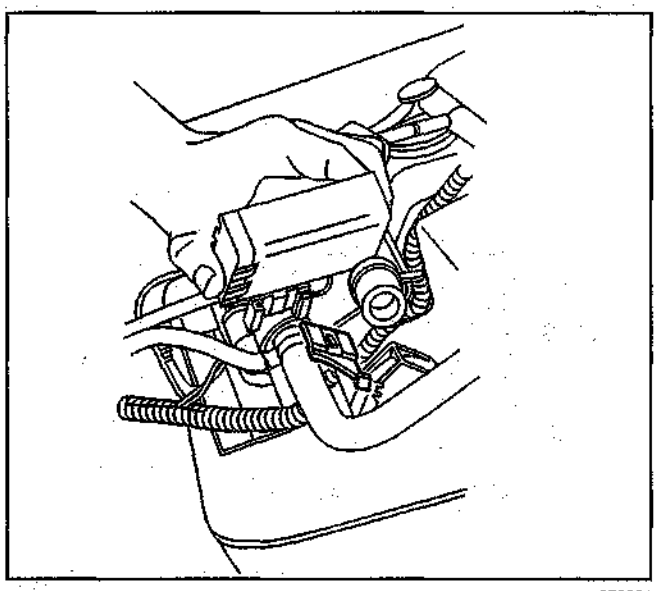
14. Remove the rear pipe clip.


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15. Remove the fuel tank.
16. Place the fuel tank in a suitable work area.

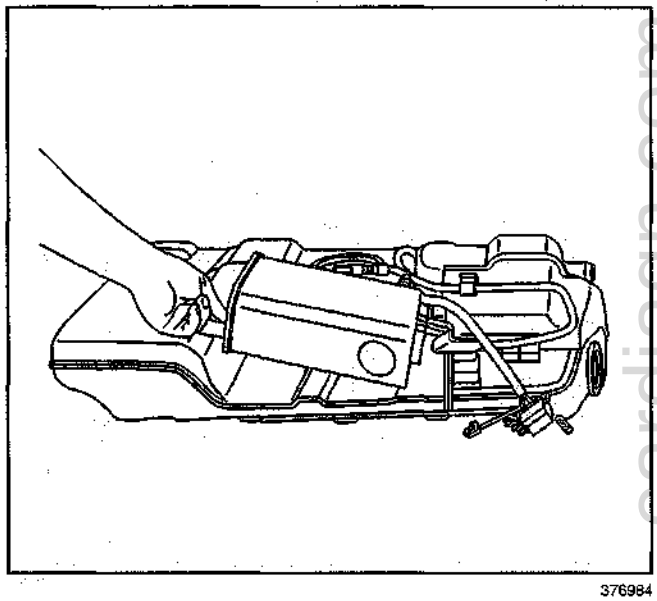
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17. Disconnect the hose from the EVAP canister vent solenoid.
18. Remove the EVAP canister vent solenoid from the fuel tank bracket.



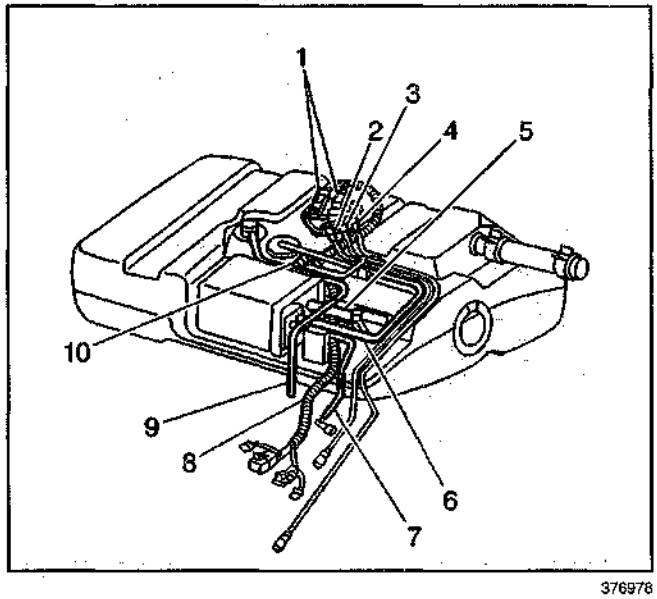
376991

19. Disconnect the fill limiter vent valve pipe from the EVAP canister.
20. Carefully bend the fuel tank bracket in order to remove the EVAP canister.



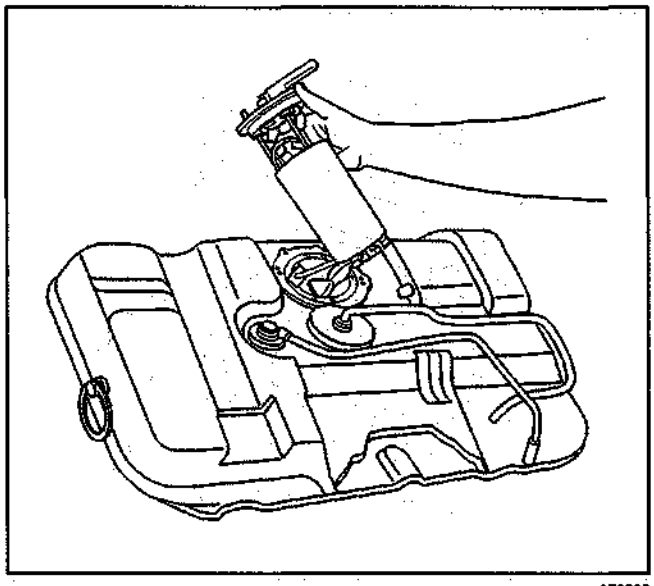
376984

21. Disconnect the fuel feed pipe (4), the fuel return pipe (2), and the EVAP pipe (3) from the fuel sender.
22. Disconnect the EVAP pipe from the fill limiter vent valve pipe (10).
23. Remove the fuel and EVAP pipes from the fuel tank.
24. Disconnect the fuel sender electrical connectors (1).
25. Remove the fuel sender electrical harness (8) from the fuel tank.

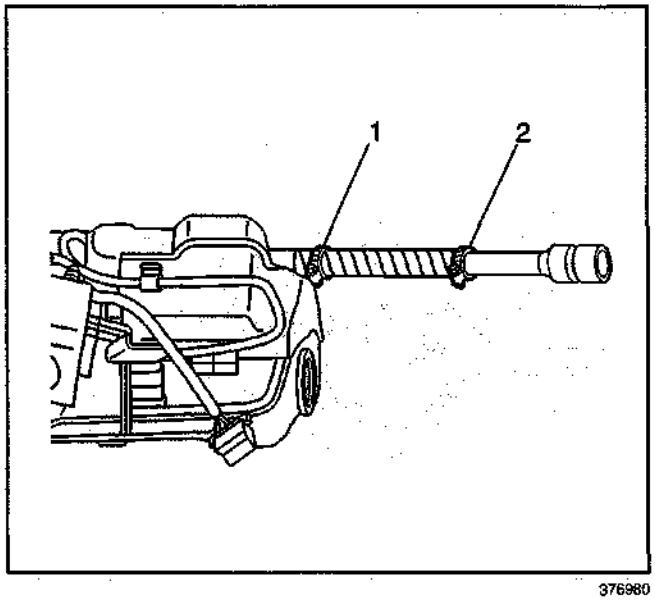



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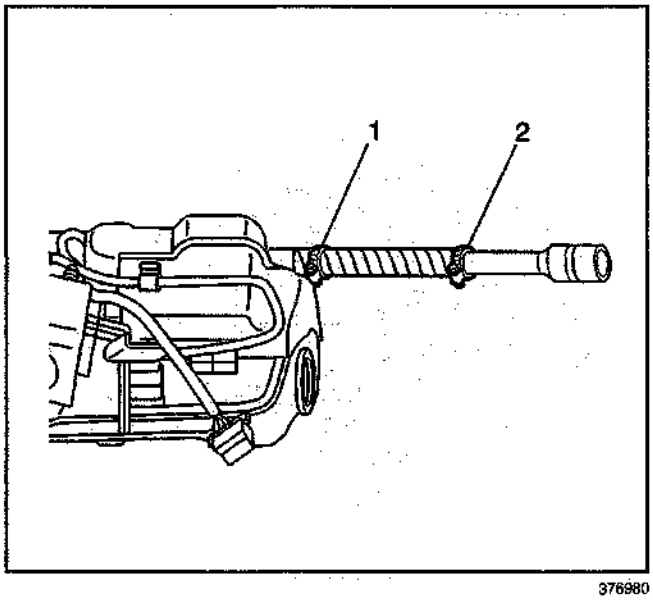

376962

26. Remove the fuel sender assembly from the fuel tank. Refer to *Fuel Sender Assembly Replacement*.



376980

27. Remove the fuel fill hose to fuel tank clamp (1).
28. Remove the fuel fill pipe and hose from the fuel tank.



376980

## Installation Procedure

1. Install the fuel fill pipe and hose to the fuel tank.

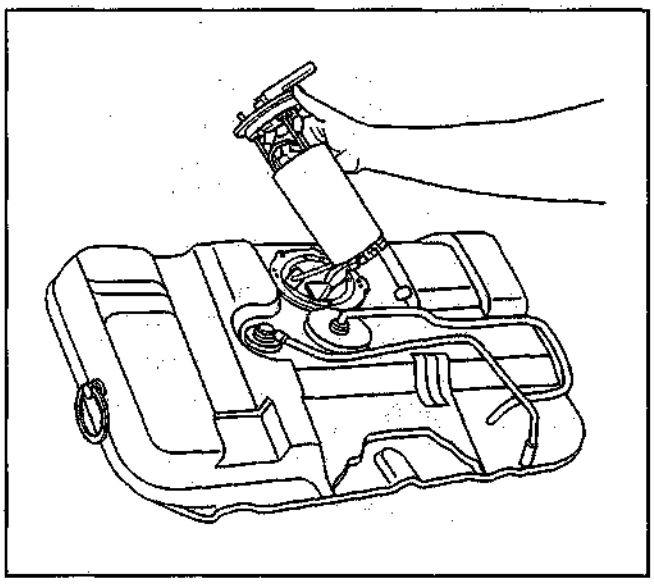
***Notice:*** Refer to the *Fastener Notice* in Cautions and Notices.

**Tighten**

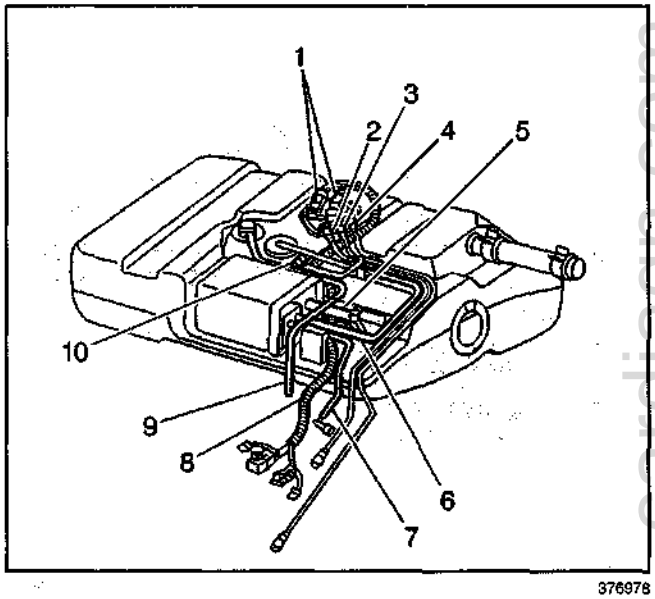
Tighten the fuel fill hose clamp (1) to 2.5 N·m (22 lb in).

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2. Install the fuel sender assembly to the fuel tank. Refer to *Fuel Sender Assembly Replacement.*
3. Perform the fuel tank leak check. Refer to *Fuel Tank Leak Check.*

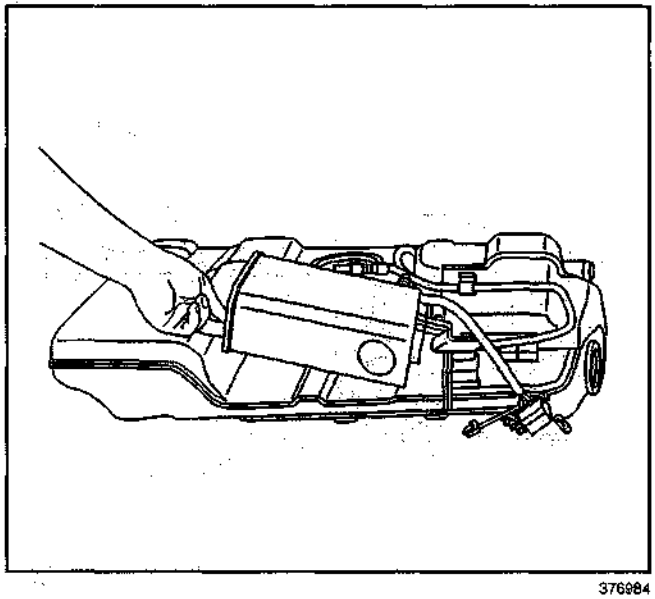

376982

4. Install the fuel sender electrical harness (8) to the fuel tank.
5. Connect the fuel sender electrical connectors (1).
6. Install the fuel feed pipe (4) and the fuel return pipe (2) to the fuel sender and the fuel tank clips.
7. Connect the EVAP pipe (3) to the fuel sender.
8. Connect the EVAP pipe to the fill limiter vent valve pipe (10).

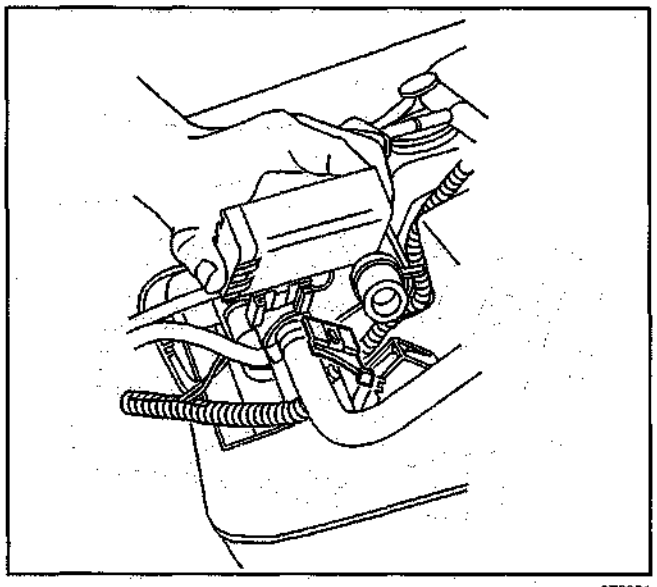


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9. Carefully bend the fuel tank bracket in order to install the EVAP canister.
10. Connect the fill limiter vent valve pipe to the EVAP canister.

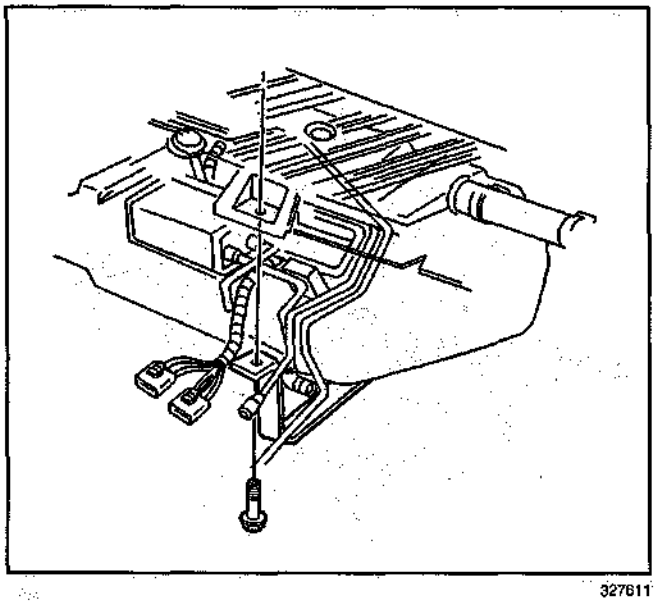

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11. Install the EVAP canister vent solenoid to the fuel tank bracket.
12. Connect the hose to the EVAP canister vent solenoid.

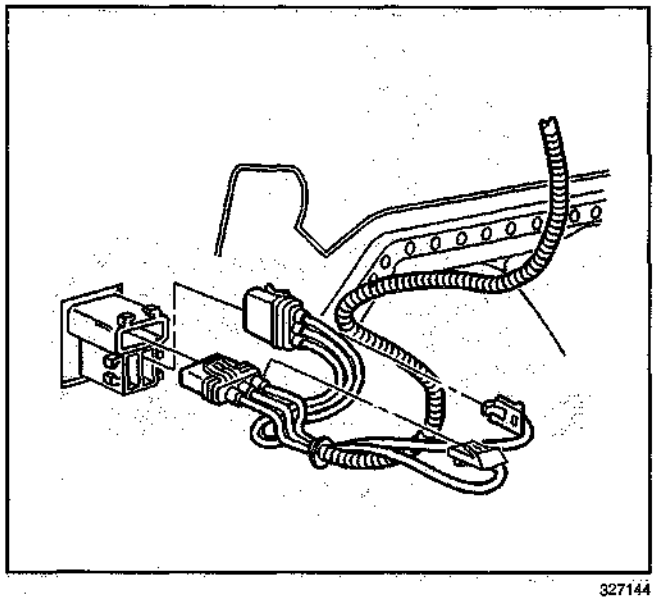


327611

13. With the aid of an assistant, position and support the fuel tank.
14. Position the fuel tank straps up.
15. Install the fuel tank strap attaching bolts.

    **Tighten**

    Tighten the fuel tank strap attaching bolts to 33 N·m (24 lb ft).

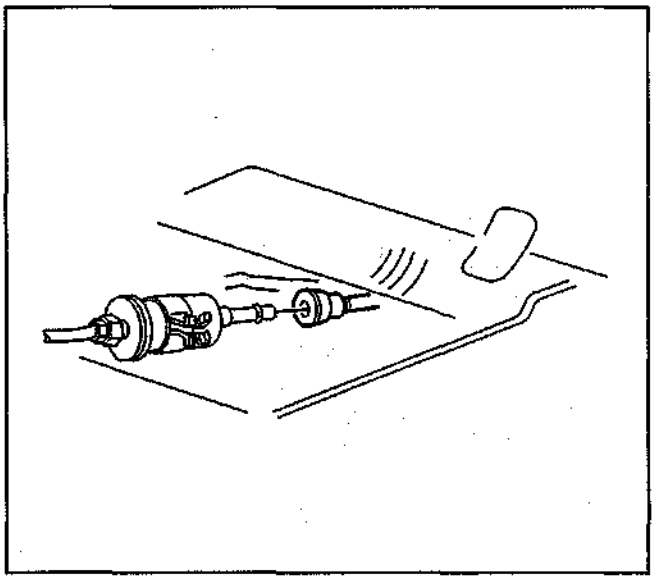


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16. Connect the fuel sender and the fuel pressure sensor electrical connectors at the pass through connector.

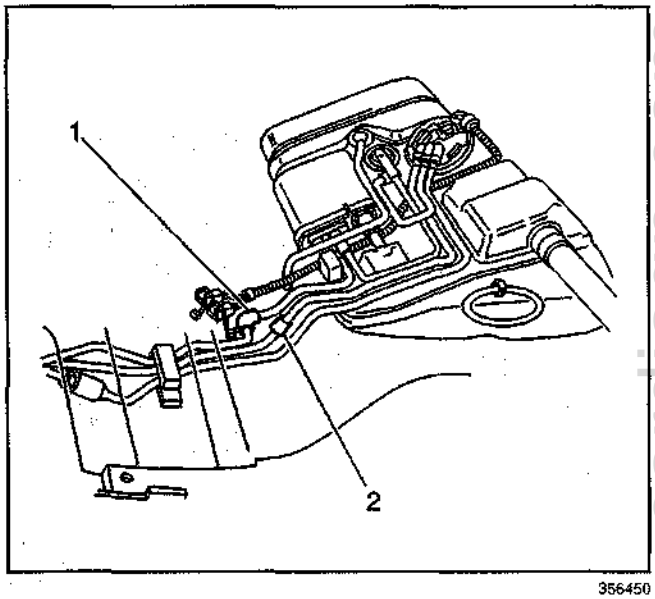
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17. Remove the caps from the fuel pipes.
18. Connect the fuel feed pipe at the fuel filter inlet.



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19. Connect the EVAP purge pipe (1) at the rear quick-connect fitting.
20. Connect the fuel return pipe (2) at the rear quick-connect fitting.

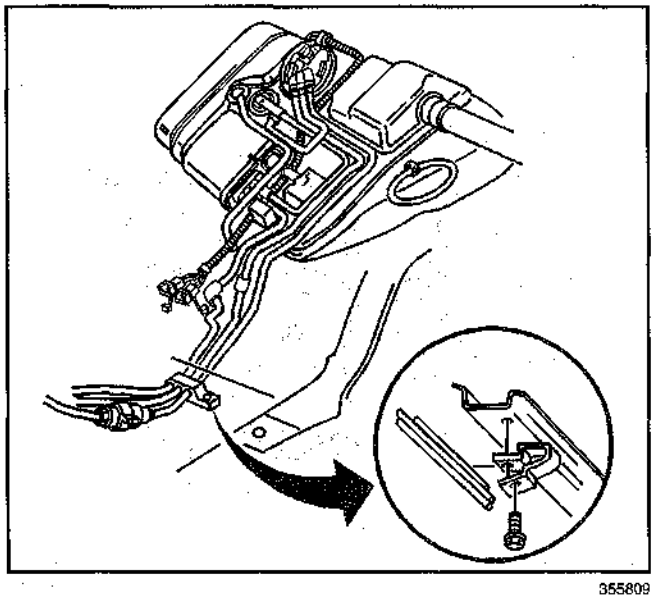



356450

21. Install the fuel and EVAP pipes into the pipe clip.
22. Align the fuel and EVAP pipes into a flat position.
23. Install the pipe clip bolt.

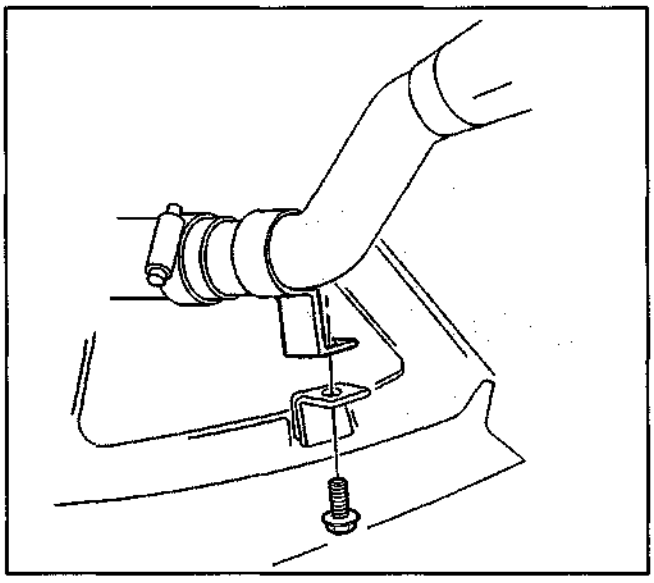
**Tighten**

Tighten the pipe clip bolt to 5.5 N·m (49 lb in).

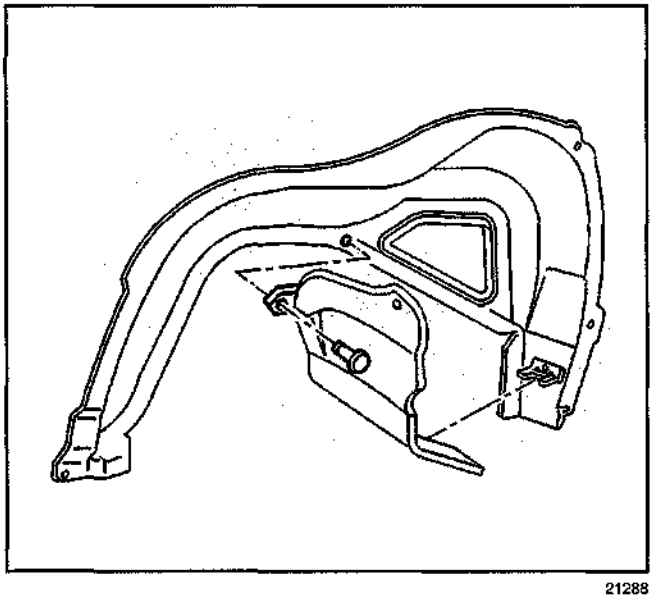


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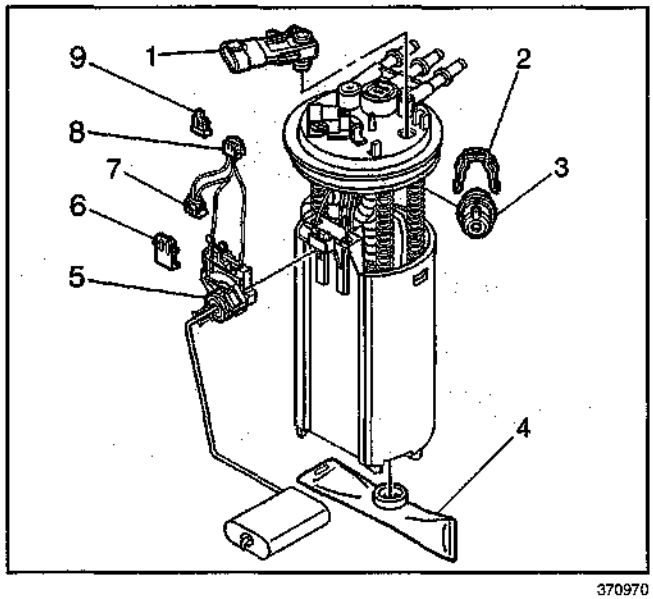
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327608

24. Install the fuel tank fill pipe support bracket bolt.
    **Tighten**
    Tighten the fuel tank fill pipe support bracket bolt to 10 N·m (89 lb in).
25. Install the exhaust system heat shields and attaching screws. Refer to *Exhaust Pipe and Muffler Heat Shields Replacement* in Engine Exhaust.
26. Install the exhaust system. Refer to *Muffler Replacement* in Engine Exhaust.


21288

27. Install the fuel filler pipe shield.
28. Lower the vehicle.
29. Refill the fuel tank.
30. Install the fuel filler cap.
31. Connect the negative battery cable.
32. Inspect for leaks.
    32.1. Turn ON the ignition for 2 seconds.
    32.2. Turn OFF the ignition for 10 seconds.
    32.3. Turn ON the ignition.
    32.4. Check for fuel leaks.



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## Fuel Tank Pressure Sensor Replacement

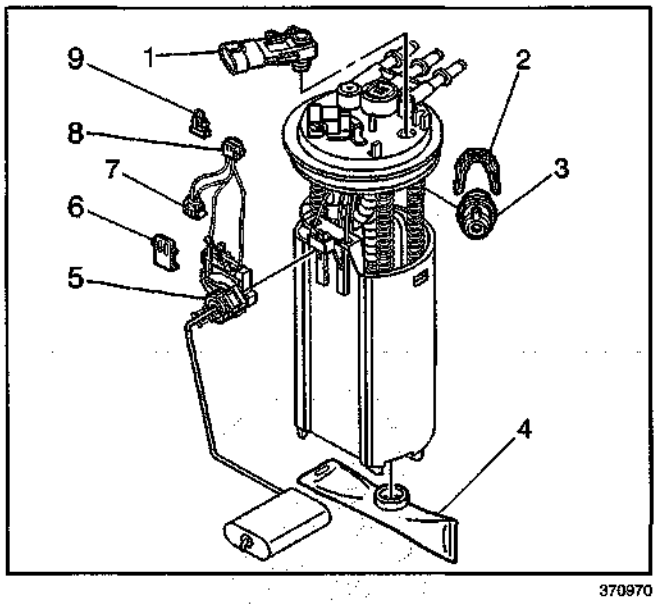
### Removal Procedure

1. Relieve the fuel system pressure. Refer to *Fuel Pressure Relief Procedure.*
2. Drain fuel tank. Refer to *Fuel Tank Draining Procedure.*
3. Raise the vehicle. Go to *Lifting and Jacking the Vehicle* in General Information.
4. Remove the fuel tank. Refer to *Fuel Tank Replacement.*
5. Remove the electrical connector from the fuel tank pressure sensor.
6. Remove the fuel tank pressure sensor (10) from the modular fuel sender.

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### Installation Procedure

1. Install the new fuel tank pressure sensor (10) to the modular fuel sender.
2. Connect the electrical connector to the fuel tank pressure sensor.
3. Reinstall the fuel tank. Refer to *Fuel Tank Replacement*.
4. Refill the fuel tank.
5. Reconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
6. Inspect for fuel leaks.
   6.1. Turn ON the ignition for 2 seconds.
   6.2. Turn OFF the ignition for 10 seconds.
   6.3. Turn ON the ignition.
   6.4. Check for fuel leaks.



370970

## Fill Limiter Vent Valve Replacement

### Removal Procedure

***Caution: Relieve the fuel system pressure before servicing fuel system components in order to reduce the risk of fire and personal injury.***

***After relieving the system pressure, a small amount of fuel may be released when servicing the fuel lines or connections. In order to reduce the chance of personal injury, cover the regulator and the fuel line fittings with a shop towel before disconnecting. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.***

***Caution: Gasoline or gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.***

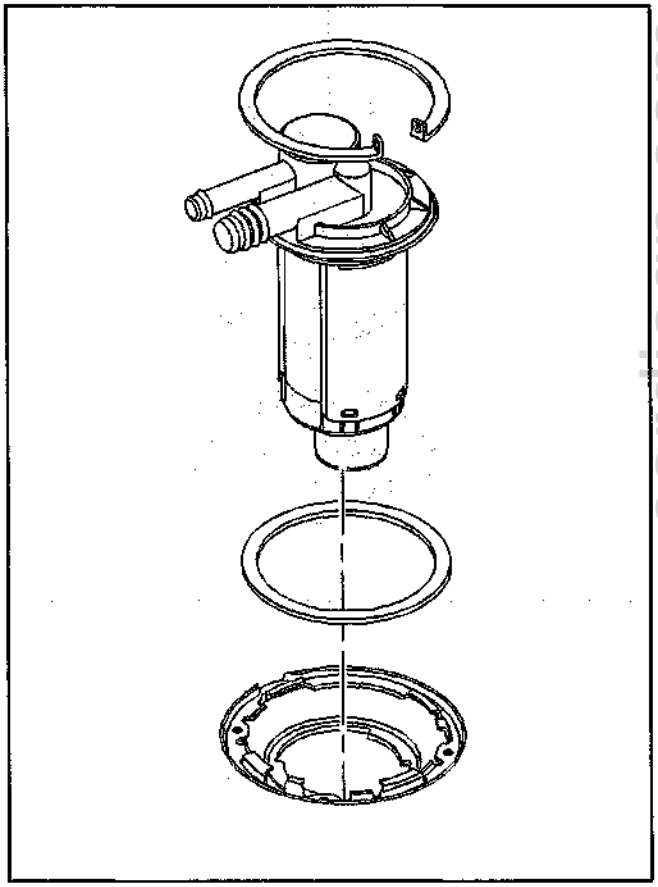
***Caution: Always wear safety goggles when working with fuel in order to protect the eyes from fuel splash.***

***Notice:*** Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.

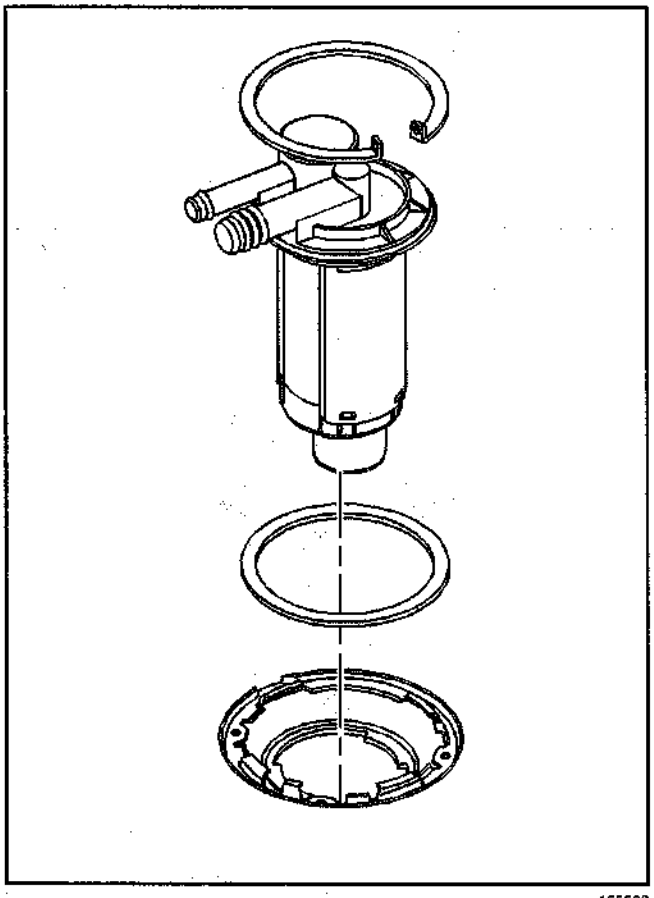
**Important:** Always replace the fuel limiter vent valve O-ring when reinstalling the fuel limiter vent valve.

**Important:** Always maintain cleanliness when servicing fuel system components.

1. Relieve the fuel system fuel pressure. Refer to *Fuel Pressure Relief Procedure*.
2. Raise the vehicle. Go to *Lifting and Jacking the Vehicle* in General Information.
3. Remove the fuel tank. Refer to *Fuel Tank Replacement*.
4. Remove the fuel limiter vent valve snap ring.


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5. Remove the fuel limiter vent valve.
6. Remove the fuel limiter vent valve O-ring.
7. Clean the fuel limiter vent valve O-ring sealing surfaces.
8. Inspect the fuel limiter vent valve O-ring sealing surfaces.
9. Inspect the fuel limiter vent valve for cracks or damage.
10. If the fuel limiter vent valve is cracked or damaged replace it.

### Installation Procedure

**Important:** Be sure that the fuel limiter vent valve retaining snap ring is fully seated within the tab slots on the fuel tank.

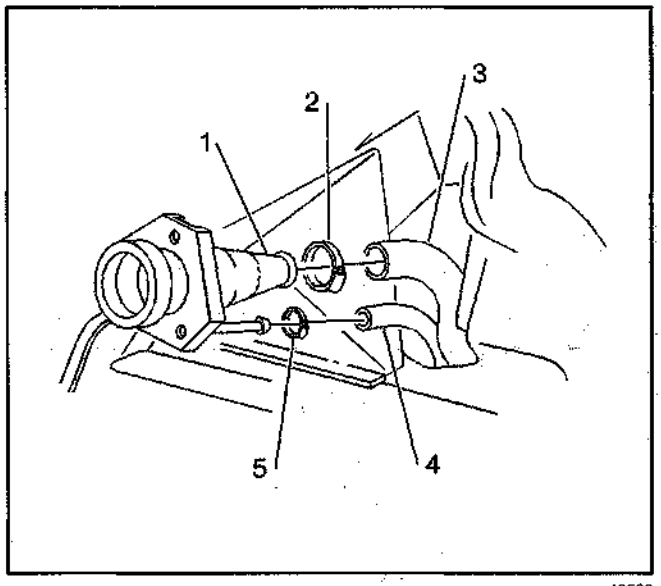
1. Position the new fuel limiter vent valve O-ring on the fuel tank.
2. Install the fuel limiter vent valve.
3. Reinstall the fuel limiter vent valve snap ring.
4. Reinstall the fuel tank. Refer to *Fuel Tank Replacement.*
5. Lower the vehicle.
6. Reconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
7. Inspect for leaks.
   7.1. Inspect turn the ignition to the ON position for two seconds.
   7.2. Turn OFF the ignition for ten seconds.
   7.3. Turn ON the ignition again.
   7.4. Visually inspect the fuel system for fuel leaks.

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## Filler Tube Replacement

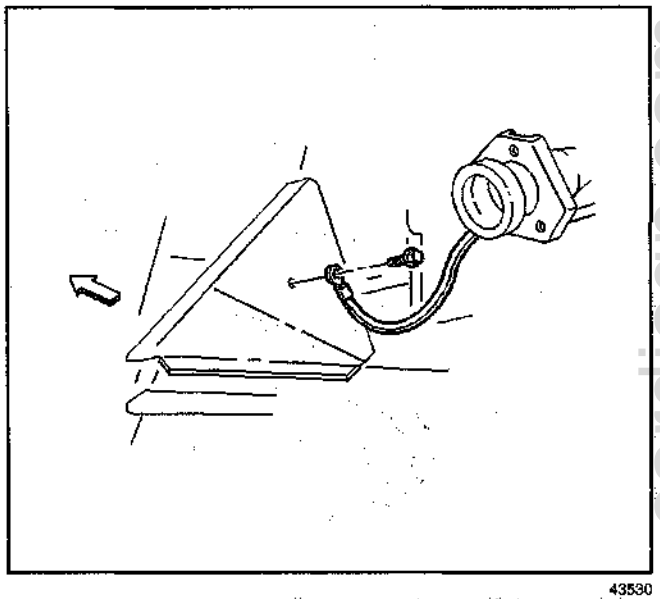
### Removal Procedure

1. Remove the fuel filler cap.
2. Remove the left rear wheelhouse panel.
3. Disconnect the fuel fill hose (3) and the vent hose (4) from the fuel tank fill and vent pipe (1).
4. Remove the fuel fill hose (3) and the vent hose (4) from the fuel tank.
5. Cap the open ends of the fuel tank.

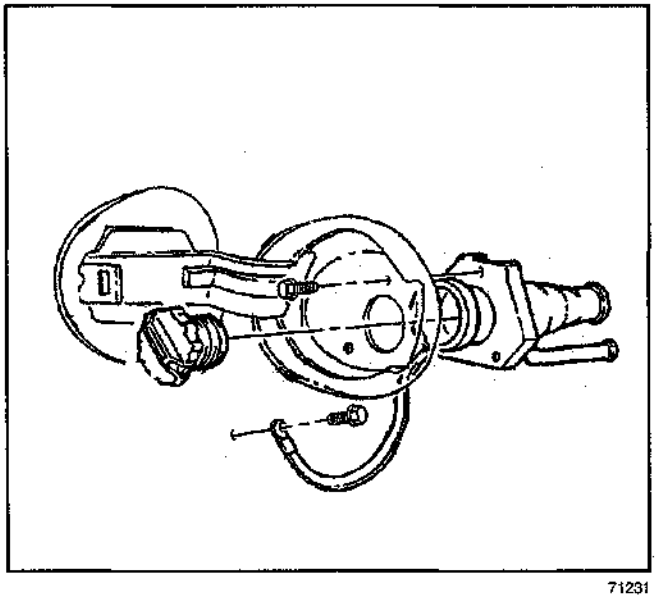


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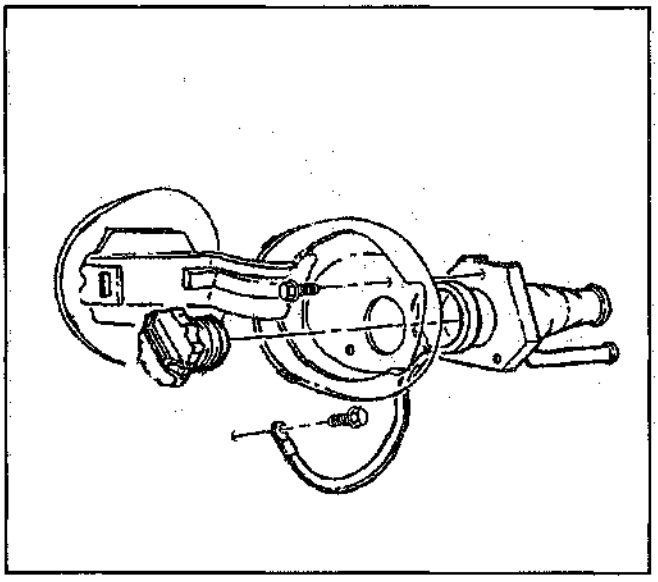
6. Disconnect the fuel system ground strap.


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7. Remove the fuel tank fill and vent pipe from the fuel filler pocket.


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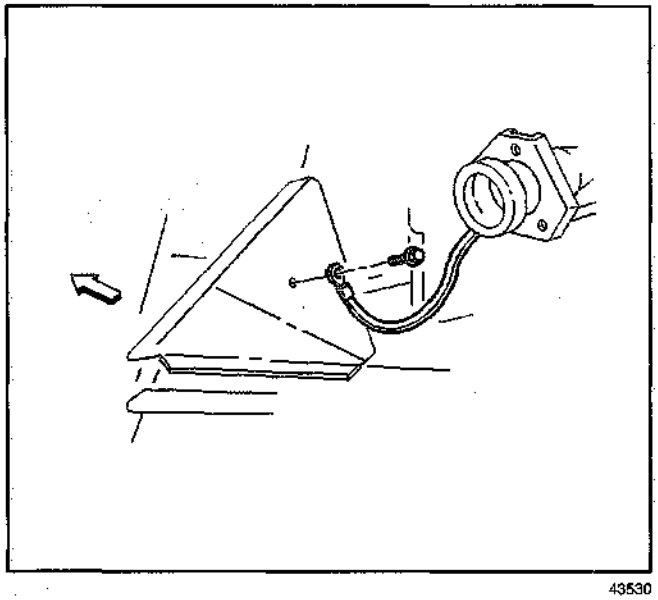
### Installation Procedure

1. Install the fuel tank fill and vent pipe to the fuel filler pocket.

***Notice:*** Refer to the *Fastener Notice* in Cautions and Notices.

**Tighten**

Tighten the fuel tank fill and vent pipe bolts to 2.5 N·m (22 lb in).

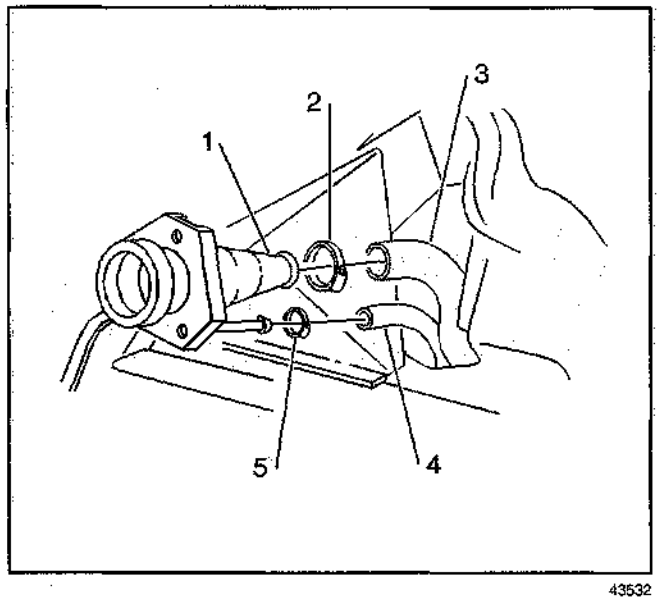


43530

2. Connect the fuel fill pipe ground strap.

**Tighten**

Tighten the fuel fill pipe ground strap bolt to 8 N·m (71 lb in).




43532

3. Uncap the openings on the fuel tank.
4. Connect the fuel fill hose (3) and the vent hose to the fuel tank.
5. Connect the fuel fill hose (3) and the vent hose (4) to the fuel tank fill and vent pipe (1).

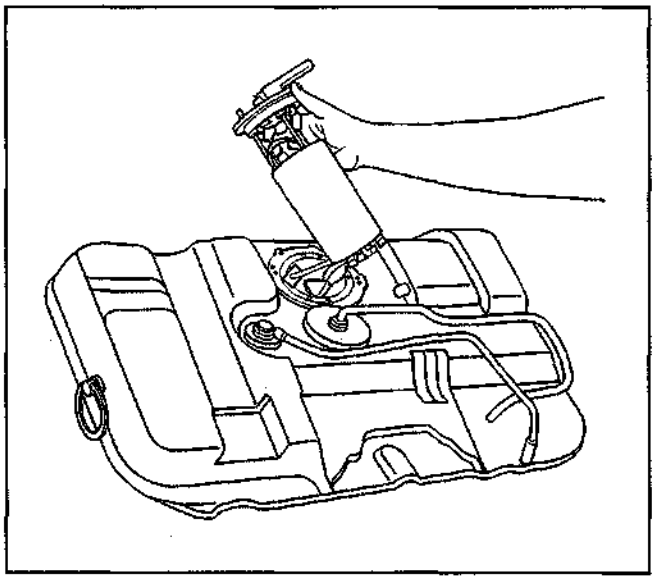
**Tighten**

Tighten the fuel fill hose clamps and the vent hose clamps to 4 N·m (35 lb in).

6. Install the left rear wheelhouse panel.
7. Install the fuel filler cap.

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## Fuel Sender Assembly Replacement


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### Removal Procedure

***Caution: In order to reduce the risk of fire and personal injury that may result from a fuel leak, always replace the fuel sender gasket when reinstalling the fuel sender assembly.***

***Notice:*** Do Not handle the fuel sender assembly by the fuel pipes. The amount of leverage generated by handling the fuel pipes could damage the joints.

***Notice:*** Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.

**Important:** Always maintain cleanliness when servicing fuel system components.

1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure.*
3. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure.*
4. Remove the fuel tank. Refer to *Fuel Tank Replacement.*
5. Remove the fuel sender assembly retaining nuts (1), the retaining ring (2), the fuel sender assembly (3), and the gasket (4). Discard the gasket.

***Caution: Drain the fuel from the fuel sender assembly into an approved container in order to reduce the risk of fire and personal injury. Never store the fuel in an open container.***

6. Clean the gasket sealing surfaces.

### Installation Procedure

1. Position the new gasket on the fuel tank.

**Important:** The fuel pump strainer must be in a horizontal position when the fuel sender is installed in the tank. When installing the fuel sender assembly, assure that the fuel pump strainer does not block full travel of the float arm.

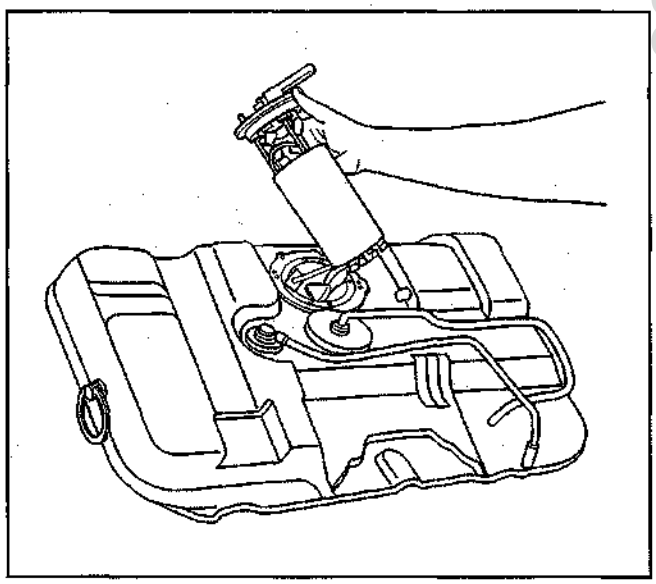
2. Carefully fold the strainer to allow it to fit through the opening in the fuel tank. Make sure the strainer unfolds once it is placed in the tank.
3. Install the fuel sender assembly into the fuel tank.
4. Install the fuel sender retaining ring (2).

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

5. Reinstall the fuel sender assembly retaining nuts (1).

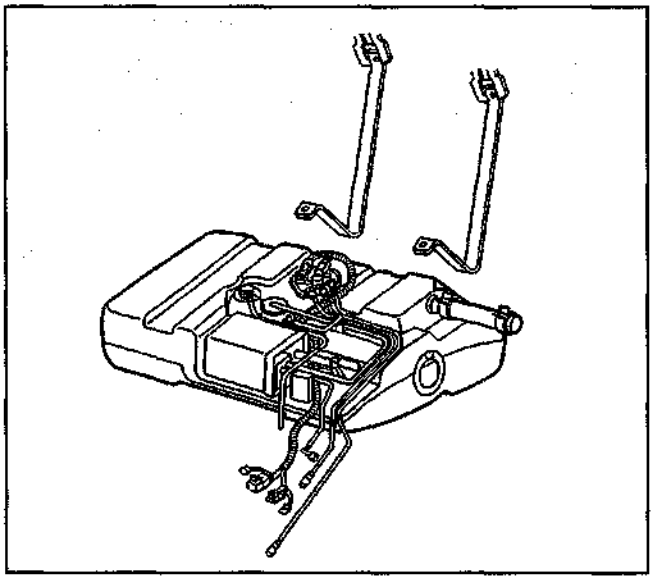
   **Tighten**

   Tighten the fuel sender assembly retaining nuts alternately and evenly to 6.5 N·m (58 lb in).
6. Reinstall the fuel tank. Refer to *Fuel Tank Replacement.*
7. Add fuel.


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8. Reinstall the fuel filler cap.
9. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
10. Inspect for leaks.
    10.1. Turn ON the ignition for 2 seconds.
    10.2. Turn OFF the ignition for 10 seconds.
    10.3. Turn ON the ignition.
    10.4. Check for fuel leaks.



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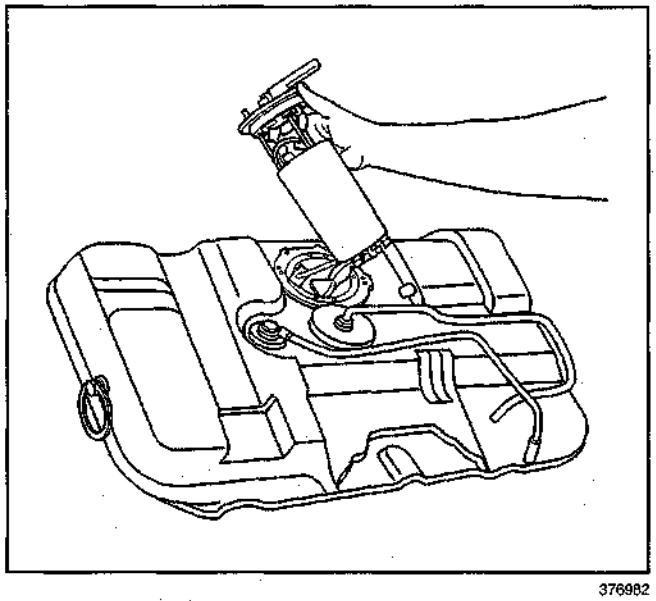
## Fuel Tank Pump Module Replacement

### Removal Procedure

**Tools Required**

- *J 34730-1A* Fuel Pressure Gauge
- *J 39765* Fuel Sender Lock Nut Wrench
- *J 42960-1* Fuel Tank Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

1. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure.*
2. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure.*
3. Remove the fuel tank. Refer to *Fuel Tank Replacement.*

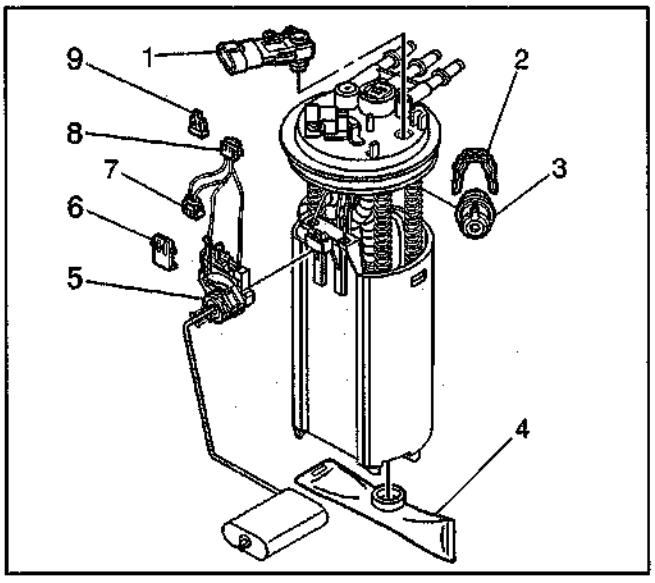


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4. Remove the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement.*

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5. Note the position of the fuel strainer (4) on the fuel pump.
6. Support the fuel sender assembly with one hand and grasp the strainer (4) with the other hand.
7. Pull the strainer off the pump. Discard the strainer after inspection.
8. Inspect the strainer. Replace a contaminated strainer and clean the fuel tank.
9. Disconnect the fuel pump electrical connector (7).
10. Remove the fuel level sensor electrical connector retaining clip (9).
11. Disconnect the fuel level sensor electrical connector (8) from under the fuel sender cover.
12. Remove the fuel level sensor retaining clip (6).
13. Squeeze the locking tangs and remove the fuel level sensor (5).
14. Remove the fuel pressure sensor (1).



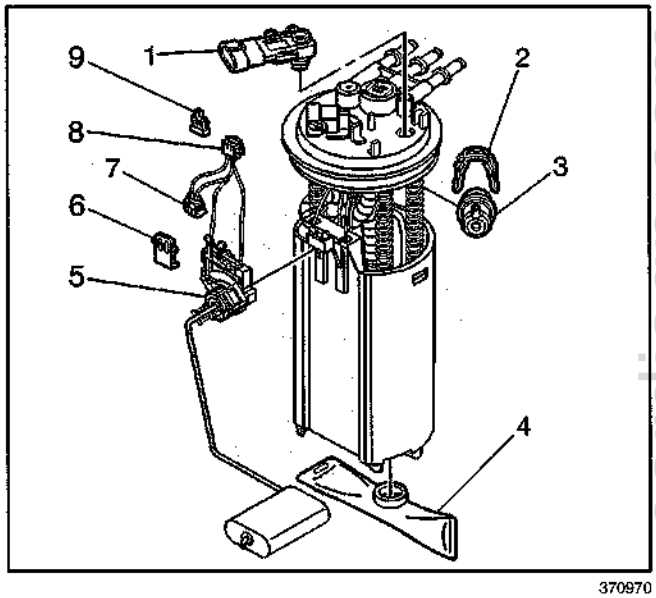
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### Installation Procedure

1. Install the fuel pressure sensor (1).
2. Install the fuel level sensor (5).
3. Install the fuel level sensor retaining clip (6).
4. Connect the fuel level sensor electrical connector (8).
5. Connect the fuel level sensor electrical connector retaining clip (9).
6. Connect the fuel pump electrical connector (7).

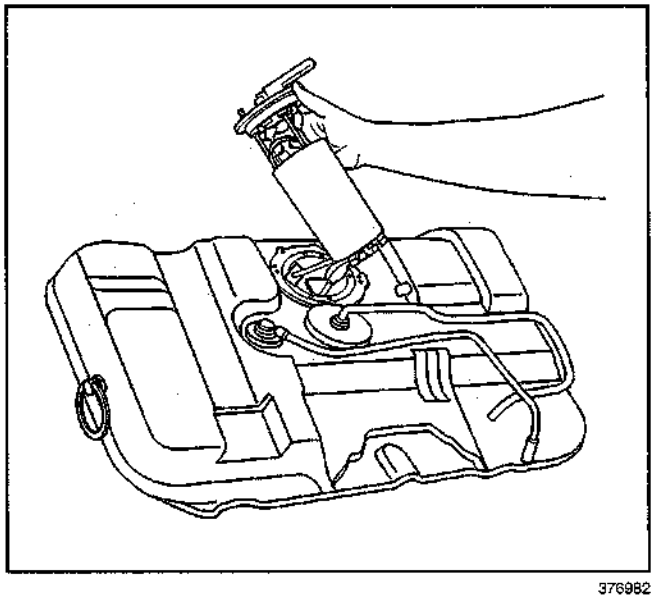
**Important:** Always install a new fuel strainer when replacing the fuel tank fuel pump module.

7. Install a new fuel strainer (4) in the same position as noted during disassembly. Push the strainer on the bottom of the fuel sender until the strainer is fully seated.

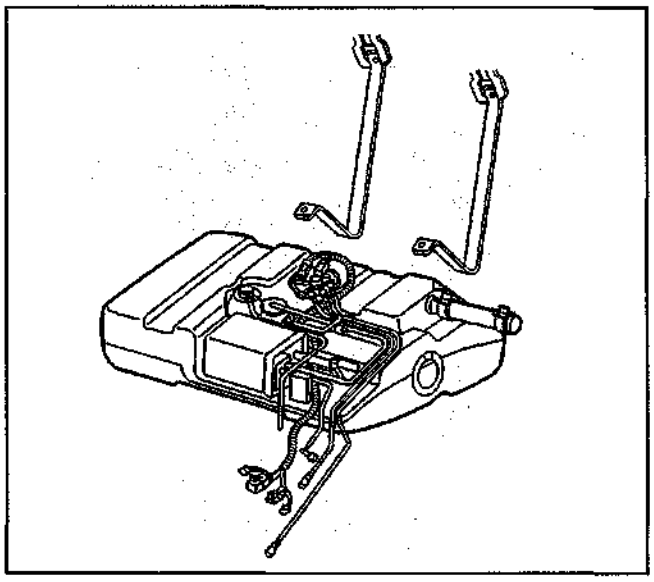


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8. Install the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*.

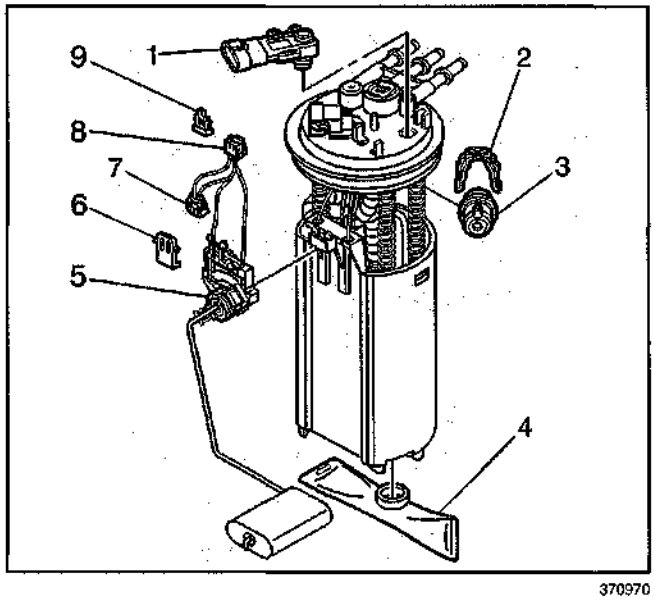

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9. Install the fuel tank. Refer to *Fuel Tank Replacement.*
10. Refill the fuel tank.
11. Reinstall the fuel filler cap.
12. Reconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
13. Inspect for leaks.
    13.1. Turn ON the ignition for 2 seconds.
    13.2. Turn OFF the ignition for 10 seconds.
    13.3. Turn ON the ignition.
    13.4. Check for fuel leaks.
14. Perform the idle learn procedure. Refer to *PCM Replacement/Programming.*



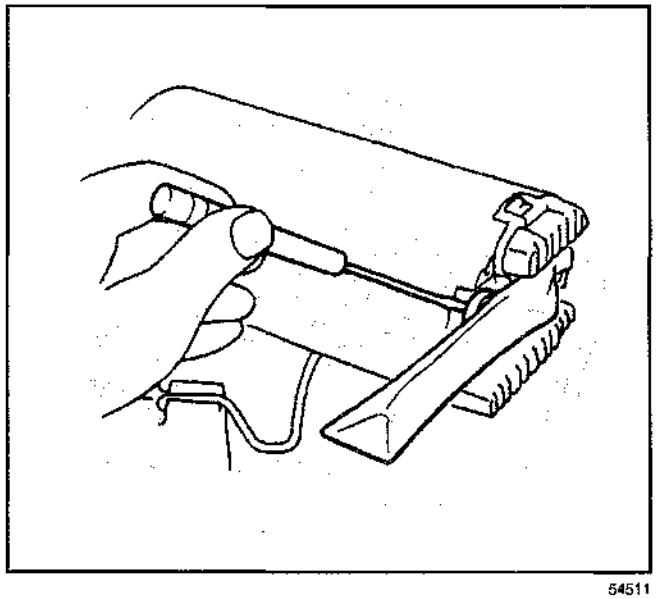

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## Fuel Pump Strainer Replacement

### Removal Procedure

**Important:** Always maintain cleanliness when servicing fuel system components.

1. Relieve fuel system pressure. Refer to *Fuel Pressure Relief Procedure.*
2. Raise the vehicle. Go to *Lifting and Jacking the Vehicle* in General Information.
3. Remove the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement.*
4. Note the position of the strainer (5) for aid in installation.



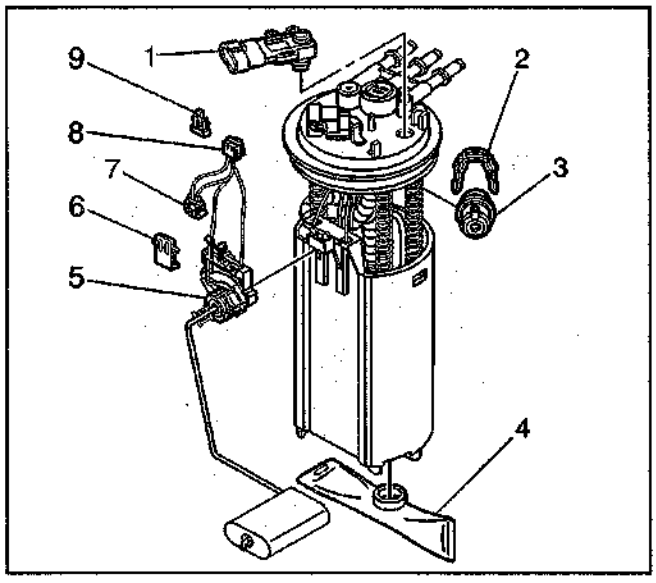
54511

5. Support the reservoir with one hand and grasp the strainer with the other hand.
6. Use a screwdriver to pry the strainer ferrule off the reservoir.
7. Discard the strainer.

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### Installation Procedure

1. Install the new strainer (5) to the reservoir.
2. Support the reservoir with one hand and grasp the strainer with the other hand twisting the strainer into position.
3. Install the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement.*
4. Lower the vehicle.
5. Reconnect the negative battery cable. Refer to *Lifting and Jacking the Vehicle* in Engine Electrical.
6. Inspect for fuel leaks:
   6.1. Turn ON the ignition for 2 seconds.
   6.2. Turn OFF the ignition for 10 seconds.
   6.3. Turn ON the ignition.
   6.4. Check for fuel leaks.



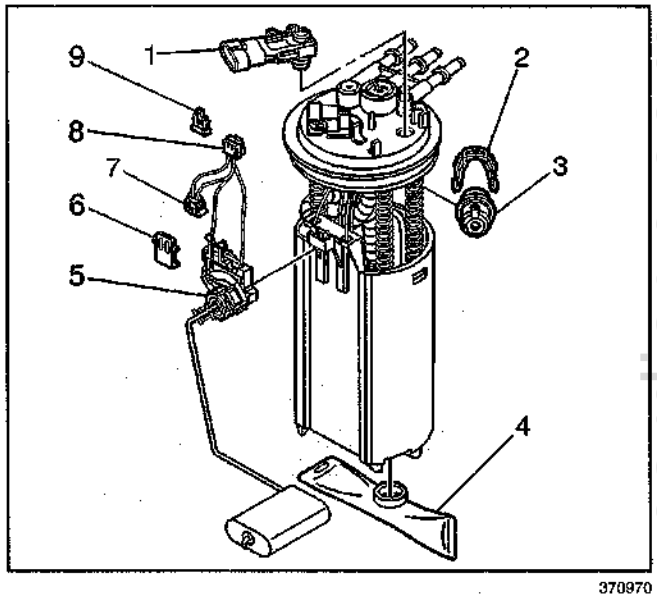
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## Fuel Level Sensor Replacement

### Removal Procedure

**Important:** Always maintain cleanliness when servicing fuel system components.

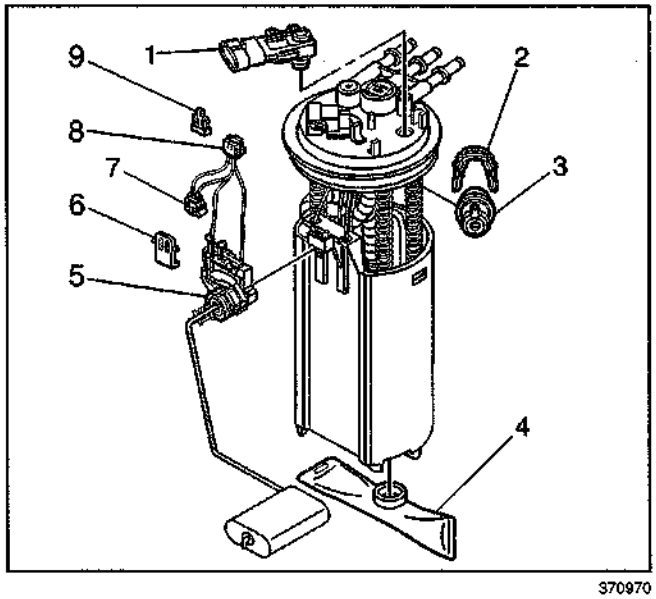
1. Relieve fuel system pressure. Refer to *Fuel Pressure Relief Procedure.*
2. Raise the vehicle. Go to *Lifting and Jacking the Vehicle* in General Information.
3. Remove the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement.*
4. Remove the fuel level sensor (8) from the modular fuel sender.



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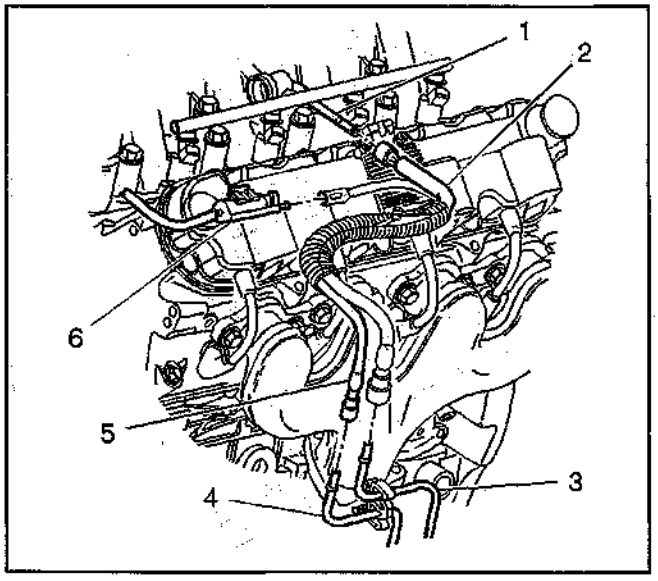
### Installation Procedure

1. Install the fuel level sensor (8) to modular fuel sender.
2. Install the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement.*
3. Lower the vehicle.
4. Reconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
5. Inspect for fuel leaks:
   5.1. Turn ON the ignition for 2 seconds
   5.2. Turn OFF the ignition for 10 seconds.
   5.3. Turn ON the ignition.
   5.4. Visually inspect the fuel system for fuel leaks.

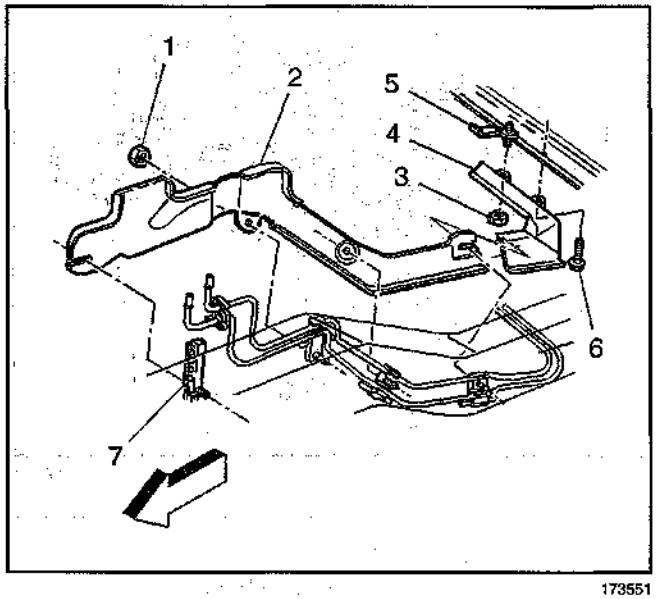


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## Fuel Hose/Pipes Replacement (Chassis)

### Removal Procedure

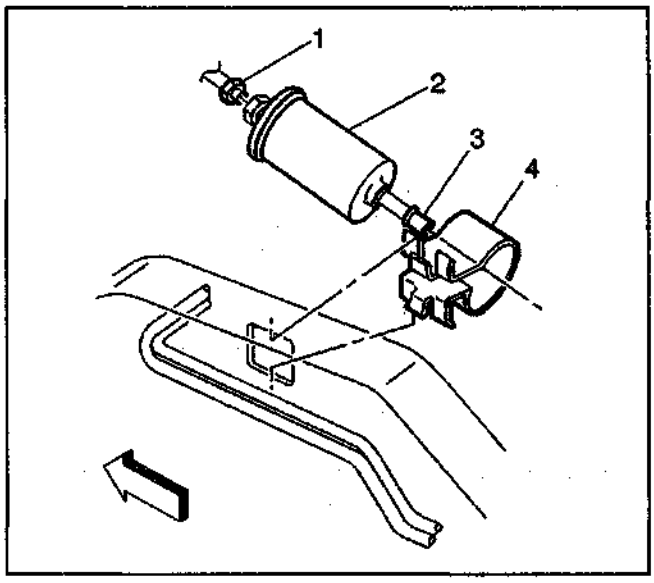
#### Tools Required

J 37088-A Fuel Line Quick-Connect Separator

1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure*.
3. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure*.
4. Clean all the fuel and EVAP pipe connections and the surrounding areas before disconnecting the pipes in order to avoid possible contamination of the fuel system.
5. Disconnect the engine compartment fuel feed pipe (2) from the chassis fuel feed pipe (3). Refer to *Quick Connect Fitting(s) Service (Metal Collar)*.
6. Disconnect the engine compartment EVAP pipe (5) from the chassis EVAP pipe (4). Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
7. Raise the vehicle.
8. Remove the rear fuel pipe shield attaching nuts (3) and bolt (6).
9. Remove the rear fuel pipe shield (4).
10. Remove the front fuel pipe shield attaching nuts (1).
11. Remove the front fuel pipe shield (2).

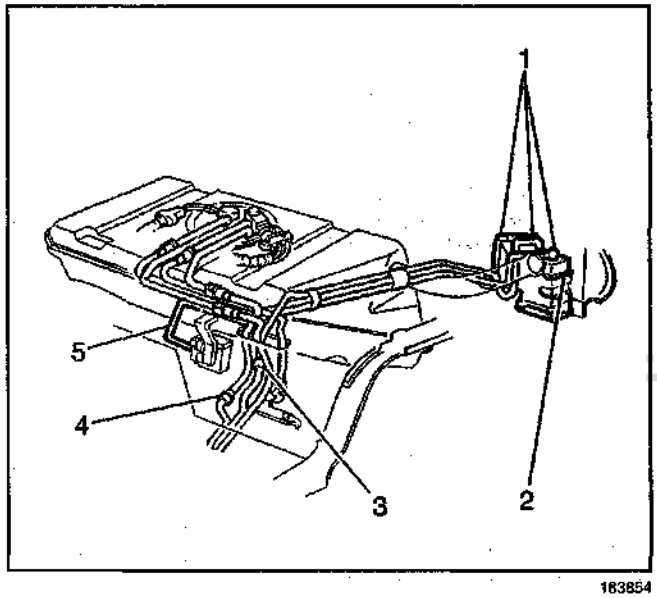
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12. Disconnect the fuel feed pipe (1) from the outlet side of the fuel filter (2). Discard the O-ring.



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13. Disconnect the EVAP purge pipe (3) at the rear quick connect fitting. Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
14. Disconnect the fuel return pipe (4) at the rear quick connect fitting. Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
15. Remove the fuel pipe attaching hardware and the fuel pipes. Note the position of the fuel pipes for installation.
16. Inspect the pipes for bends, kinks, and cracks. Repair or replace the pipes as required.



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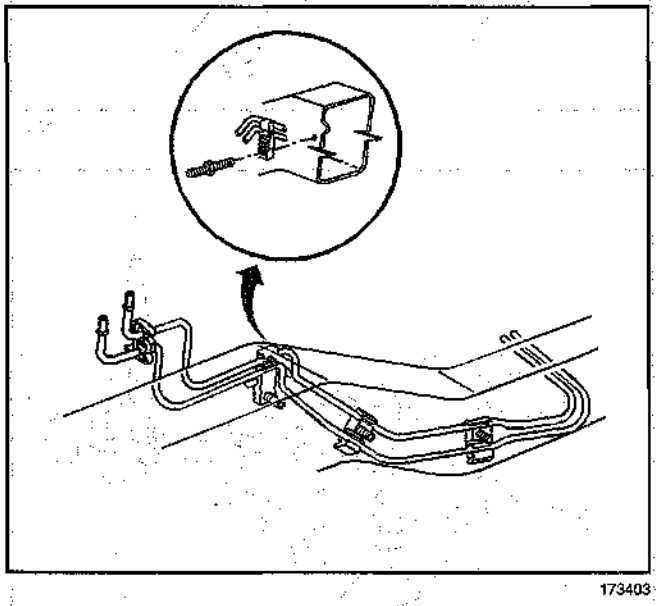
### Repair Procedure

When repairing the fuel or EVAP pipes with hoses, always replace them with original equipment or parts meeting GM specifications. Use only reinforced fuel resistant hose which is identified with the word Fluoroelastomer or GM 6163–M on the hose. The inside hose diameter must match the outside pipe diameter.

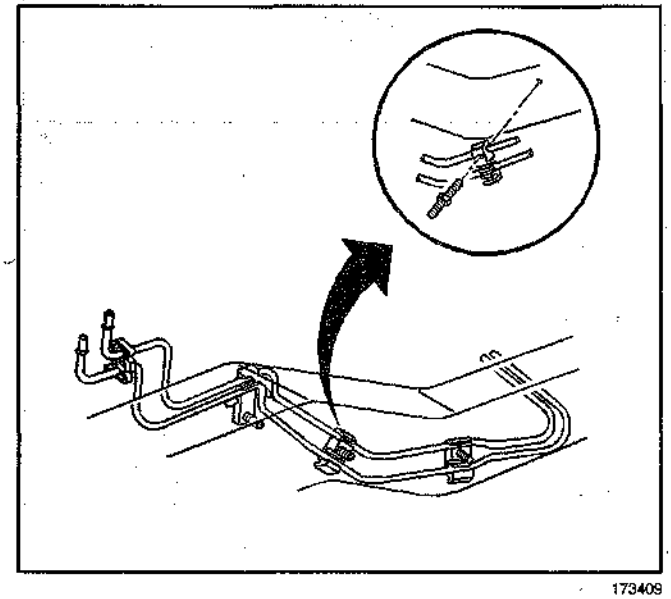
Do Not use rubber hose within 100 mm (4 in) of any part of the exhaust system or within 254 mm (10 in) of the catalytic converter.

A minimum of 13 mm (½ in) clearance must be maintained around sharp edges such as flanges, pinch welds, etc., in order to prevent contact and chafing. A minimum of 19 mm (¾ in) clearance must be maintained around all moving parts.

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Cut the ends of the pipe remaining on the car square with a tube cutter. Using the first step of a double flaring tool, form a bead on the end of both pipe sections. If the pipe is too corroded to withstand the beading operation without damage, the pipe should be replaced. If a new section of pipe is used, form a bead on both ends of the pipe also.

Use screw type hose clamps. Slide the clamps onto the pipe and push the hose 51 mm (2 in) onto each portion of the fuel pipe.

If more than a 6 in length of pipe is removed, use a combination of steel pipe and hose so that the total hose lengths, including the 100 mm (4 in) additional length will not be more than 254 mm (10 in) long. Follow the same routing as the original pipe.

## Installation Procedure

**Important:**

- When replacing the fuel or EVAP pipes, always replace them with original equipment or parts that meet the GM specifications for those parts. The replacement pipes must have the same type of fittings as the original pipes in order to ensure the integrity of the connection.
- Do Not use copper or aluminum tubing to replace steel tubing. Only tubing meeting the 124–M specification or its equivalent is capable of meeting all pressure, corrosion and vibration characteristics necessary to ensure the durability standard required.

1. Position the fuel and EVAP pipes to the frame rail.

***Notice:*** Refer to the *Fastener Notice* in Cautions and Notices.

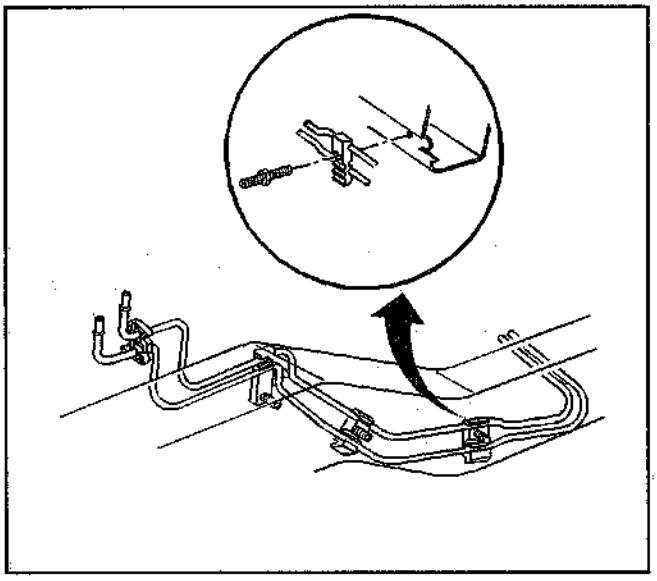
2. Loosely install the number 1 position pipe clip stud.
3. Loosely install the number 2 position pipe clip stud.

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4. Loosely install the number 3 position pipe clip stud.

**Tighten**

Tighten the 3 studs to 5 N·m (44 lb in).

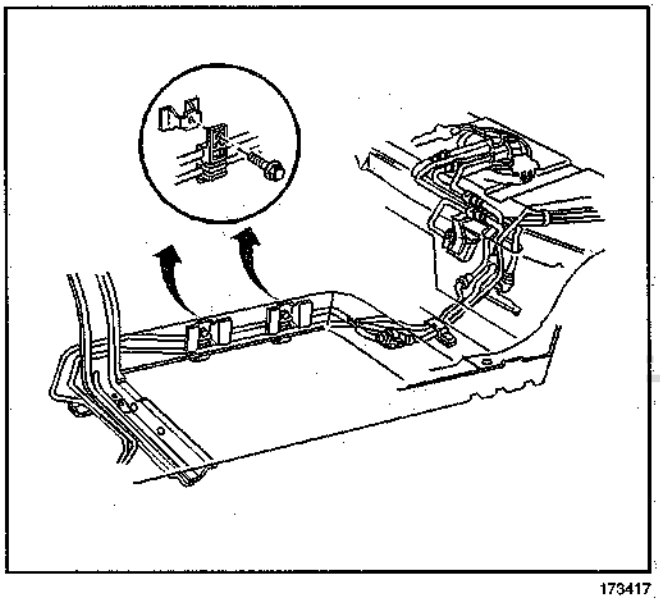


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5. Align the fuel and EVAP pipes to the number 5 and number 6 position.
6. Install the front pipe clip bolts.

**Tighten**

Tighten the front pipe clip bolts to 4.5 N·m (40 lb in).

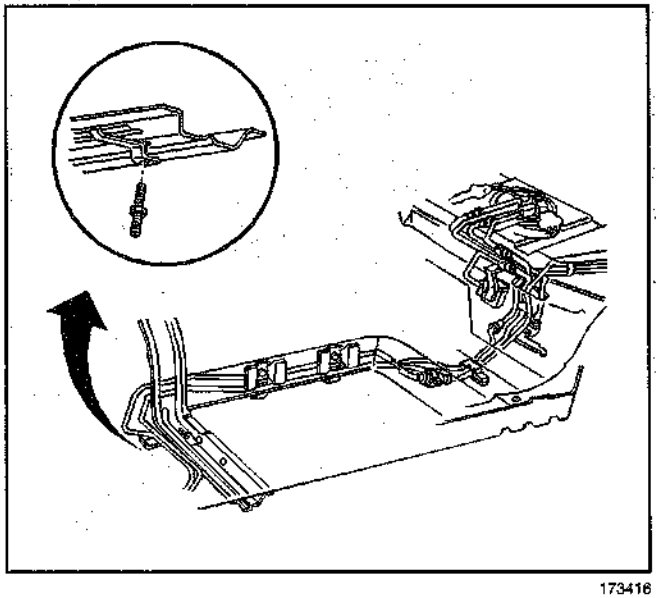


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7. Align the fuel and EVAP pipes to the number 4 position clamp.
8. Install the pipe clamp stud.

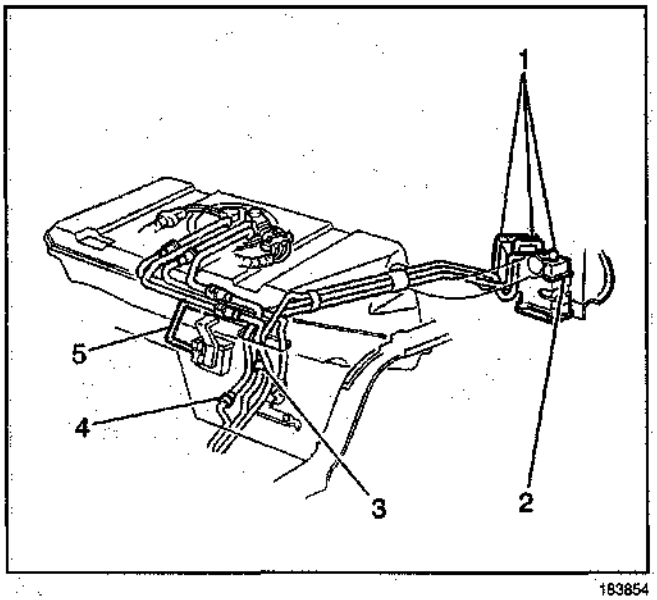
**Tighten**

Tighten the pipe clamp stud to 5 N·m (44 lb in).



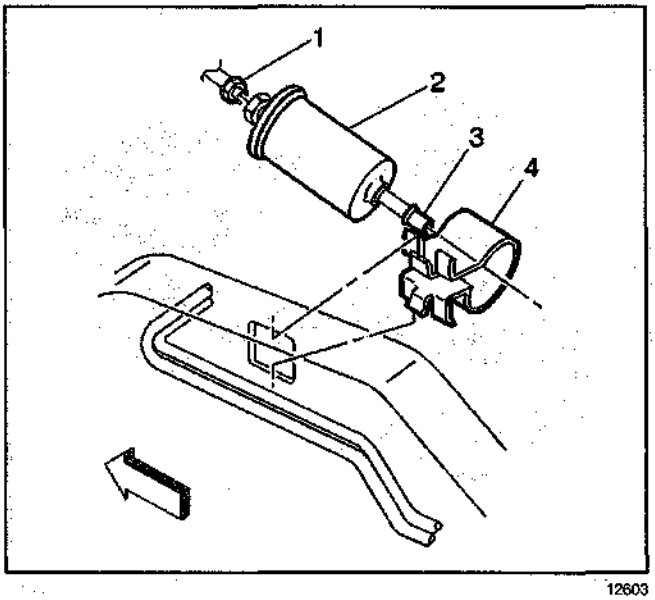
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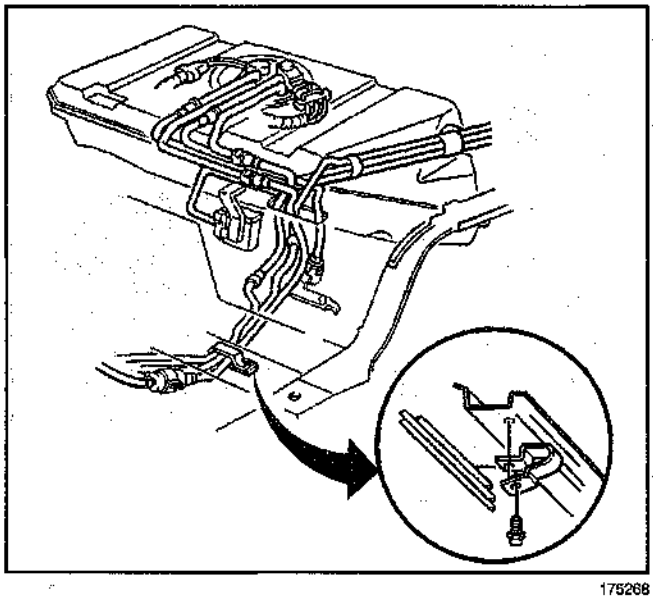
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9. Connect the fuel return pipe (4) at the rear quick connect fitting. Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
10. Connect the EVAP purge pipe (3) at the rear quick connect fitting. Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.



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11. Connect the fuel feed pipe (1) to the fuel filter (2).
    **Tighten**
    Tighten the fuel feed pipe fitting to 30 N·m (22 lb ft).


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12. Install the fuel and EVAP pipes into the rear pipe clip.
13. Align the fuel and EVAP pipes in a flat position.
14. Install the rear pipe clip bolt.
    **Tighten**
    Tighten the rear pipe clip bolt to 5.5 N·m (49 lb in).

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15. Position the front fuel pipe shield (2) to the 3 fuel pipe clip studs and the brake pipe clip stud (7).
16. Install the pipe shield nuts (1).

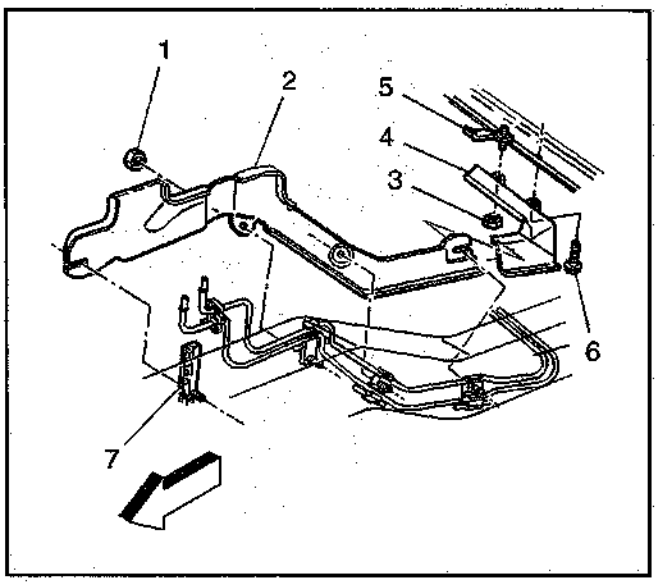
    **Tighten**

    Tighten the pipe shield nuts to 5 N·m (44 lb in).
17. Position the rear fuel pipe shield (4) to the fuel pipe stud and the fuel pipe clip stud (5).
18. Loosely install the pipe shield nuts (3).
19. Install the pipe shield bolt (6).

    **Tighten**

    19.1. Tighten the pipe shield bolt to 5 N·m (44 lb in).

    19.2. Tighten the pipe shield nuts to 5 N·m (44 lb in).
20. Lower the vehicle.



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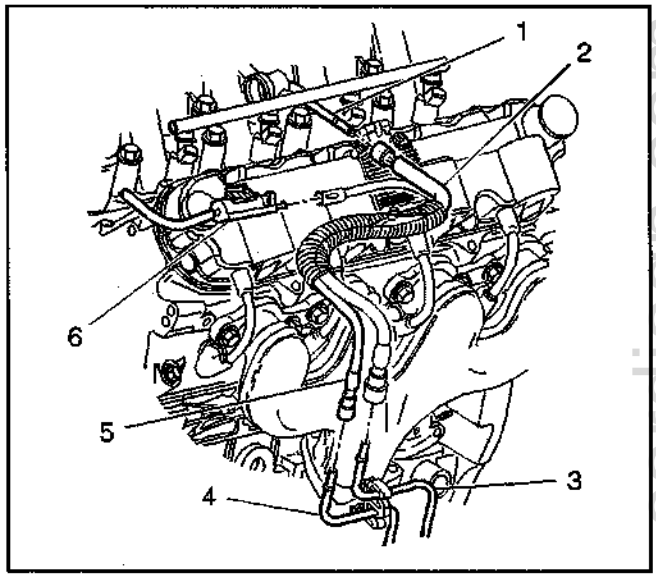
21. Connect the engine compartment EVAP pipe (5) to the chassis EVAP pipe (4). Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
22. Connect the engine compartment fuel feed pipe (2) to the chassis fuel feed pipe (3). Refer to *Quick Connect Fitting(s) Service (Metal Collar)*.
23. Refill the fuel tank.
24. Tighten the fuel filler cap.
25. Connect the negative battery cable.
26. Inspect for leaks.

    26.1. Turn ON the ignition for 2 seconds.

    26.2. Turn OFF the ignition for 10 seconds.

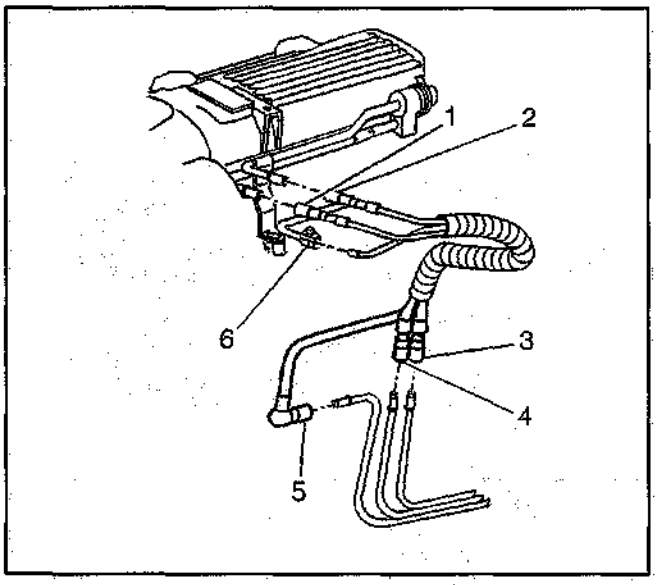
    26.3. Turn ON the ignition.

    26.4. Inspect for fuel leaks.



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## Fuel Hose/Pipes Replacement (Engine Compartment)

### Removal Procedure

***Caution: In order to Reduce the Risk of Fire and Personal Injury:***

- ***If nylon fuel pipes are nicked, scratched or damaged during installation, Do Not attempt to repair the sections of the nylon fuel pipes. Replace them.***
- ***When installing new fuel pipes, Do Not hammer directly on the fuel harness body clips as it may damage the nylon pipes resulting in a possible fuel leak.***
- ***Always cover nylon vapor pipes with a wet towel before using a torch near them. Also, never expose the vehicle to temperatures higher than 115°C (239°F) for more than one hour, or more than 90°C (194°F) for any extended period.***
- ***Before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends. This will ensure proper reconnection and prevent a possible fuel leak. (During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.)***

***Notice:*** Do not attempt to straighten any kinked nylon fuel lines. Replace any kinked nylon fuel feed or return pipes in order to prevent damage to the vehicle.

***Notice:*** Replace the EVAP pipes and hoses with the original equipment or parts that meet the GM specifications for those parts. The replacement EVAP pipe must have the same type of fittings as the original pipe in order to ensure the integrity of the connection. When replacing EVAP hoses, use only reinforced fuel-resistant hose identified with the word Fluoroelastomer or GM 6163-M on the hose. The inside hose diameter must match the outside pipe diameter. Do not use rubber hose within 100 mm (4 in) of any part of the exhaust system or within 254 mm (10 in) of the catalytic converter.

***Notice:*** Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.

**Important:** Always maintain cleanliness when servicing fuel system components.

1. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure*.
2. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure*.
3. Clean all the engine compartment connecting fuel pipe connections and the surrounding areas before disconnecting in order to avoid possible contamination of the fuel system.

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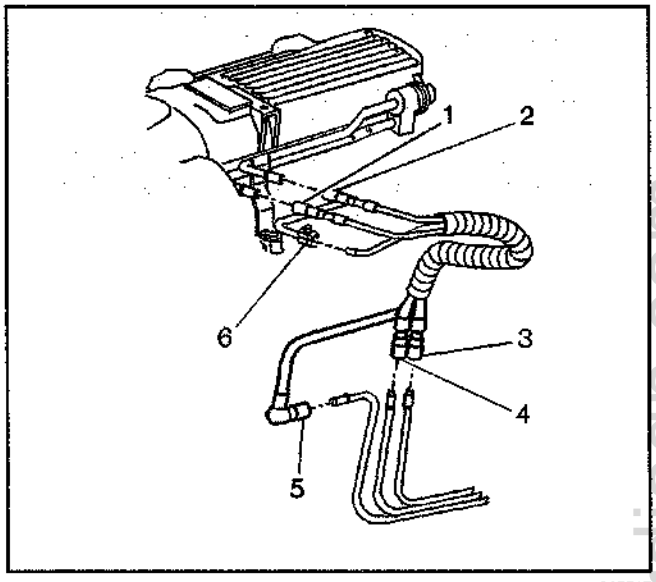
4. Disconnect the fuel feed pipe (1) at the engine. Refer to *Quick Connect Fitting(s) Service (Metal Collar)*.
5. Disconnect the fuel return pipe (2) at the engine.
6. Disconnect the EVAP pipe (6) at the engine.
7. Raise the vehicle. Go to *Lifting and Jacking the Vehicle* in General Information.
8. Disconnect the EVAP pipe (5) at the chassis fuel and EVAP pipes.
9. Disconnect the fuel feed pipe (4) at the chassis fuel and EVAP pipes.
10. Disconnect the fuel return pipe (3) at the chassis fuel and EVAP pipes.
11. Remove the fuel feed, return, and EVAP pipes.

## Installation Procedure

**Important:**

- Always re-attach the fuel lines and fuel filter with all original type fasteners and hardware.
- If fuel line bundle attaching hardware is damaged or broken replace it.

1. Install the fuel feed, return, and EVAP pipes.
2. Connect the fuel feed pipe (4) at the chassis fuel and EVAP pipes.
3. Connect the fuel return pipe (3) at the chassis fuel and EVAP pipes.
4. Connect the EVAP pipe (5) at the chassis fuel and EVAP pipes.
5. Lower the vehicle.
6. Connect the fuel feed pipe (1) to the engine.
7. Connect the fuel return pipe (2) to the engine.
8. Connect the EVAP pipe (6) to the engine.
9. Refill the fuel tank.
10. Reinstall the fuel filler cap.
11. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
12. Inspect for leaks.
    12.1. Turn ON the ignition for 2 seconds.
    12.2. Turn OFF the ignition for 10 seconds.
    12.3. Turn ON the ignition.
    12.4. Check for fuel leaks.



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## Fuel System Cleaning

**Important:**

- Only use oil free compressed air to blow out the fuel pipes.
- Inspect the fuel tank internally and clean the fuel tank if you find a plugged fuel filter.

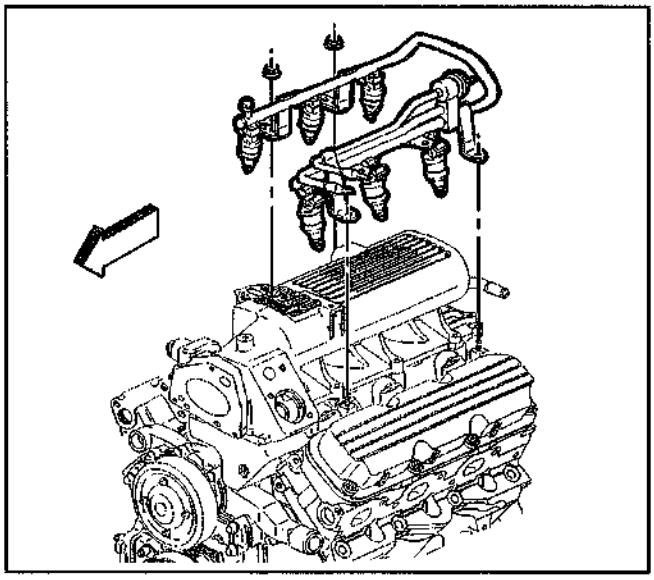
1. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure*.
2. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure*.
3. Remove the fuel tank. Refer to *Fuel Tank Replacement*.
4. Remove the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*.
5. Inspect the fuel pump strainer. Replace a contaminated strainer and inspect the fuel pump.
6. Inspect the fuel pump inlet for dirt and debris. Replace the fuel pump if you find dirt or debris in the fuel pump inlet.

**Important:** When flushing the fuel tank, handle the fuel and water mixture as a hazardous material. Handle the fuel and water mixture in accordance with all applicable local, state, and federal laws and regulations.

7. Flush the fuel tank with hot water.
8. Pour the water out of the fuel sender assembly opening. Rock the tank to be sure that removal of the water from the tank is complete.
9. Install the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*.
10. Install the fuel tank. Refer to *Fuel Tank Replacement*.
11. Refill the fuel tank.
12. Install the fuel filler cap.
13. Reconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
14. Inspect for leaks.
    14.1. Turn ON the ignition for 2 seconds.
    14.2. Turn OFF the ignition for 10 seconds.
    14.3. Turn ON the ignition.
    14.4. Check for fuel leaks.

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## Fuel Rail Assembly Replacement


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### Removal Procedure

#### Tools Required

*J 37088-A* Fuel Line Quick-Connect Separator

***Notice:*** Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.

**Important:** Always maintain cleanliness when servicing fuel system components.

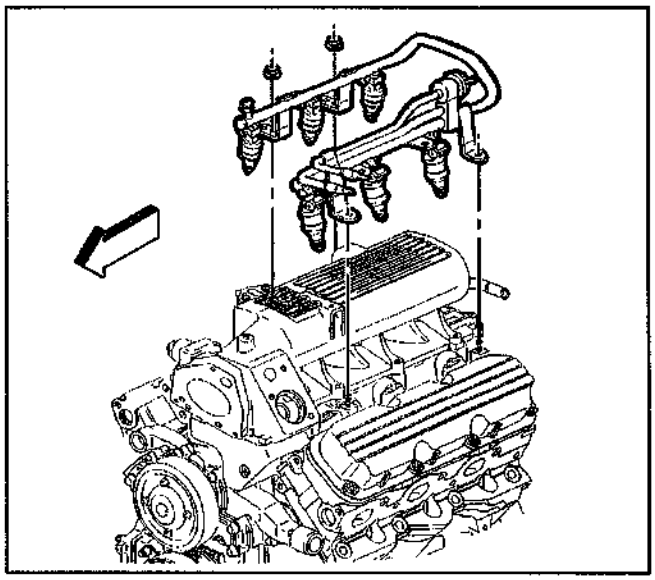
1. Bleed fuel pressure from the fuel system. Refer to *Fuel Pressure Relief Procedure.*
2. Clean the fuel rail assembly and connections.
3. Remove the fuel feed and fuel return pipes from the fuel rail tubes. Refer to *Quick Connect Fitting(s) Service (Metal Collar).*
4. Remove the fuel injector coil wires.
5. Remove the vacuum line from the vacuum source to the fuel pressure regulator.
6. Remove the MAP sensor electrical connector.
7. Remove the vacuum line to the vacuum switch from the fuel pipe bundle.
8. Remove the vacuum source from the intake manifold.
9. Remove the fuel injector electrical connectors.
10. Remove the fuel injector harness fasteners.
11. Remove the fuel rail hold-down bolts.
12. Remove the fuel rail with equal force on both sides of the fuel rail.
13. Remove the front fuel injector retaining clips on each side of the fuel rail.
14. Remove the front fuel injector on each side of the fuel rail. The fuel rail will now clear the intake manifold.

### Installation Procedure

***Caution: In order to reduce the risk of fire and personal injury that may result from a fuel leak, always install the fuel injector O-rings in the proper position. If the upper and lower O-rings are different colors (black and brown), be sure to install the black O-ring in the upper position and the brown O-ring in the lower position on the fuel injector. The O-rings are the same size but are made of different materials.***

***Notice:*** Always re-attach the fuel lines and fuel filter with all original type fasteners and hardware.

Do not repair sections of fuel pipes.


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***Notice:***

- Use care when servicing the fuel system components, especially the fuel injector electrical connectors, the fuel injector tips, the injector O-rings. Plug the inlet and the outlet ports of the fuel rail in order to prevent contamination.
- Do not use the compressed air to clean the fuel rail assembly as this may damage the fuel rail components.
- Do not immerse the fuel rail assembly in a solvent bath in order to prevent damage to the fuel rail assembly.

1. The O-rings must be replaced on all components that are replaced.
2. Lightly oil the fuel injector O-rings with clean engine oil.
3. Place the fuel rail assembly (WITHOUT the front fuel injectors on each side of the fuel rail) on the intake manifold.
4. Reinstall the front fuel injector on each side of the fuel rail.
5. Reinstall the fuel injector retaining clips on the front fuel injector on each side of the fuel rail.
6. Seat the fuel injectors by HAND.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

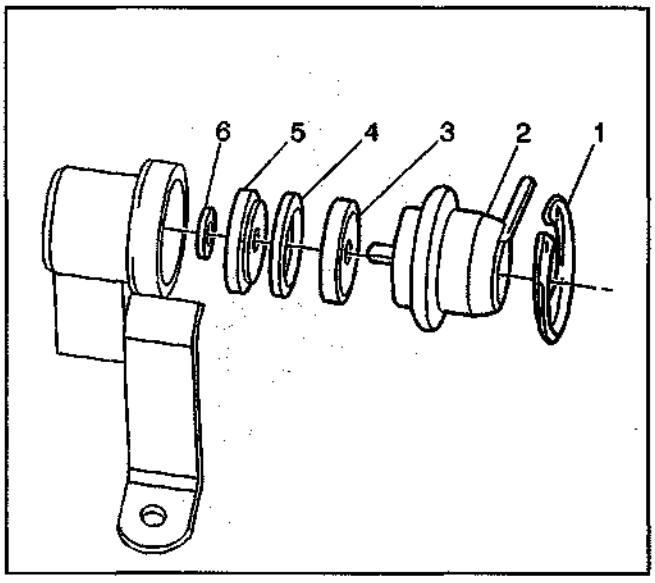
**Tighten**

Tighten the fuel rail hold-down bolts to 10 N·m (89 lb in).

7. Reconnect the fuel injector harness fasteners.
8. Reconnect the fuel injector electrical connectors.
9. Reinstall the vacuum source to the intake manifold.
10. Reinstall the vacuum line to the vacuum switch from the fuel pipe bundle.
11. Reinstall the vacuum line from the vacuum source to the fuel pressure regulator.
12. Reconnect the fuel feed and fuel return pipes by pushing the pipes onto the fuel rail tubes.
13. Reconnect the MAP sensor electrical connector.
14. Reconnect the fuel injector coil wires.
15. Reconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
16. Inspect for leaks.
    16.1. Turn ON the ignition for 2 seconds.
    16.2. Turn OFF the ignition for 10 seconds.
    16.3. Turn ON the ignition.
    16.4. Check for fuel leaks.

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## Fuel Pressure Regulator Replacement



12686

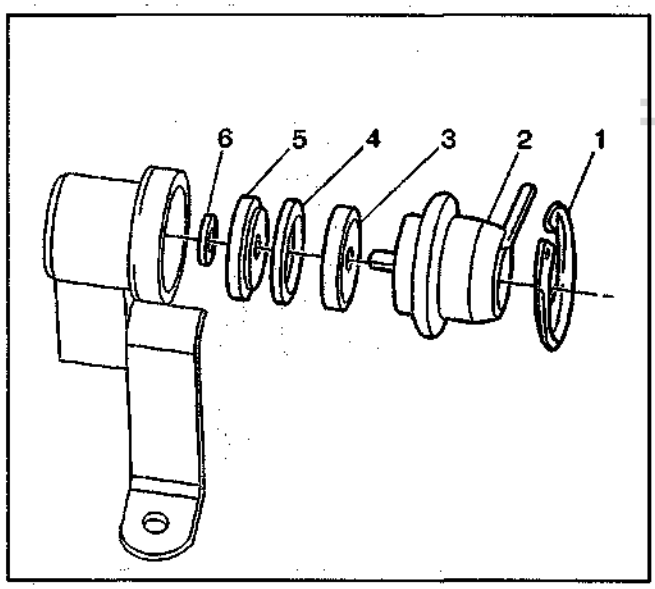
### Removal Procedure

***Notice:*** Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.

**Important:** Always maintain cleanliness when servicing fuel system components.

1. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure*.
2. Remove the fuel rail. Refer to *Fuel Rail Assembly Replacement*.
3. Clean any dirt from the fuel pressure regulator retaining ring.
4. Remove the snap ring (1).
5. Using a shop towel to catch any spilled fuel, lift and twist the fuel pressure regulator in order to remove the fuel pressure regulator (2) from the fuel pressure regulator housing.
6. Remove the pressure regulator small O-ring (6).
7. Remove the pressure regulator filter screen (5).
8. Remove the pressure regulator large O-ring (4).
9. Remove the pressure regulator O-ring back up (3).
10. Cover the fuel pressure regulator housing in order to prevent contamination from entering the fuel system.

### Installation Procedure



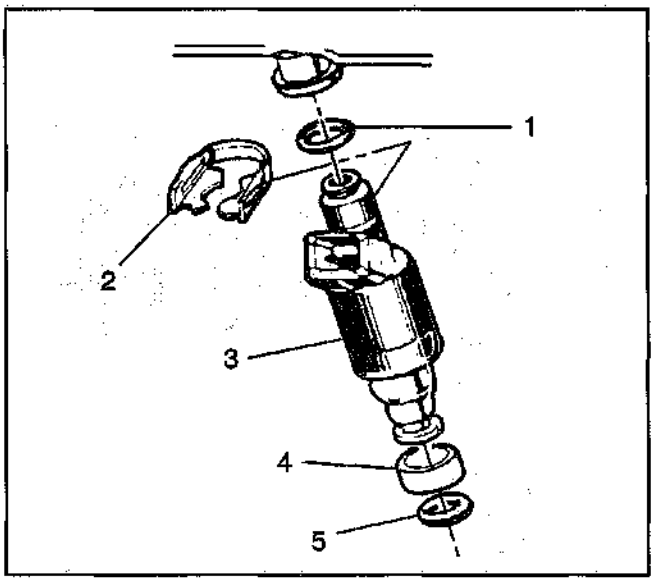
12686

***Notice:***

- Do not use compressed air in order to test or clean a fuel pressure regulator as damage to the fuel pressure regulator may result.
- Clean the fuel pressure regulator filter screen with gasoline if necessary.
- Do not immerse the fuel pressure regulator in a solvent bath in order to prevent damage to the fuel pressure regulator.

1. Install new O-rings on the fuel pressure regulator. Lubricate the O-rings lightly with clean engine oil.
2. Install pressure regulator O-ring back up (3).
3. Install pressure regulator large O-ring (4).
4. Install pressure regulator filter screen (5).
5. Install pressure regulator small O-ring (6).
6. Install the fuel pressure regulator (2) in the fuel pressure regulator housing.
7. Install the snap ring (1).
8. Install the fuel rail.
9. Reconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
10. Inspect for leaks.
    - 10.1. Turn ON the ignition for 2 seconds.
    - 10.2. Turn OFF the ignition for 10 seconds.
    - 10.3. Turn ON the ignition.
    - 10.4. Check for fuel leaks.

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12687

## Fuel Injector Replacement

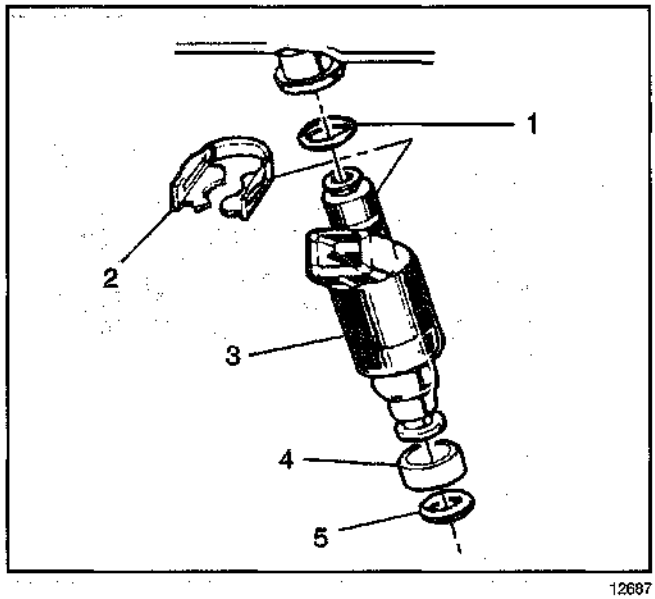
### Removal Procedure

***Notice:*** Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering the open pipes and passages.

***Notice:*** Use care in removing the fuel injectors in order to prevent damage to the fuel injector electrical connector pins or the fuel injector nozzles. Do not immerse the fuel injector in any type of cleaner. The fuel injector is an electrical component and may be damaged by this cleaning method.

**Important:** The fuel injector is serviced as a complete assembly only. If the fuel injectors are found to be leaking, the engine oil may be contaminated with fuel. Always maintain cleanliness when servicing fuel system components.

1. Relieve the fuel pressure. Refer to *Fuel Pressure Relief Procedure.*
2. Remove the fuel rail. Refer to *Fuel Rail Assembly Replacement.*
3. Remove the fuel injector retaining clip (2).
4. Remove the fuel injector (3).
5. Remove the fuel injector upper O-ring (1).
6. Remove the fuel injector lower O-ring (5).
7. Remove the fuel injector O-ring back up (4).



12687

### Installation Procedure

**Important:** Each fuel injector is calibrated for a specific flow rate. Be sure to use the correct part number when ordering replacement fuel injectors.

When replacing the fuel injector O-rings, be sure to install the brown O-ring in the lower position.

The fuel injector lower O-ring uses a nylon collar, called the O-ring backup, to properly position the O-ring on the fuel injector. Be sure to reinstall the O-ring backup, or the sealing O-ring may move on the fuel injector when installing the fuel rail. If the sealing O-ring is not seated properly, a vacuum leak is possible and driveability complaints may occur.

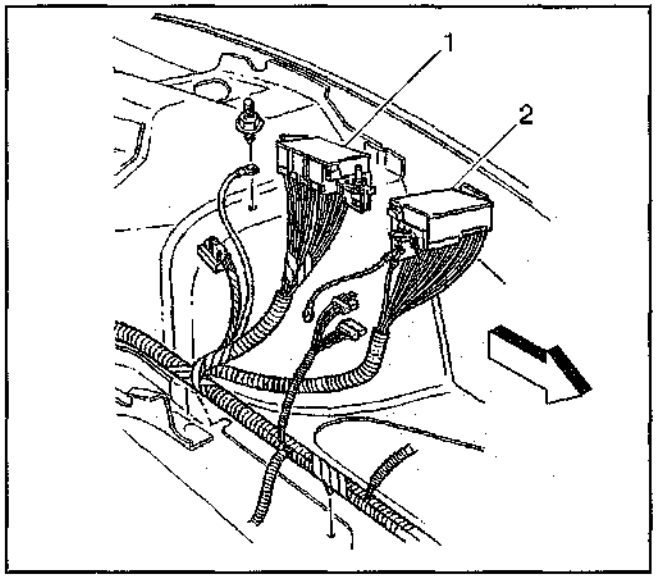
1. Coat all new O-rings with clean engine oil before installing.
2. Install the fuel injector O-ring back up (4).
3. Install the fuel injector lower O-ring (5).
4. Install the fuel injector upper O-ring (1).
5. Install the fuel injector (3).
6. Install the fuel injector retaining clip (2).
7. Inspect for leaks.
   - 7.1. Turn ON the ignition for 2 seconds.
   - 7.2. Turn OFF the ignition for 10 seconds.
   - 7.3. Turn ON the ignition.
   - 7.4. Visually inspect the fuel system for fuel leaks.

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## Fuel Pump Relay Replacement

### Removal Procedure

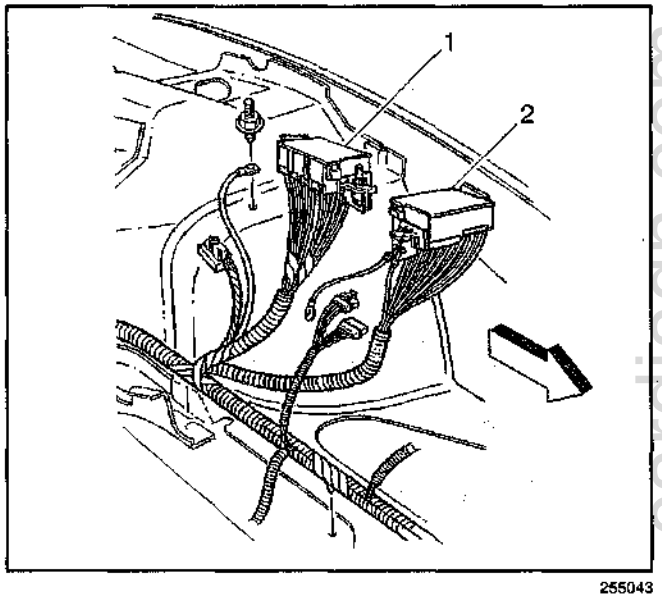
1. Remove the cover from the relay center (2).
2. Remove the fuel pump relay by pulling upward.



255043

### Installation Procedure

1. Push the relay into the relay center socket.
2. Install the cover on the relay center (2).



255043

## EVAP Canister Purge Valve Replacement

### Removal Procedure

1. Turn OFF the ignition.
2. Remove the electrical connector and hose from the EVAP canister purge valve.
3. Remove the hold down bolt from the EVAP canister purge valve.
4. Remove the EVAP canister purge valve.

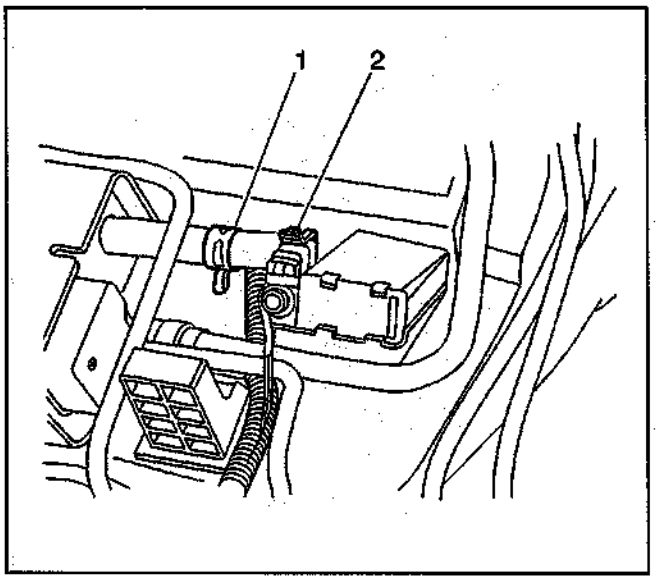
### Installation Procedure

1. Install the EVAP canister purge valve to the intake.

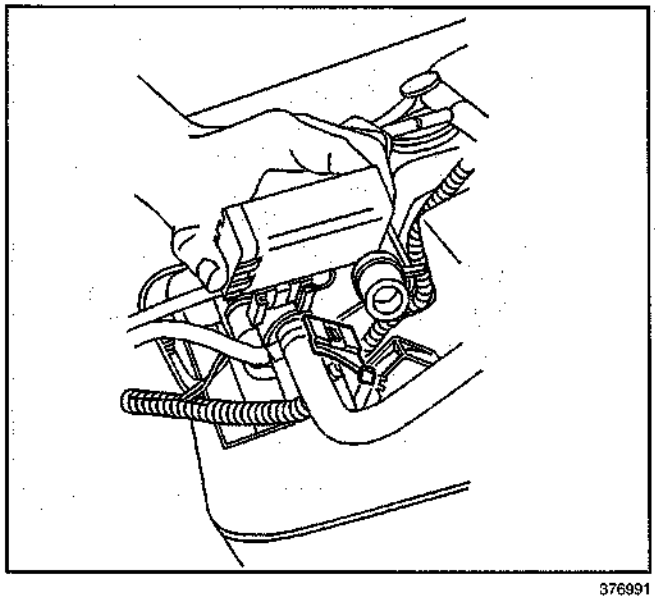
***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Reinstall the hold down bolt through the EVAP canister purge valve.
3. Connect the electrical connector and hose to the EVAP canister purge valve.

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## EVAP Vent Valve Replacement

### Removal Procedure

**Tools Required**

- *J 34730-1A* Fuel Pressure Gauge
- *J 42960-1* Fuel Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

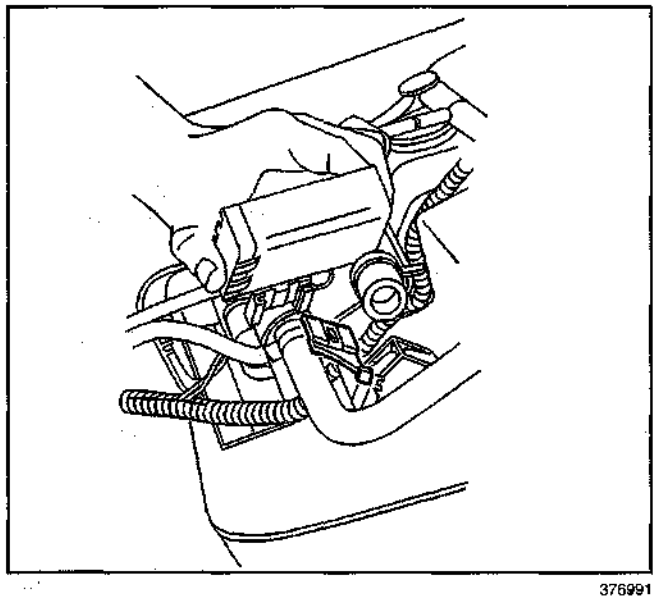
***Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.***

1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure.*
3. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure.*
4. Remove the fuel tank. Refer to *Fuel Tank Replacement.*
5. Disconnect the EVAP canister vent valve electrical connector (2).
6. Slide the vent hose clamp (1) back.
7. Disconnect the vent hose from the EVAP vent valve.
8. Remove the EVAP canister vent valve from the EVAP canister vent valve bracket.

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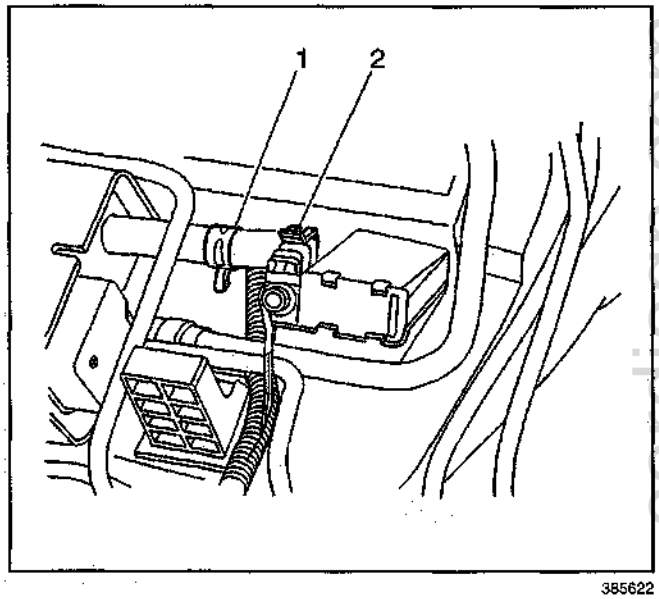
### Installation Procedure

1. Install the EVAP canister vent valve to the EVAP canister vent valve bracket.



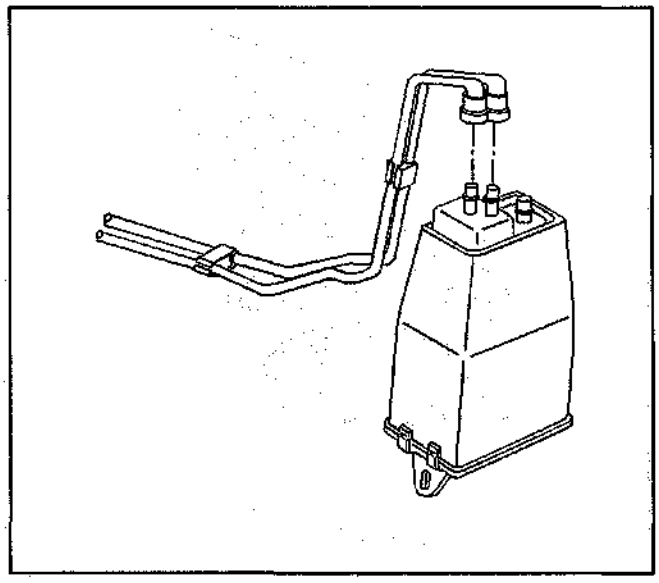
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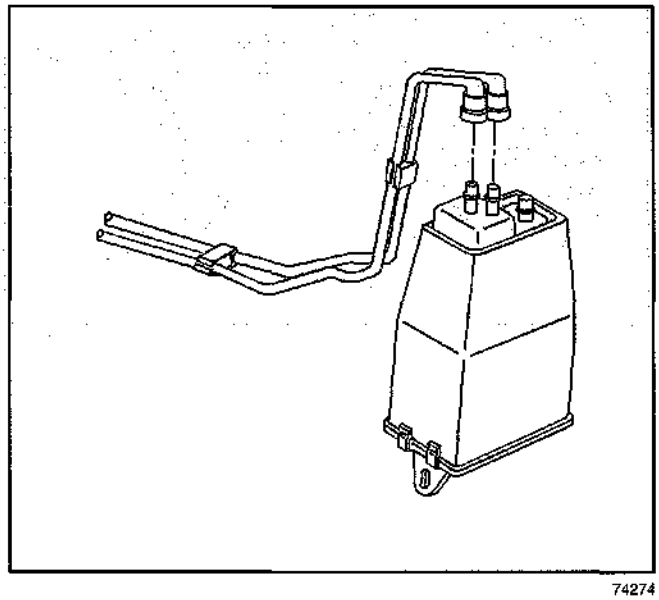
2. Connect the vent hose to the EVAP canister vent valve.
3. Slide the vent hose clamp (1) back into position.
4. Connect the EVAP canister vent valve electrical connector (2).
5. Install the fuel tank. Refer to *Fuel Tank Replacement*.
6. Refill the fuel tank.
7. Install the fuel filler cap.
8. Connect the negative battery cable.
9. Inspect for leaks.
   - 9.1. Turn ON the ignition ON for 2 seconds.
   - 9.2. Turn OFF the ignition for 10 seconds.
   - 9.3. Turn ON the ignition.
   - 9.4. Check for fuel leaks.




385622

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## EVAP System Hoses/Pipes Replacement

### Removal Procedure

***Notice:*** Do Not attempt to repair the EVAP pipes or the connecting hoses. Replace the damaged EVAP pipes or the connecting hoses are damaged. If the nylon EVAP pipe becomes kinked and cannot be straightened, it must be replaced.

***Notice:*** Replace the EVAP pipes and hoses with the original equipment or parts that meet the GM specifications for those parts. The replacement EVAP pipe must have the same type of fittings as the original pipe in order to ensure the integrity of the connection. When replacing EVAP hoses, use only reinforced fuel-resistant hose identified with the word Fluoroelastomer or GM 6163-M on the hose. The inside hose diameter must match the outside pipe diameter. Do not use rubber hose within 100 mm (4 in) of any part of the exhaust system or within 254 mm (10 in) of the catalytic converter.

1. Raise the vehicle. Go to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the hardware retaining the EVAP pipes. Note the location of the attaching hardware for installation.
3. Disconnect the EVAP pipes at the EVAP canister.
4. Disconnect the EVAP pipes at the fuel tank.
5. Remove the EVAP pipes.

### Installation Procedure

***Notice:*** Always re-attach the fuel lines and fuel filter with all original type fasteners and hardware.

Do not repair sections of fuel pipes.

**Important:** Route the replacement EVAP pipe in the same manner as the original EVAP pipe was routed.

1. Reinstall the EVAP pipes into the vehicle.
2. Connect the EVAP pipes onto the fuel tank.
3. Connect the EVAP pipes onto the EVAP canister.

***Notice:*** Properly secure the EVAP pipe in order to prevent chafing of the pipe.

4. Install the hardware retaining the EVAP pipe.
5. Lower the vehicle.

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## EVAP Canister Replacement

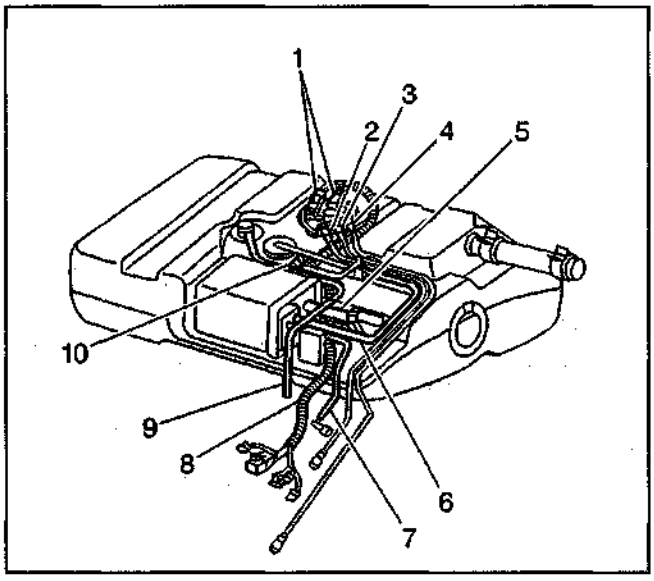
### Removal Procedure

#### Tools Required

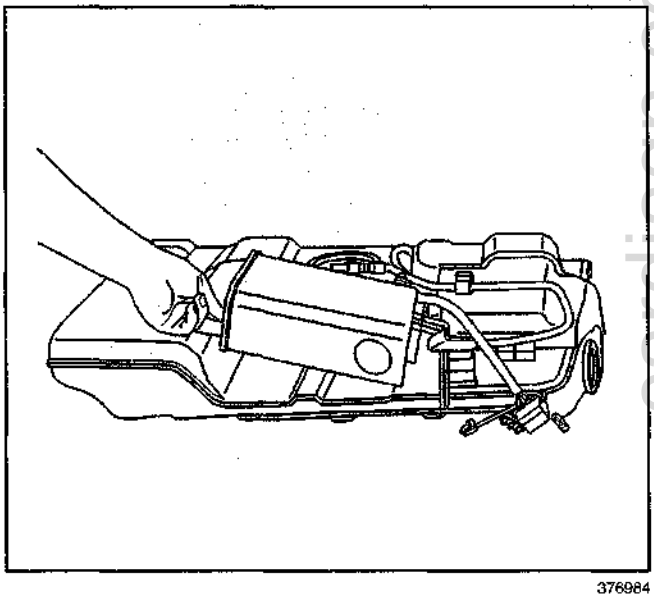
- *J 34730-1A* Fuel Pressure Gauge
- *J 42960-1* Fuel Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

***Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.***

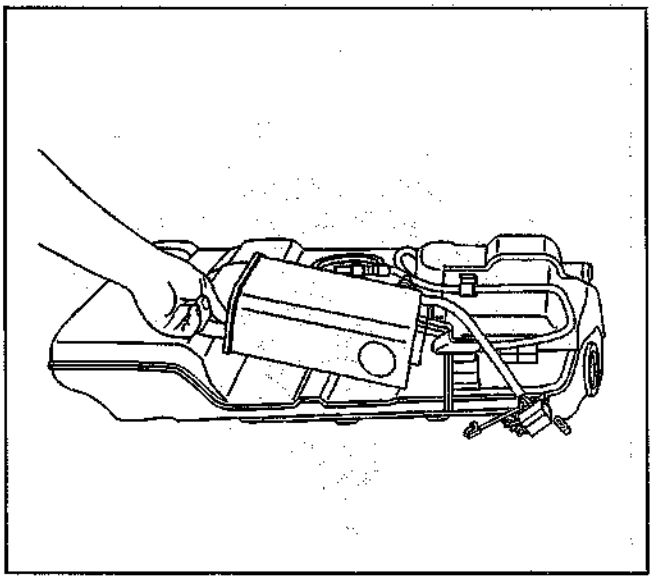
1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure.*
3. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure.*
4. Remove the fuel tank. Refer to *Fuel Tank Replacement.*
5. Disconnect the fill limiter vent valve pipe (6) from the EVAP canister.
6. Disconnect the EVAP purge pipe (7) from the EVAP canister.
7. Disconnect the vent hose (5) from the EVAP canister.
8. Carefully bend the bracket in order to remove the EVAP canister from the bracket.



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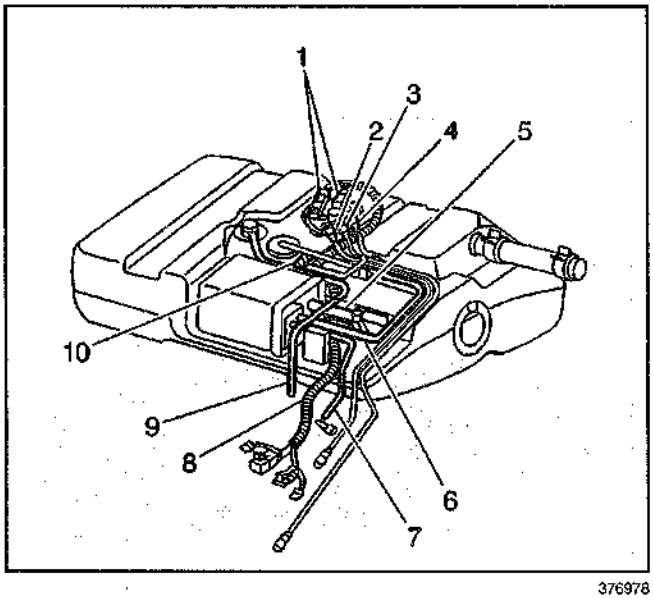
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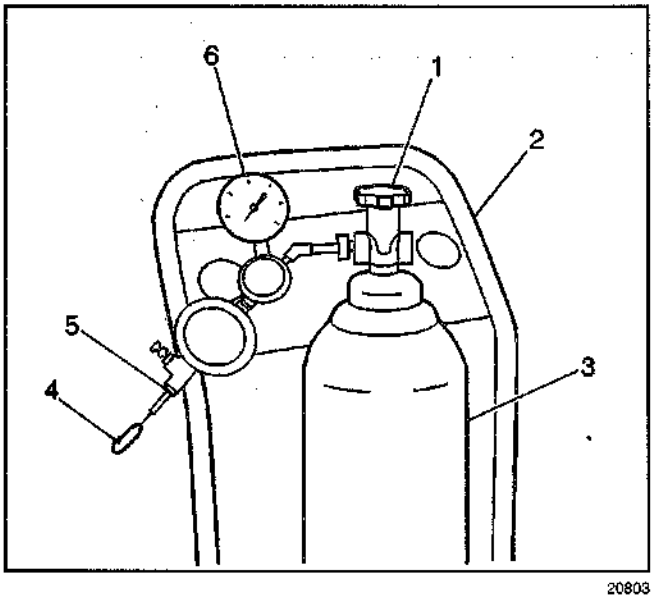
### Installation Procedure

1. Install the EVAP canister to the bracket.




376978

2. Connect the vent hose (5) to the EVAP canister.
3. Connect the EVAP purge pipe (7) to the EVAP canister.
4. Connect the fill limiter vent valve pipe (6) to the EVAP canister.
5. Install the fuel tank. Refer to *Fuel Tank Replacement.*
6. Refill the fuel tank.
7. Install the fuel filler cap.
8. Connect the negative battery cable.
9. Inspect for leaks.
   9.1. Turn ON the ignition for 2 seconds.
   9.2. Turn OFF the ignition for 10 seconds.
   9.3. Turn ON the ignition.
   9.4. Check for fuel leaks.




20803

## EVAP System Cleaning

### Inspection Procedure

#### Tools Required

*J 41413* EVAP Pressure/Purge Diagnostic Station

Whenever the DTC diagnostics lead to a no trouble found or a purge solenoid replacement, proceed with the following charcoal canister diagnostics.

***Notice:*** Use the EVAP Pressure/Purge Diagnostic Station J 41413 in order to provide a clean, dry, low pressure gas source. Do not substitute any other pressurized gas source. Damage may result to the EVAP system.

The *J 41413* EVAP pressure/purge diagnostic station is required to provide a clean, dry, low pressure gas source. Do not substitute any other pressurized gas source or damage to the EVAP system may result.

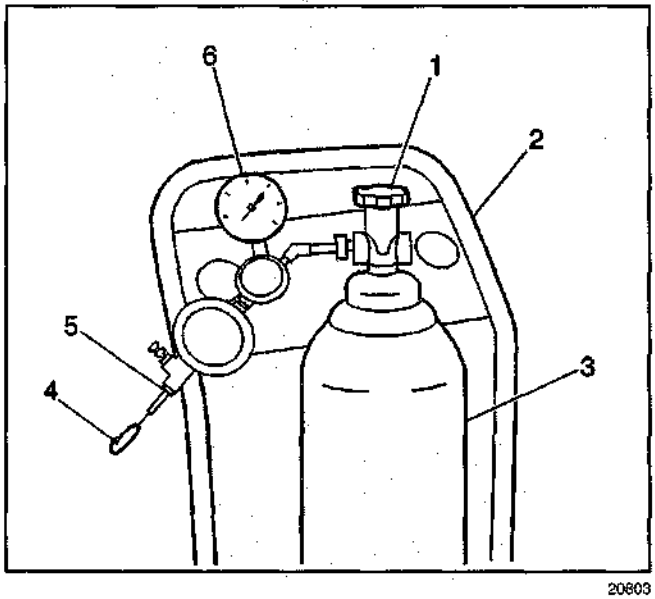
1. Turn the ignition OFF.

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2. Remove the EVAP canister purge solenoid from the vehicle.
3. Lightly tap the EVAP canister purge solenoid on a clean work area.
4. Look for carbon particles existing from either of the vacuum ports.
5. If no carbon release is evident, reinstall the components. Continue with the published service manual DTC procedures.
6. If carbon is being released from either component, continue with this service procedure.
7. Remove the charcoal canister from the vehicle.
8. Turn off the main cylinder valve (1) on the *J 41413* EVAP pressure/purge diagnostic station.
9. Disconnect the black hose (4) that connects the nitrogen cylinder to the cart at the pressure regulator (5).
10. Using a section of the vacuum hose, connect one end onto the open fitting of the pressure regulator (5).
11. Connect the other end of the vacuum line side of the EVAP purge line at the vehicle.
12. Turn on the main nitrogen cylinder valve (1).
13. Continue to blow any debris from the purge line for 15 seconds.
14. Return the *J 41413* to its original condition by re-installing the black hose (4) disconnected in step 9.
15. Replace the EVAP purge solenoid and the charcoal canister with the new components.
16. Proceed with the published service manual diagnostics for the manifold vacuum vehicles (4.3L).

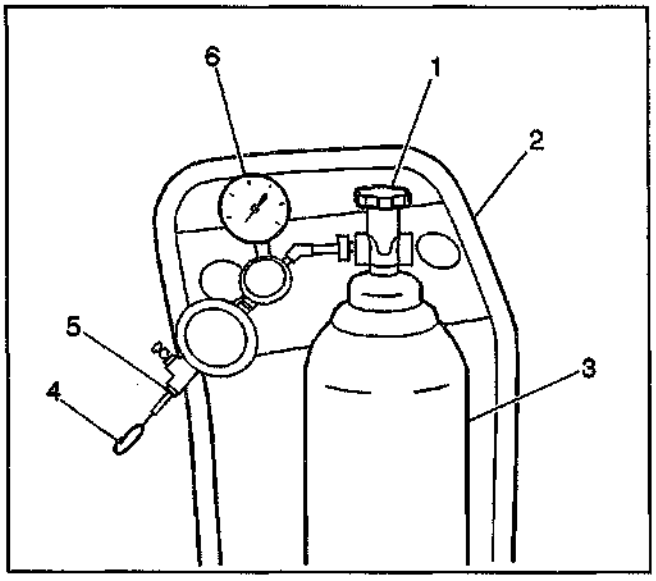
**Ported Applications with EVAP Vacuum Switch**

1. Connect a scan tool and display the data parameter EVAP vacuum switch.
2. Start the engine and allow the engine to reach the operating temperature.
3. Open the throttle until the engine speed reaches 2000 RPM.
4. If the EVAP vacuum switch changes its state, go to step 6.
5. If the EVAP vacuum switch does not change state, repair the low source vacuum condition by performing a complete throttle body service including a cleaning of the purge ports. Go to step 1.
6. If the EVAP vacuum switch does change state, proceed with the published service manual diagnostics.



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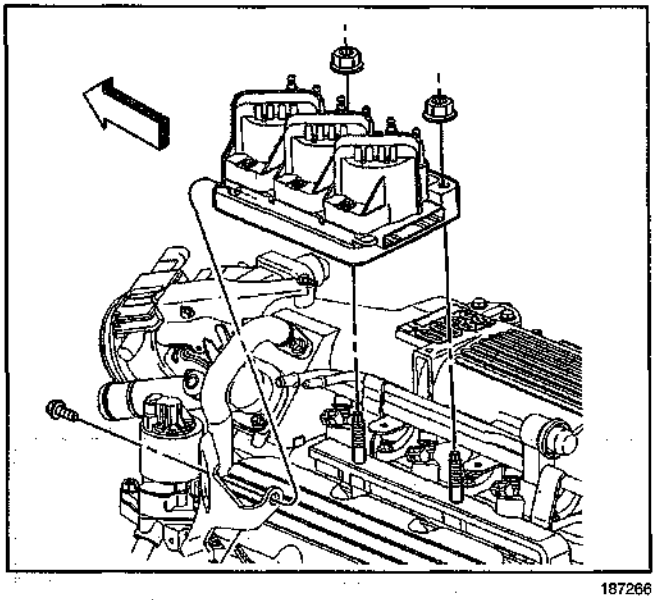
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**Ported Applications with EVAP Service Port**

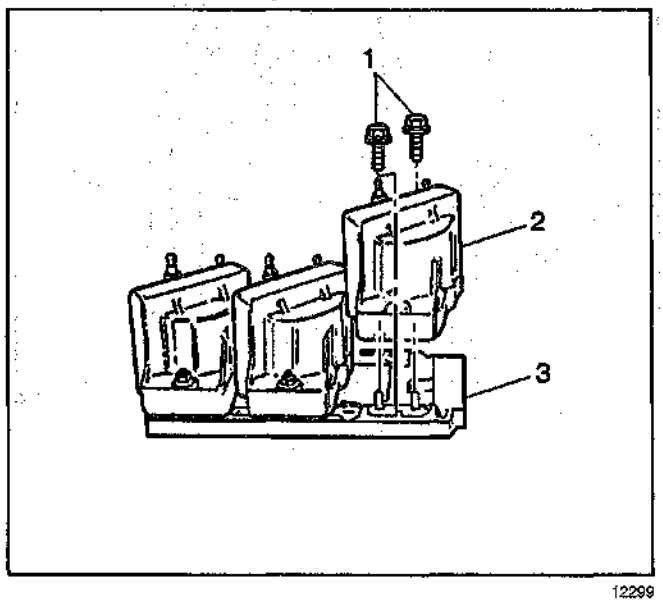
1. Connect the EVAP diagnostic cart *J 41413* to the vehicle EVAP service port. Turn the four position switch to Purge.
2. Start the engine. Allow the engine to reach the operating temperature.
3. Open the throttle until the engine speed reaches 2000 RPM.
4. Note the H2O vacuum gauge on the EVAP cart. The vacuum should read more than 15 inches H2O.
5. If the vacuum is less than 15 inches H2O, perform a complete throttle body service including a cleaning of the purge ports as outlined in the service manual. Go to step 1.
6. If the vacuum is more than 15 inches H2O, continue with the published service manual diagnostics.


187266

## Ignition Control Module Replacement

### Removal Procedure

1. Disconnect the 14-way connector at ignition control module.
2. Disconnect the spark plug wires from the ignition coils.
3. Remove the 6 screws securing coil assemblies to ignition control module.
4. Disconnect the ignition coils from ignition control module.
5. Remove the ignition control module retaining bolt and nuts.
6. Remove the ignition control module from the vehicle.



12299

### Installation Procedure

1. Position the ignition control module onto the bracket.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Install the ignition control module retaining bolt and nuts.

   **Tighten**

   Tighten fasteners to 8 N·m(70 lb in).
3. Position the ignition coils onto the ignition control module.
4. Hand start 6 screws through the ignition coils and module to the bracket.

   **Tighten**

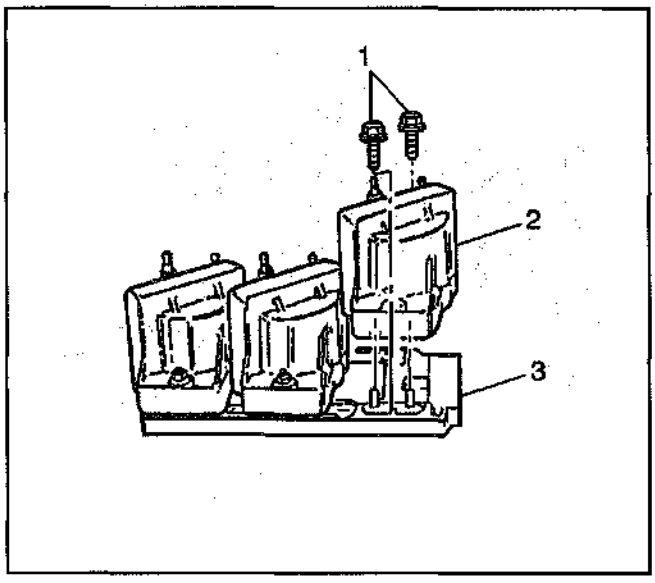
   Tighten screws to 4–5 N·m(40 lb in).
5. Connect the spark plug wires to the ignition coils.
6. Connect the 14-way connector to the ignition control module.

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## Ignition Coil(s) Replacement

### Removal Procedure

1. Disconnect the spark plug wires from the coil assemblies.
2. Remove 6 screws (1) securing the coil assemblies to the ignition control module.
3. Remove the coils (2) from the ignition control module (3).



12299

### Installation Procedure

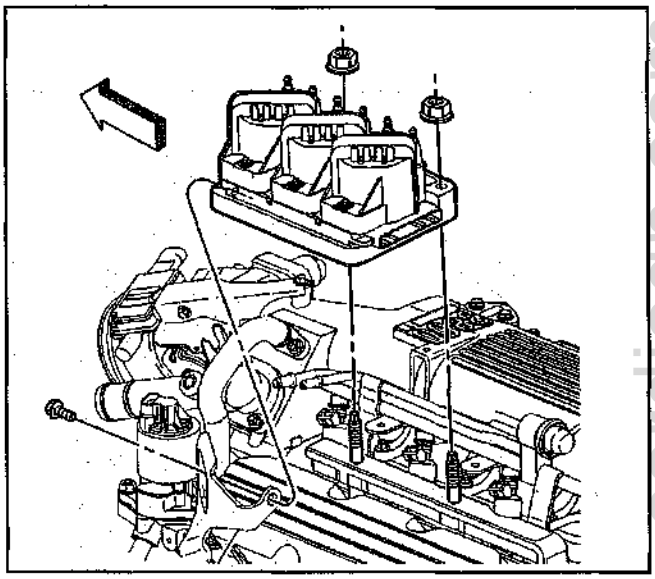
1. Attach the coils to the ignition control module.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Install 6 ignition coil attaching screws

   **Tighten**

   Tighten the screws to 4-5 N·m (40 lb. in.).
3. Connect the spark plug wires.


187266

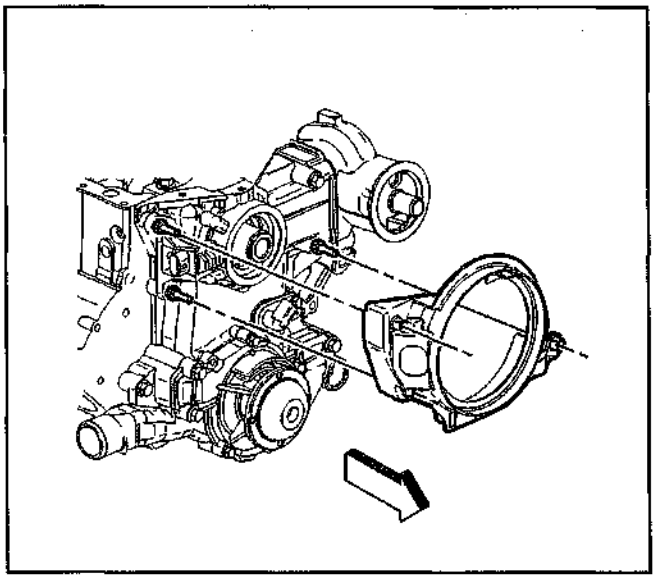
## Crankshaft Position (CKP) Sensor Replacement

### Removal Procedure

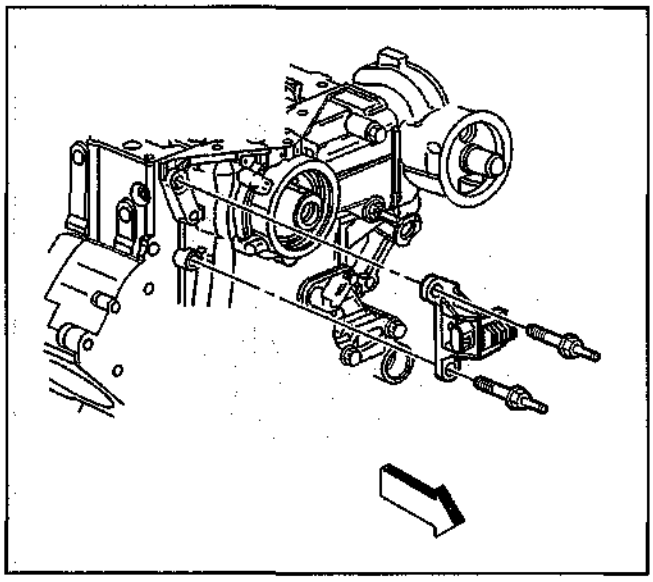
**Tools Required**

*J 38197* Balancer Remover

1. Disconnect the negative battery cable.
2. Remove the serpentine belts from crankshaft pulley.
3. Using 28 mm socket, remove the crankshaft harmonic balancer retaining bolt.
4. Remove the crankshaft harmonic balancer using *J 38197* balancer remover.
5. Remove the crankshaft position sensor shield. Do Not use a pry bar.
6. Disconnect the sensor electrical connector.
7. Remove the sensor from the block face.


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187288

### Installation Procedure

1. Position the crankshaft position sensor onto the engine block face.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

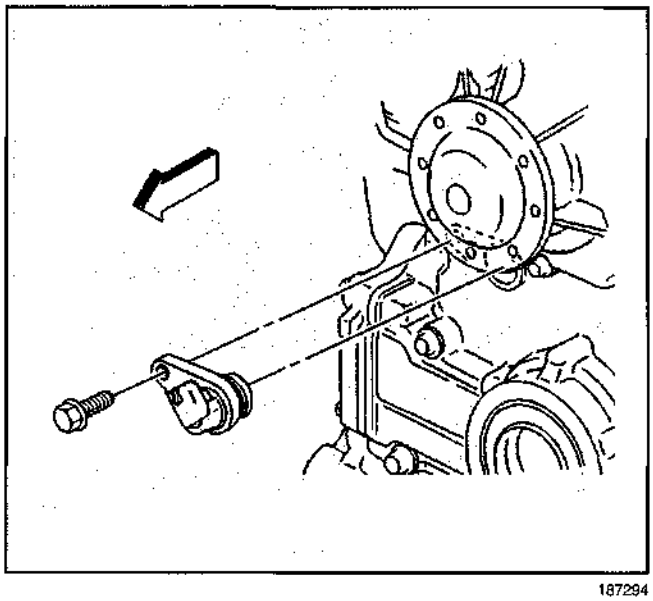
2. Install the bolts to hold the sensor to the engine block face.

   **Tighten**

   Tighten bolts to 20–40 N·m (14–28 lb ft).
3. Position and install the crankshaft position sensor shield.
4. Connect the electrical connector.
5. Position the balancer onto the crankshaft.
6. Apply thread sealer GM-1052080 or equivalent to threads of crankshaft balancer bolt.

   **Tighten**

   Tighten bolt to
   150 N·m +76 degrees(110 lb ft +76 degrees).
7. Install the serpentine accessory drive belt.
8. Connect the negative battery cable.



187294

## Camshaft Position (CMP) Sensor Replacement

### Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from camshaft position sensor.
3. Remove the camshaft position sensor retaining screw.
4. Remove the camshaft position sensor.

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### Installation Procedure

1. Position the camshaft position sensor.

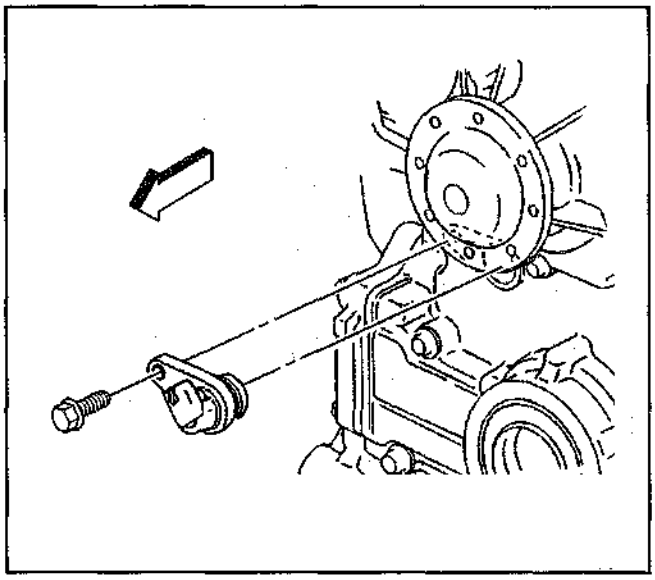
***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Hand start the camshaft position sensor retaining bolt.

   **Tighten**

   Tighten the retaining bolt to 5 N·m (44 lb in).

3. Connect the electrical connector.
4. Connect the negative battery cable.

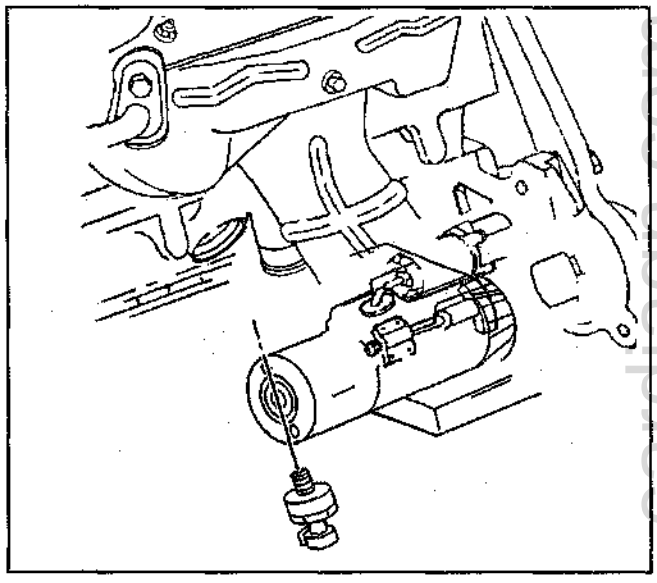


187294

## Knock Sensor (KS) Replacement

### Removal Procedure

1. Drain the cooling system.
2. Disconnect the wiring harness connector from the appropriate knock sensor.
3. Remove the knock sensor from engine block.



21707

### Installation Procedure

**Important:** Do Not apply thread sealant to sensor threads. Sensor is coated at the factory and applying additional sealant will affect the sensors ability to detect detonation.

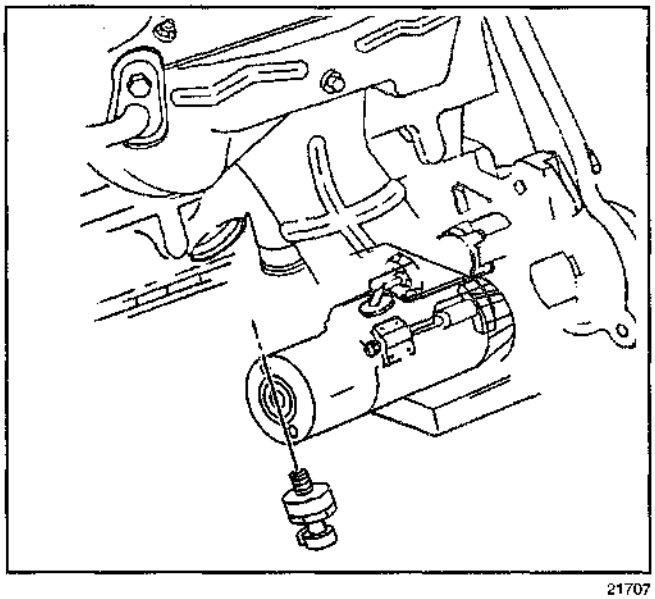
***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

1. Hand start the knock sensor into the engine block.

   **Tighten**

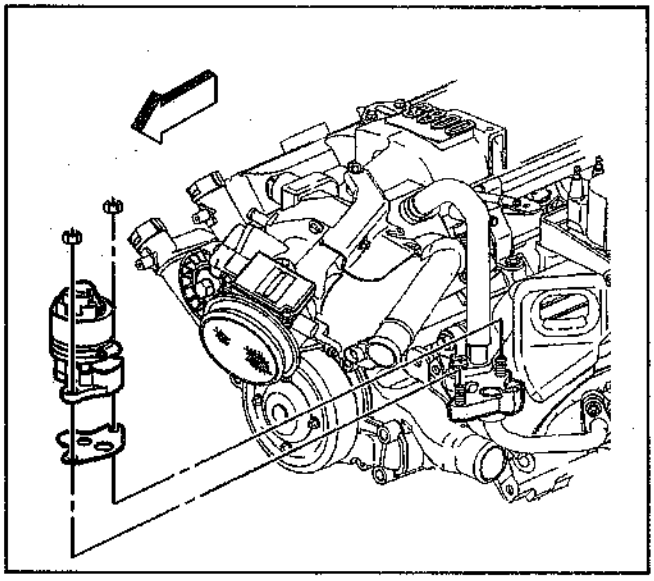
   Tighten the knock sensor to 19 N·m (14 lb ft).

2. Connect the wiring harness connector to the appropriate knock sensor.
3. Fill the cooling system.



21707

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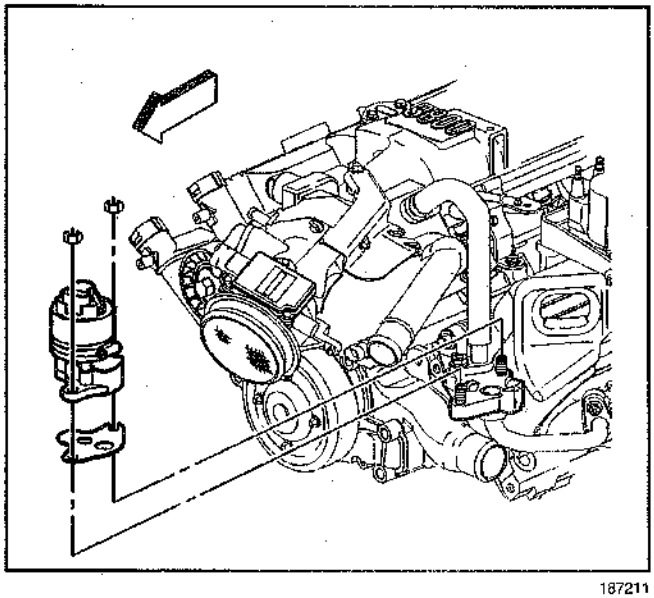


187211

## EGR Valve Replacement

### Removal Procedure

1. Disconnect the electrical connector at the EGR valve.
2. Remove the 2 base to flange nuts.
3. Remove the linear EGR valve assembly.



187211

### Installation Procedure

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

1. Position the linear EGR valve assembly and hand start the two nuts holding the EGR Valve to the adapter.

   **Tighten**

   Tighten the nuts to 29 N·m (21 lb ft).
2. Connect the electrical connector.

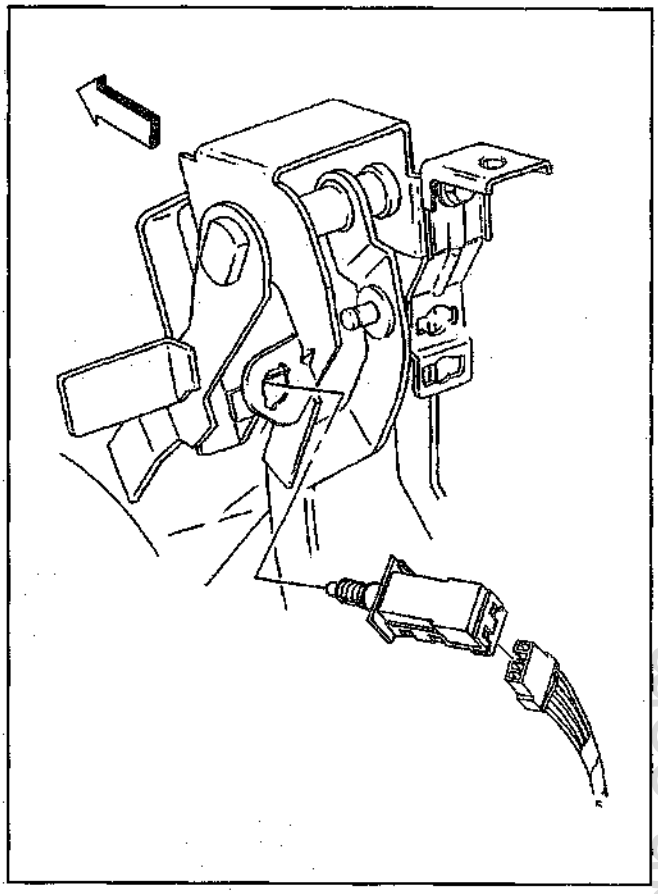
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## Clutch Anticipate Switch Replacement

### Removal Procedure

The clutch anticipate switch is located on the brake/clutch pedal bracket.

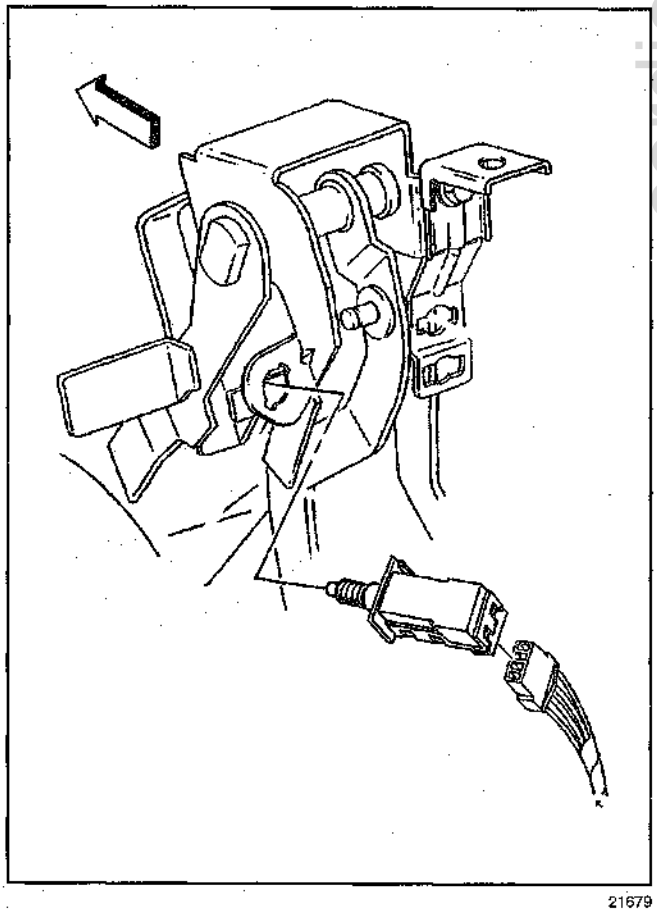
1. Remove the left side hush panel.
2. Disconnect the electrical connectors.
3. Grasp and pull the clutch anticipate switch straight out of the retainer.



21679

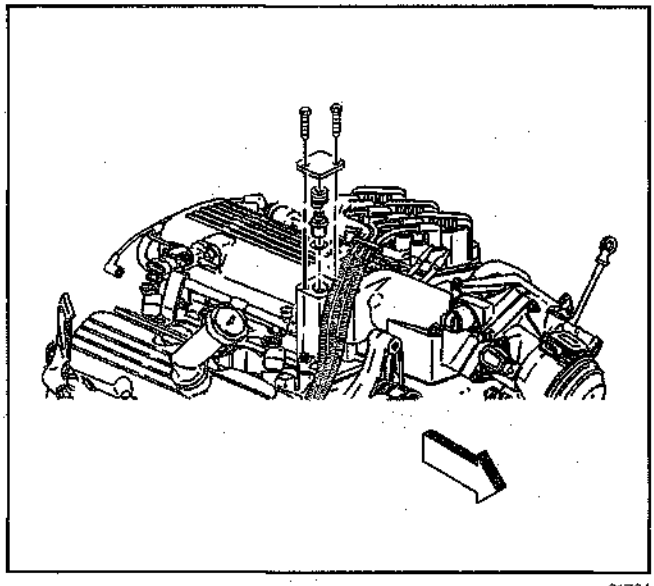
### Installation Procedure

1. Position the clutch anticipate switch into the Brake/Clutch Pedal Bracket.
   - Hold the clutch pedal depressed while installing the switch.
   - The switch should bottom in the retainer. Note that audible clicks can be heard as the switch is pressed into the retainer.
2. Slowly pull the clutch pedal rearward against the pedal stop.
3. Release the clutch pedal and pull back on it again to ensure proper switch adjustment.
4. Connect the electrical connector.
5. Install the left side hush panel.



21679

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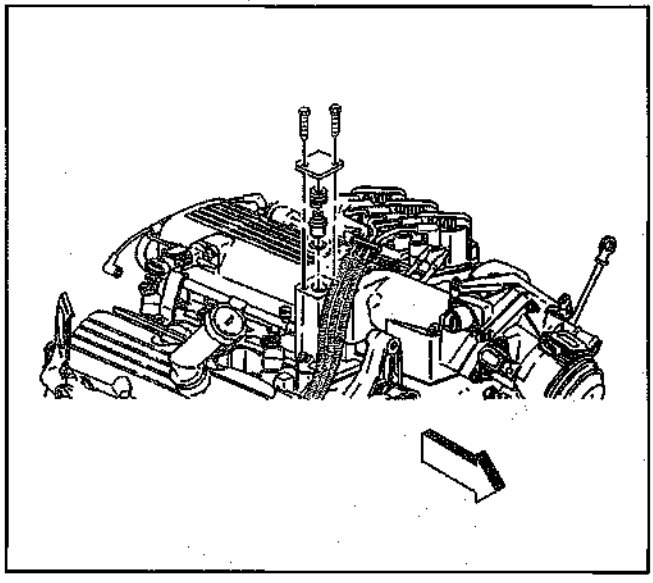


21764

## Crankcase Ventilation System Inspection

### Removal Procedure

1. While holding down the PCV valve cover, remove the two (2) cover retaining bolts.
2. Remove the PCV valve cover.
3. Remove the PCV valve, spring, and O-ring.



21764

### Installation Procedure

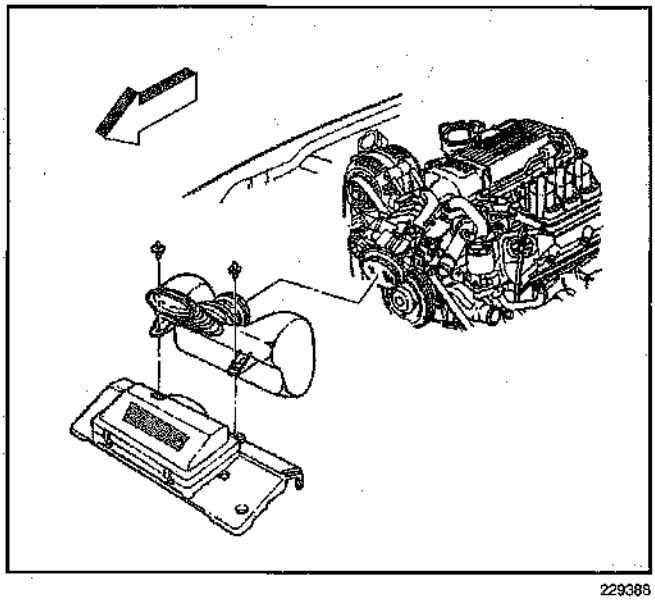
1. Install the PCV valve, spring, and O-ring.

***Notice:*** Refer to *Fastener Notice* in Cautions and Notices.

2. Position the PCV valve cover (use a new gasket if necessary) and hand start the two (2) cover retaining bolts.

   **Tighten**

   Tighten the 2 cover retaining bolts to 12 N·m (106 lb in).



229388

## Air Cleaner Element Replacement

### Removal Procedure

***Notice:*** If the mass air flow (MAF) sensor is installed backwards, the system will go rich. An arrow cast into the plastic portion of the sensor indicates proper air flow direction. The arrow must point toward the engine.

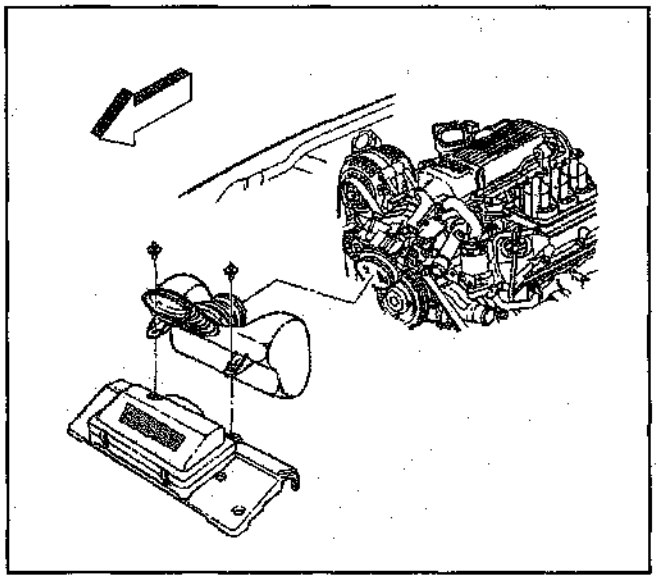
1. Release the fasteners located at the front of the air cleaner duct assembly.
2. Remove the air cleaner element from the air cleaner duct assembly.

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### Installation Procedure

***Notice:*** Verify that the radiator air deflector is in position before installing an air cleaner assembly. Improper installation may allow water intrusion which could damage the engine.

1. Install a new air cleaner element into the air cleaner assembly.
2. Position and lock the fasteners located at the front of the air cleaner duct assembly.



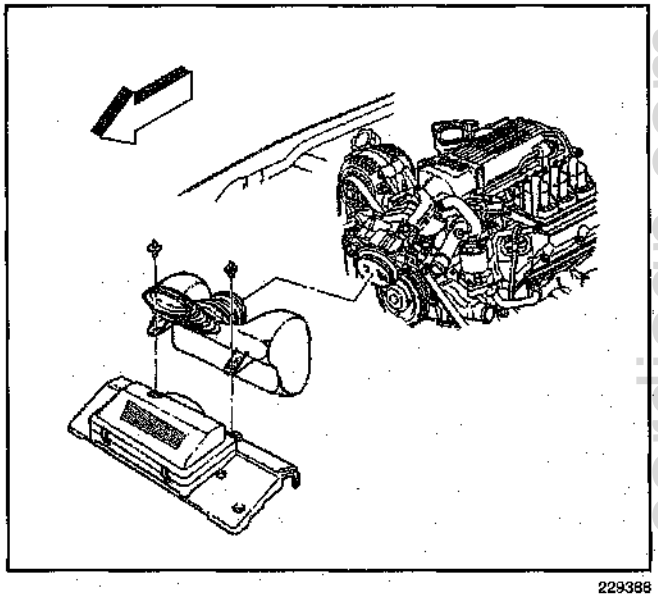
229388

## Air Cleaner Intake Duct Replacement

### Removal Procedure

***Notice:*** If the mass air flow (MAF) sensor is installed backwards, the system will go rich. An arrow cast into the plastic portion of the sensor indicates proper air flow direction. The arrow must point toward the engine.

1. Release the fasteners located at the front of the air cleaner duct/resonator assembly.
2. Release the button fasteners located at the rear of the air cleaner duct assembly.
3. Loosen the hose clamp from the air intake duct at the air cleaner duct assembly.
4. Loosen the hose clamp from the air intake duct at the throttle body assembly
5. Remove the air intake duct from the air cleaner duct/resonator assembly.

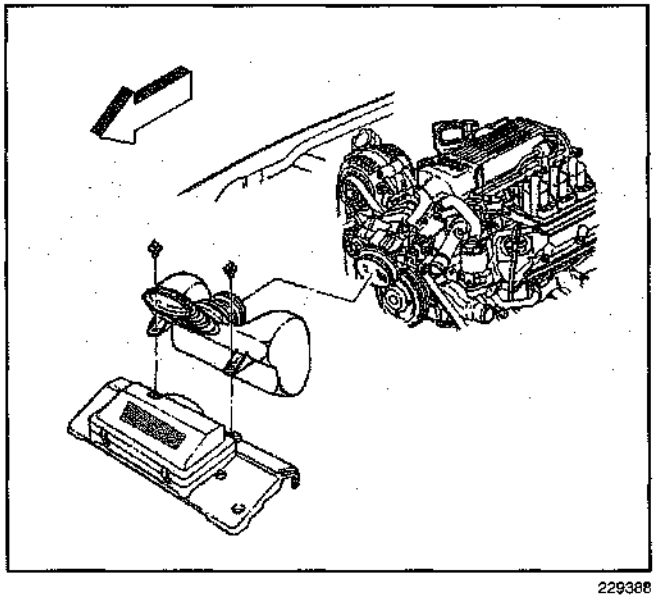


229388

### Installation Procedure

***Notice:*** Verify that the radiator air deflector is in position before installing an air cleaner assembly. Improper installation may allow water intrusion which could damage the engine.

1. Position the air intake duct at the front of the air cleaner assembly.
2. Position the air intake duct onto the front of the throttle body unit.
3. Securely fasten the hose clamp at the air cleaner assembly.
4. Securely fasten the hose clamp at the throttle body assembly
5. Position the air cleaner assembly onto the radiator support.
6. Install the button fasteners located at the rear of the air cleaner assembly.

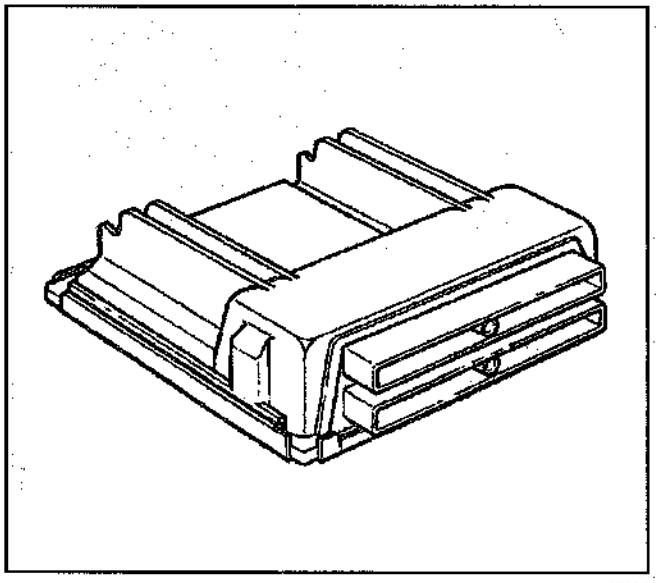


229388

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# Description and Operation

## Powertrain Control Module Description



187237

The Powertrain Control Module (PCM) is the control center of the vehicle. It controls the following items:

- Fuel metering system.
- Transaxle/transmission shifting.
- Ignition timing.
- On-board diagnostics for powertrain functions.

It constantly monitors the information from various sensors, and controls the systems that affect vehicle performance. The PCM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the MIL, and store diagnostic trouble codes which identify the problem areas to aid the technician in making repairs.

The type of PCM used is a PCM 32U. The knock sensor system is no longer a separate component. The PCM contains integrated knock sensor (KS) diagnostic circuitry. For further information, refer to *Knock Sensor (KS) System Description*.

## Information Sensors/Switches Description

### 3X Reference PCM Input

From the ignition control module, the PCM uses this signal to calculate engine RPM and crankshaft position at engine speeds above 1200 RPM. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, DTC P1374 will set and the PCM will use the 18X reference signal circuit for fuel and ignition control. The engine will continue to start and run using the 18X reference signal only.

### 18X Reference PCM Input

From the ignition control module, the PCM uses this signal to calculate engine RPM and crankshaft position at engine speeds below 1200 RPM. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, DTC P0336 will set and the PCM will use the 3X reference signal circuit at all times for fuel and ignition control. The engine will continue to start and run using the 3X reference signal only.

### A/C Refrigerant Pressure Sensor

The A/C refrigerant pressure sensor signal indicates high side refrigerant pressure to the PCM. The PCM uses this information to adjust the idle air control valve to compensate for the higher engine loads present with high A/C refrigerant pressures and to control the cooling fans. A fault in the A/C refrigerant pressure sensor signal will cause DTC P0530 to set.

### A/C Request PCM Input

The A/C request signal indicates to the PCM that A/C mode is selected at the A/C control head. The PCM uses this information to adjust the idle speed before turning ON the A/C clutch. If this signal is not available to the PCM, the A/C compressor will be inoperative.

### Crankshaft Position (CKP) Sensor

The crankshaft position sensor provides a signal used by the ignition control module to calculate ignition sequence. The ignition control module also uses the crankshaft position sensor signals to initiate 18X and 3X reference pulses which the PCM uses as reference to calculate RPM and crankshaft position.

### Camshaft Position (CMP) Sensor and CAM Signal

The camshaft position sensor sends a cam signal to the PCM which uses it as a sync pulse to trigger the injectors in proper sequence. The CAM signal is passed through the ignition control module. It is filtered and buffered by the ignition control module, but the signal is not processed in any other way. The PCM uses the CAM signal to indicate the position of the #1 piston during its power stroke. This allows the PCM to calculate true Sequential Fuel Injection (SFI) mode of operation. If the PCM detects an incorrect CAM signal while the engine is running, DTC P0341 will set.

If the CAM signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. The engine can be restarted and will run in the calculated sequential mode as long as the fault is present with a 1 in 6 chance of injector sequence being correct.

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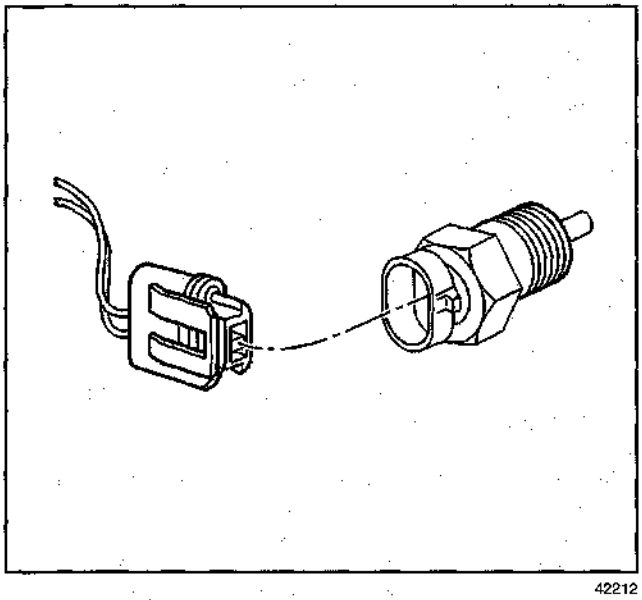
### Clutch Anticipate Switch (Manual Transaxle)

The Clutch Anticipate Switch input allows the PCM/TAC to adjust the idle when the manual transmission clutch is being disengaged. The PCM monitors the Clutch Anticipate Switch input; if a low voltage is monitored, the PCM considers the Clutch Anticipate Switch closed to ground (clutch pedal released). When the ground at the Clutch Anticipate Switch input is interrupted (clutch pedal applied), the PCM will immediately decrease idles. This is done to avoid a possible RPM flare caused by the sudden change in engine load.

### Electronic Brake Control Module (EBCM) - PCM Serial Data (CKT 800)

The PCM uses the UART serial data line (CKT 800) to communicate with various other components and systems within the vehicle. The PCM receives rough road information from the EBCM on the serial data circuit. The PCM uses the rough road information to enhance the misfire diagnostic by detecting crankshaft speed variations caused by driving on rough road surfaces. This allows false misfire information to be rejected. The EBTCM / EBCM calculates rough road information by monitoring the ABS wheel speed sensors. If a malfunction occurs which does not allow the EBTCM / EBCM to transmit correct rough road information to the PCM while a misfire DTC is requesting the MIL, DTC P1380 will set. If a loss of communications occurs which causes the PCM to not receive rough road information while a misfire DTC is requesting the MIL, DTC P1381 will set.

### Engine Coolant Temperature (ECT) Sensor



42212

The engine coolant temperature sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance (100,000 ohms at -40°C/-40°F) while high temperature causes low resistance (70 ohms at 130°C/266°F).

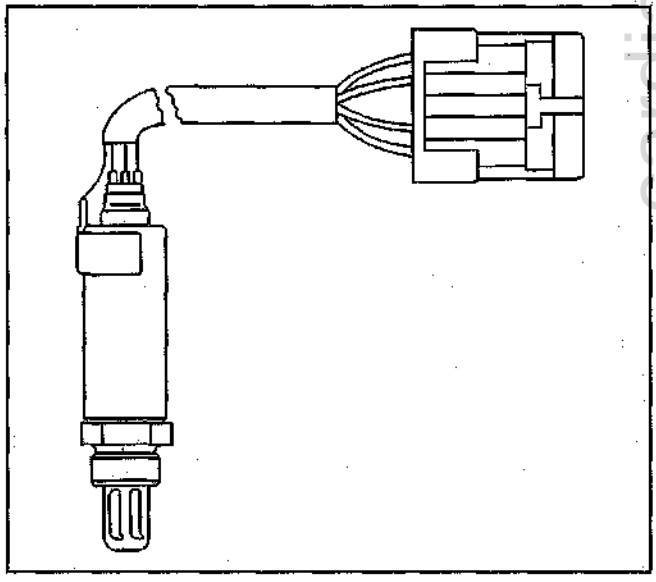
The PCM supplies a 5 volt signal to the engine coolant temperature sensor through a resistor in the PCM and measures the voltage. The voltage will be high when the engine is cold, and low when the engine is hot. By measuring the voltage, the PCM calculates the engine coolant temperature. The scan tool displays engine coolant temperature in degrees. After engine startup, the temperature should rise steadily to about 90°C (194°F) then stabilize when thermostat opens. If the engine has not been run for several hours (overnight), the engine coolant temperature and intake air temperature displays should be close to each other.

Engine coolant temperature affects most systems the PCM controls. A hard fault in the engine coolant sensor circuit should set DTC P0117 or DTC P0118; an intermittent fault should set a DTC P1114 or P1115. This section also contains a specification table to check for sensor resistance values relative to temperature.

### EGR Pintle Position Sensor

The PCM monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM and to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage outside the normal range of the pintle position sensor, or a signal voltage that is not within a tolerance considered acceptable for proper EGR system operation, the PCM will set DTC P1404. Refer to *EGR System Description* for a complete description of the EGR system.

### Heated Oxygen Sensors



14490

The fuel control Heated Oxygen Sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are mounted in the exhaust manifolds where they can monitor the oxygen content of the exhaust gas stream. The oxygen present in the exhaust gas reacts with the sensor to produce a voltage output. This voltage should constantly fluctuate from approximately 100mV (high oxygen content - lean mixture) to 900mV (low oxygen content - rich mixture). The heated oxygen sensor voltage can be monitored with a scan tool.

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By monitoring the voltage output of the oxygen sensor, the PCM can calculate what fuel mixture command to send the injectors (lean mixture-low HO2S voltage = rich command, rich mixture-high HO2S voltage = lean command).

An open Bank 1 HO2S 1 circuit should set a DTC P0134; an open in Bank 2 HO2S 1 circuit should set a DTC P0154. With an open HO2S signal, the scan tool will display a constant voltage between 400 - 500mV. A constant voltage below 300mV in the Bank 1 HO2S 1 sensor circuit (circuit grounded) should set DTC P0131. A constant voltage below 300mV in the Bank 2 HO2S 1 sensor circuit (circuit grounded) should set DTC P0151. A constant voltage above 800mV in the Bank 1 HO2S 1 circuit should set DTC P0132, while a constant voltage above 800mV in the Bank 2 HO2S 1 circuit should set DTC P0152. A fault in the Bank 1 HO2S 1 heater circuit should cause DTC P0135 to set. A fault in the Bank 2 HO2S 1 heater circuit should cause DTC P0155 to set. The PCM can also detect HO2S response problems. If the response time of an HO2S is determined to be too slow, the PCM will store a DTC that indicates degraded HO2S performance.

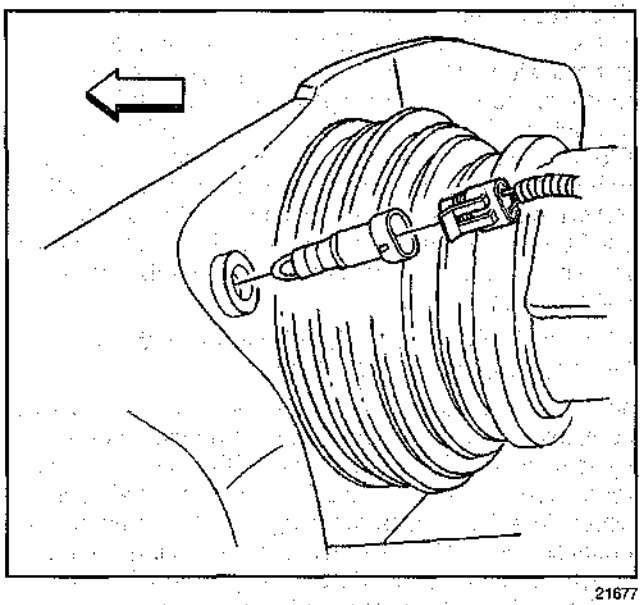
To control emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the Bank 1 HO2S 2.

The Bank 1 HO2S 1 or Bank 2 HO2S 1 produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 and the Bank 2 sensor 1 signals will be far more active than that produced by the Bank 1 HO2S 2 sensor.

Although the Bank 1 HO2S 2 sensors' main function is catalyst monitoring, they also plays a limited role in fuel control. If the sensor output indicates a voltage either above or below the 450 millivolt bias voltage for an extended period of time, the PCM will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the Bank 1 HO2S 2 signal circuit should set DTC P0137, P0138 or P0140 depending on the specific condition. A fault in the heated oxygen sensor heater element or its ignition feed or ground will result in slower oxygen sensor response. This may cause erroneous catalyst monitor diagnostic results. A fault in the Bank 1 HO2S 2 heater circuit should cause DTC P0141 to set.

## Intake Air Temperature Sensor



21677

The Intake Air Temperature (IAT) sensor is a thermistor which changes value based on the temperature of air entering the engine. Low temperature produces a high resistance (100,000 ohms at -40°C/-40°F), while high temperature causes low resistance (70 ohms at 130°C/266°F). The PCM supplies a 5 volt signal to the sensor through a resistor in the PCM and measures the voltage. The voltage will be high when the incoming air is cold, and low when the air is hot. By measuring the voltage, the PCM calculates the incoming air temperature.

The IAT sensor signal is used to adjust spark timing according to incoming air density. The scan tool displays temperature of the air entering the engine, which should read close to ambient air temperature when engine is cold, and rise as underhood temperature increases. If the engine has not been run for several hours (overnight) the IAT sensor temperature and engine coolant temperature should read close to each other. A failure in the IAT sensor circuit should set DTC P0112 or DTC P0113.

### Reference Low

This is a ground circuit for the digital RPM counter inside the PCM, but the wire is connected to engine ground only through the ignition control module. Although this circuit is electrically connected to the PCM, it is not connected to ground at the PCM. The PCM compares voltage pulses on the 18X and 3X reference input circuits to any on this circuit, ignoring pulses that appear on both. If the circuit is open, or connected to ground at the PCM, it may cause poor engine performance and possibly a MIL with no DTC set.

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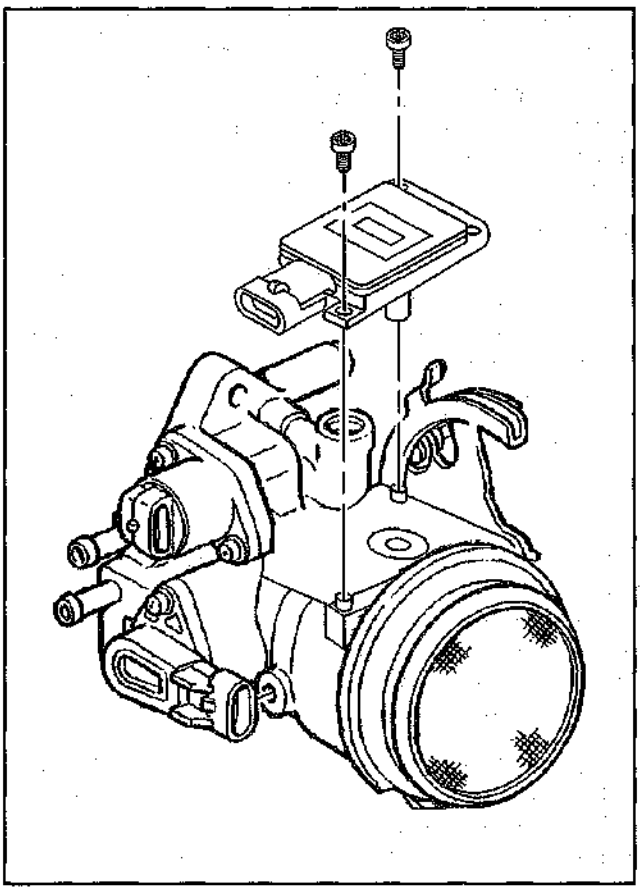
### Knock Sensors

The knock sensors detect abnormal vibration (spark knocking) in the engine. The sensors are mounted in the engine block near the cylinders. The knock sensors produce an AC voltage signal under all engine operating conditions. The PCM adjusts the Ignition Control (IC) spark timing based on the amplitude and frequency of the KS signal being received.

The PCM contains integrated Knock Sensor (KS) diagnostic circuitry. The PCM uses the circuitry to diagnose the KS sensors and related wiring. The PCM calculates an average voltage of each knock sensor's signals and takes instantaneous signal voltage readings. The PCM uses the instantaneous signal voltage readings to determine the state of the knock sensor circuitry. If the knock sensor system is operating normally, the PCM should monitor instantaneous KS signal voltage readings varying outside a voltage range above and below the calculated average voltage. If the PCM malfunctions in a manner which will not allow proper diagnosis of the KS circuit DTC P0325 will set. DTCs P0327 and P0332 are designed to diagnose the knock sensors, and related wiring, so problems encountered with the KS system should set a DTC.

For further information, refer to *Knock Sensor (KS) System Description.*

### Mass Air Flow Sensor

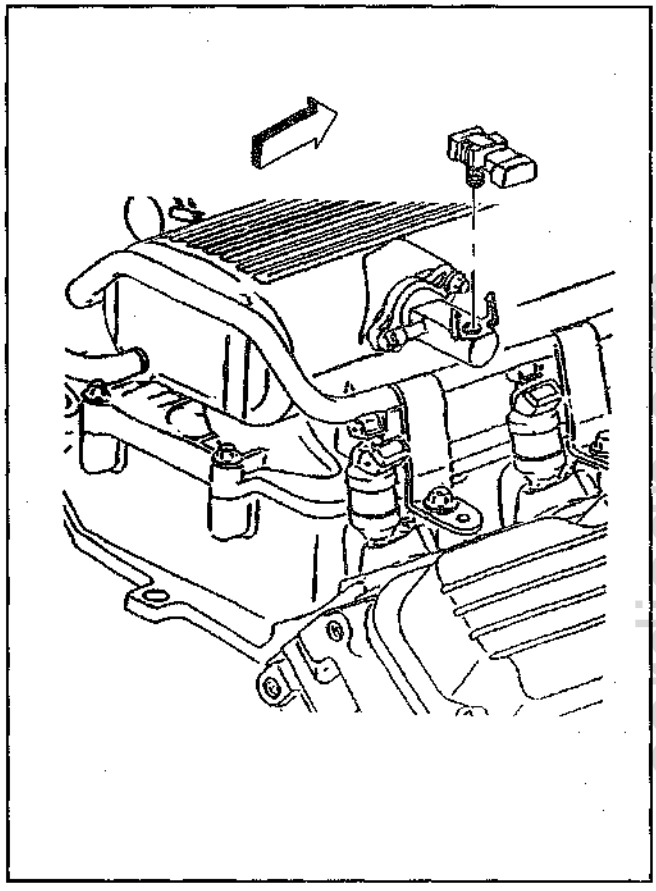


15006

The Mass Air Flow (MAF) sensor measures the amount of air which passes through the throttle body. The PCM uses this information to determine the operating condition of the engine, to control fuel delivery. A large quantity of air indicates acceleration, while a small quantity indicates deceleration or idle.

The scan tool displays the MAF value in grams per second (gm/s). At idle, MAF should read between 4 gm/s -7 gm/s on a fully warmed up engine. Values should change rather quickly on acceleration, but values should remain fairly stable at any given RPM. A MAF sensor malfunction or MAF signal circuit problem should set DTC P0101, DTC P0102, or DTC P0103.

### Manifold Absolute Pressure Sensor



21663

The Manifold Absolute Pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the key ON, engine not running or at wide-open throttle (low vacuum). The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run, to determine engine vacuum level for other diagnostics and to determine barometric pressure (BARO).

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If the PCM detects a voltage that is lower than the possible range of the MAP sensor, DTC P0107 will be set. A signal voltage higher than the possible range of the sensor will set DTC P0108. An intermittent low or high voltage will set DTC P1107 or P1106 respectively. The PCM can also detect a shifted MAP sensor. The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.

### TCC Brake Switch

The TCC brake switch signal indicates when the brake pedal is applied. The TCC brake switch information is used by the PCM mainly to control the transmission torque converter clutch. This switch is used as a redundant input to the PCM on vehicles equipped with manual transmissions and if faulty, could cause a DTC P1586 to set.

### Transmission Temperature Sensor

The transmission fluid temperature sensor is a thermistor which changes value based on the temperature of the transmission fluid. A high transmission fluid temperature may cause the vehicle to operate in Hot Mode. While in Hot Mode, shift points may be altered, 4th gear disabled, and TCC forced ON in 2nd gear.

A failure in the TFT sensor or associated wiring should cause DTC P0712 or P0713 to set. In this case, engine coolant temperature will be substituted for the TFT sensor value, and the transmission will operate normally.

## PCM Controlled Warning Lamps Description

### MIL Operation

The Malfunction Indicator Lamp (MIL) is located on the instrument panel (CHECK ENGINE) or (SERVICE ENGINE SOON). The MIL performs the following functions:

- It informs the driver that a problem has occurred and that the vehicle should be taken for service as soon as possible.
- As a bulb check and system check, the MIL will illuminate with the ignition switch ON and the engine not running. when the engine is started, the MIL will turn OFF. If the MIL remains ON, the self-diagnostic system has detected a problem. If the problem goes away, the MIL will turn OFF in most cases, but a diagnostic trouble code will remain stored.
- If the MIL is illuminated, then the engine stalls, the MIL will remain Illuminated so long as the ignition switch is ON.
- Now, if the MIL is not illuminated and the engine stalls, the MIL will not illuminate until the ignition switch is cycled OFF, then ON.

Perform the Powertrain On-Board Diagnostic System Check first, when the following conditions are present:

- When the MIL does not turn ON when the ignition switch is turned to the RUN position
- When the MIL remains ON while the engine is running
- When you suspect a driveability problem

### Low Oil Level Lamp

The PCM commands the Low Oil Level Lamp ON if the engine oil level sensor indicates that a low oil level condition exists. The PCM determines whether or not to test for low oil level based on the difference between engine coolant temperature at the last shutdown and engine coolant temperature at startup. This is to ensure that the oil has drained back into the oil pan before testing.

The engine oil level switch is a simple float switch that is grounded when the engine oil level is OK. When the ignition is first turned ON, the PCM commands the Low Oil Level lamp ON for a brief period of time to test the bulb (approximately 3 seconds). The PCM also checks the engine oil level switch circuit at startup. If the engine has been running, the PCM performs a test routine based on engine coolant temperature to ensure that the engine oil drained back into the sump before checking the state of the engine oil level switch. If the engine coolant temperature is between 15°C (59°F) and 130°C (266°F), the PCM compares the engine coolant temperature at the last key OFF to the engine coolant temperature at the current key ON. If the difference between the recorded temperature values is at least 12°C (54°F), the PCM will test the engine oil level.

### Generator Lamp

The PCM commands the generator lamp ON under the following conditions:

- When the engine speed is greater than 1200 rpm and system voltage falls below 10 volts for longer than 10 seconds. The PCM commands the generator lamp OFF when system voltage rises to above 12 volts.
- When the generator control circuit (L terminal) remains low for longer than 10 seconds.

### Second Gear Lamp (4L60E Transaxle Only)

The PCM supplies 12 volts to the second gear start switch through a pull–up resistor. The second gear start switch is a normally open switch. The PCM senses a high input voltage, commands normal transaxle shifting, and the second gear start lamp is not illuminated. When the second gear start switch is closed, the input voltage to the PCM is pulled low. The PCM turns the second gear lamp ON and commands the to vehicle begin in second gear (the following gears shift in normal sequence).

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## PCM Controlled Air Conditioning Description

### Operation

The air conditioning system uses a compressor with variable displacement. This compressor is referred to as the V-5 type compressor. The V-5 compressor meets A/C requirements without cycling. The A/C compressor operation is controlled by the Powertrain Control Module (PCM) for the following reasons:

- Improved idle quality during compressor clutch engagement.
- Improved wide open throttle performance (WOT).
- Protects the A/C compressor from operation with incorrect refrigerant pressures.

The A/C clutch electrical system consists of the following components:

- The A/C control head and/or the A/C programmer.
- The A/C refrigerant pressure sensor.
- The A/C compressor clutch.
- The A/C compressor clutch relay.
- The PCM.

When an A/C mode is selected at the A/C control head, the A/C programmer provides a 12 volt signal to the A/C request circuit. The PCM monitors the A/C request circuit and controls the A/C compressor relay based on the A/C request signal. This allows the PCM to increase the engine idle speed just prior to A/C clutch engagement for better idle quality. In addition, the PCM will command the cooling fans ON during A/C operation. The PCM also monitors the A/C refrigerant pressure sensor circuit. If the A/C refrigerant pressure is too high or low, the PCM will disable the A/C compressor relay.

The PCM will enable the A/C compressor clutch whenever the engine is running and the A/C has been requested unless one or more of the following conditions are present:

- Throttle angle is more than 90%.
- A/C head pressure is more than 414 psi (4.27 volts) or less than 34 psi (0.35 volt) as determined by the A/C refrigerant pressure sensor.
- Ignition voltage is less than 10.5 volts.
- Engine speed is more than 5400 RPM for any amount of time.
- Engine speed is more than 4500 RPM for longer than 5 seconds.
- ECT is more than 125°C (257°F).
- IAT is less than 5°C (41°F).

Any of the conditions described above will inhibit A/C compressor relay operation.

### Diagnosis

DTC P0530, P0560 or P1639 can affect A/C operation. Refer to the DTC tables if any DTCs are set.

The A/C Clutch Control Circuit Diagnosis table should be used for diagnosing the electrical portion of the A/C compressor clutch circuit if a DTC is not set. To diagnose the refrigerant portion of the HVAC system, refer to the Heater, Ventilation, and Air Conditioning (HVAC) section. A scan tool will be used in diagnosing the system. The scan tool has the ability to display the A/C request and refrigerant pressure inputs to the PCM. The scan tool can display when the PCM has commanded the A/C clutch ON. The scan tool also has the ability to override the A/C request signal and energize the A/C control relay.

## Engine Cooling Fan Description - Electric

### Operation

The Powertrain Control Module (PCM) controls the operation of the cooling fans. This is accomplished by providing a ground path for the cooling fan relay coils within the PCM. The relay contacts will close and complete the circuit between the fusible link at the battery junction block and the fan motors. Whenever there is a fan ON request both fans will be running.

Power for the fan motors is supplied through a fusible link at the battery junction block. Battery positive voltage is applied to the cooling fan relay contacts and coils. The cooling fan relays are energized when current flows through the relay coils to ground at the PCM. The cooling fan relay #1 control circuit is used for low speed cooling fan operation. The cooling fan relay #1 control circuit and the cooling fan relay #2 and #3 control circuit are both grounded for high speed fan operation. The cooling fan relay control circuits are monitored by the PCM. Before using the Electric Cooling Fans diagnostic tables be sure to perform the Powertrain On-Board Diagnostic System Check. If diagnostic trouble codes P0480 or P0481 are present, use the appropriate DTC diagnostic tables prior to performing Electric Cooling Fans diagnostics.

**Important:** When certain Diagnostic Trouble Codes (DTCs) are present, the PCM may command the cooling fans to run all the time. It is important to perform the Powertrain On-Board Diagnostic System check prior to diagnosing the engine cooling fans.

The PCM will complete the ground path for cooling fan relay #1 under any of the following conditions:

- When engine coolant temperature exceeds 105°C (221°F).
- When A/C is requested and ambient temperature is more than 10°C (50°F).
- When A/C refrigerant pressure is more than 190 psi (2 volts).

For high speed cooling fans operation, the PCM will delay control of the cooling fan #2 and #3 relays for 6 seconds. The 6 second delay ensures that the cooling fan electrical load will not exceed the capacity of the system. The PCM will complete the ground paths for cooling fan relays #1, #2, and #3 under any of the following conditions:

- When engine coolant temperature exceeds 113°C (235°F).
- When A/C refrigerant pressure is more than 275 psi (2.9 volts).

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### Diagnosis

If a problem that involves the low speed cooling fan relay control circuit (cooling fan relay #1 control) exists, DTC P0480 should set. If the problem affects the high speed cooling fan relay control circuit (cooling fan relay #2 and #3 control), DTC P0481 should set. A problem with the ECT sensor should set DTC P0117, P0118, P1114, or P1115. Any of these DTCs will affect cooling fan operation and should be diagnosed before using the Electric Cooling Fan Diagnosis table. The Electric Cooling Fan Diagnosis table should be used to diagnose the PCM controlled cooling fans only if no DTC is set.

## PCM Controlled Generator Description

The generator provides voltage to operate the vehicles electrical system and to charge the vehicles battery. A magnetic field is created when current flows through the rotor.

This field rotates as the rotor is driven by the engine, creating an AC voltage in the stator windings. The AC voltage is converted to DC voltage by the rectifier bridge and is supplied to the electrical system at the battery terminal.

The operation of the charging system is monitored by the PCM. The PCM monitors the charging system loads and adjusts the idle speed accordingly. The PCM also sends information to the Instrument Panel Cluster (IPC) when the charging system is inoperative and tells the IPC to illuminate the volts telltale lamp.

The PCM supplies 5 V through the L circuit to the generator. If the generator becomes inoperative, the PCM can detect the fault through the L circuit and tell the IPC to illuminate the volts telltale lamp.

The PCM also monitors the duty cycle of the generator through the L circuit. As the generator load increases, the PCM will adjust the idle speed accordingly. If the IPC does not see any activity from the PCM the IPC will illuminate the volts telltale lamp.

If the Voltage telltale is on and the (L) terminal voltage is low while the PCM is commanding the generator on for more than 30 seconds OR

If the Voltage telltale is on and the PWM is less than 5% while engine RPM is less than 2500 for more than 30 seconds DTC P0620 will set.

If the Voltage telltale is on but no DTCs are set, use the PCM Controlled Generator Diagnosis to diagnose the problem.

### Generator Assembly

The generator assembly is mounted to the front of the engine on the passenger side of the vehicle. The CS-type generator uses an internal regulator which features built-in fault detection. The generator used on this vehicle, is not to be disassembled for service.

## Fuel Supply Component Description

### System Overview

The fuel tank stores the fuel supply. An electric fuel pump, located in the fuel tank within the modular fuel sender assembly, pumps fuel through an in-line fuel filter to the fuel rail assembly. The pump provides fuel pressure greater than is needed by the injectors. The fuel pressure regulator keeps fuel available to the injectors at a regulated pressure. A separate fuel pipe is used to return fuel to the fuel tank.

### Fuel Tank Vent Valve

The fuel tank vent valve is located in the rear of the vehicle near the fuel tank. The fuel tank vent valve is a pressure/vacuum relief valve. When the fuel tank pressure exceeds a specified pressure, the valve opens allowing the tank pressure to bleed off. When the fuel tank is in a vacuum condition, the vent valve opens when the vacuum is within a specified range allowing fresh air to be pulled in.

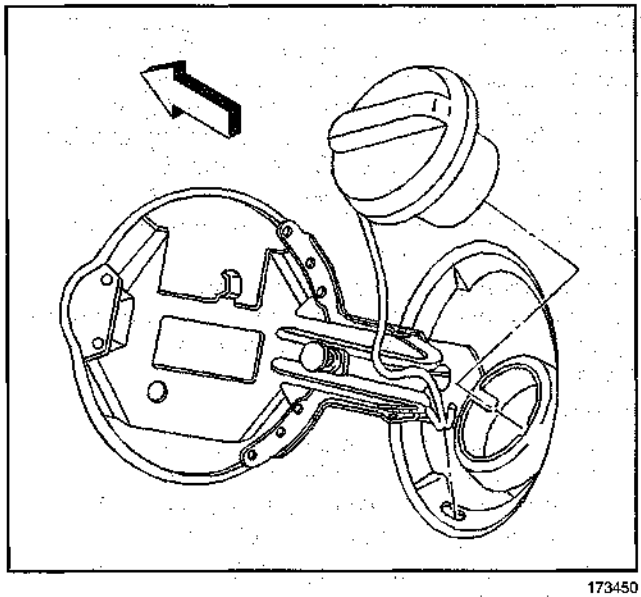
### Fuel Tank

The fuel tank stores the fuel supply. The fuel tank is located in the rear of the vehicle. The fuel tank is held in place by two metal straps that attach to the frame. The fuel tank is made of steel and is coated internally with a special corrosion inhibitor.

### Fuel Tank Filler Pipe

The fuel tank filler pipe has a built-in restrictor and deflector in order to prevent refueling with leaded fuel.

### Fuel Filler Cap



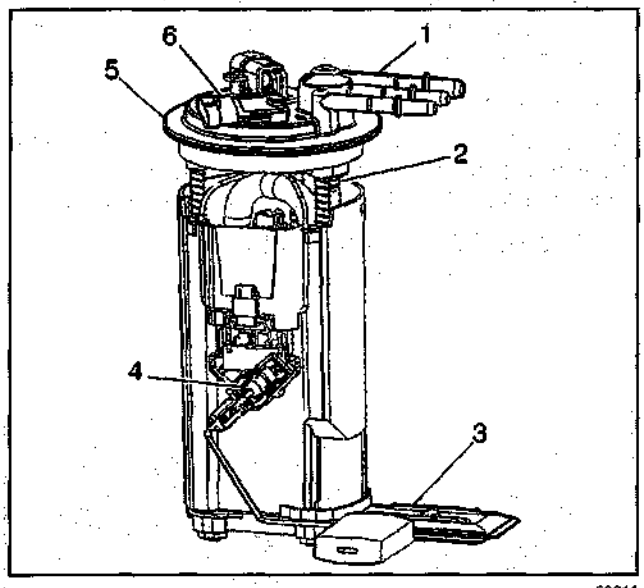
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***Notice:*** If a fuel tank filler cap requires replacement, use only a fuel tank filler cap with the same features. Failure to use the correct fuel tank filler cap can result in a serious malfunction of the fuel and EVAP system.

The fuel tank filler neck is equipped with a tethered fuel filler cap. The cap requires a quarter of a turn to remove it. A built in torque-limiting device prevents over tightening. In order to install the cap, turn the cap clockwise until you hear three audible clicks. This signals that the correct torque has been reached and the cap is fully seated. A fuel filler cap that is not fully seated may cause a malfunction in the emission system.

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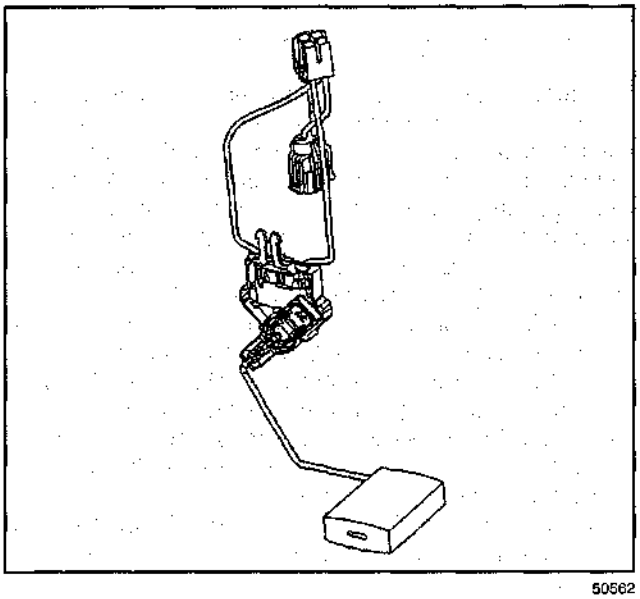
### Modular Fuel Sender Assembly




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The Modular Fuel Sender Assembly consists of the following major components: fuel sender strainer, fuel pump strainer, roll-over valve, fuel level sensor, and fuel tank pressure sensor.

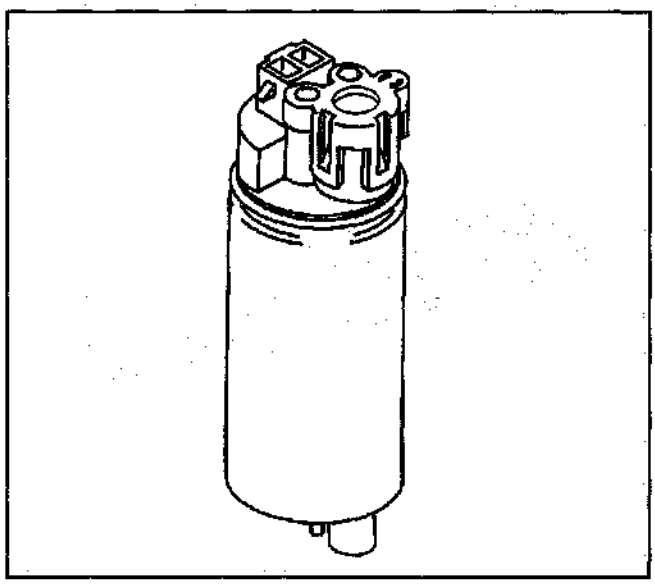
### Fuel Level Sensor



50562

The Fuel Level Sensor consists of the following components: float, the wire float arm, and the ceramic resistor card. The Fuel Level Sensor is mounted on the Modular Fuel Sender Assembly and is used as an input to the PCM. The PCM uses this information as a fuel level input for Various diagnostics. In addition the PCM transmits the fuel level over the Class II communication circuit to the IP cluster. This information is used for the IP Fuel Gauge, and low Fuel Warning indicator if applicable.

### Fuel Pump



49371

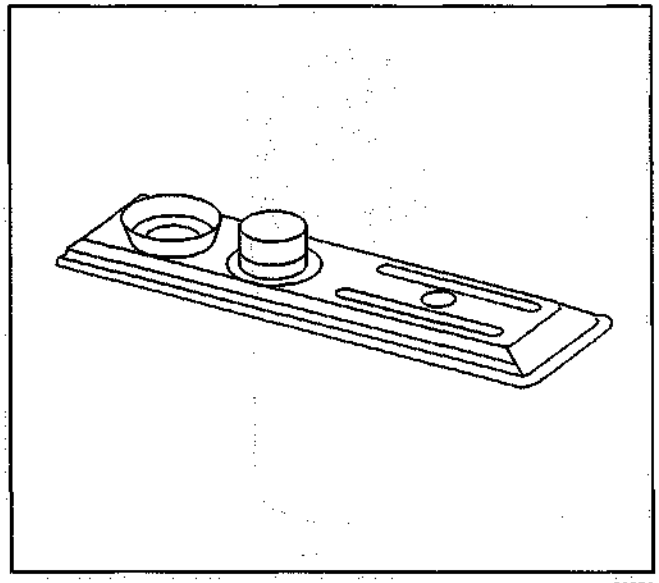
The fuel pump is mounted in the fuel reservoir within the modular fuel sender. The fuel pump is an electric high pressure gerotor pump. The fuel is pumped to the fuel rail at a specified flow and pressure. Excess fuel returns to the fuel tank by a return pipe. The fuel pump delivers a constant flow of fuel to the engine even during low fuel conditions and aggressive vehicle maneuvers. The electric fuel pump operation is controlled by the Powertrain Control Module (PCM) through a fuel pump relay. The fuel pump flex pipe acts to dampen the fuel pulses and noise generated by the fuel pump. The fuel pump is serviced as part of the Modular Fuel Sender.

### Fuel Pressure Regulator Assembly

The fuel pressure regulator attaches to the fuel rail on the fuel return side. The fuel pressure is a diaphragm operated relief valve and is referenced to manifold vacuum. If the fuel pressure is too low, poor performance could result. If the pressure is to high, excessive odor and a Diagnostic Trouble Code (DTC) may result.

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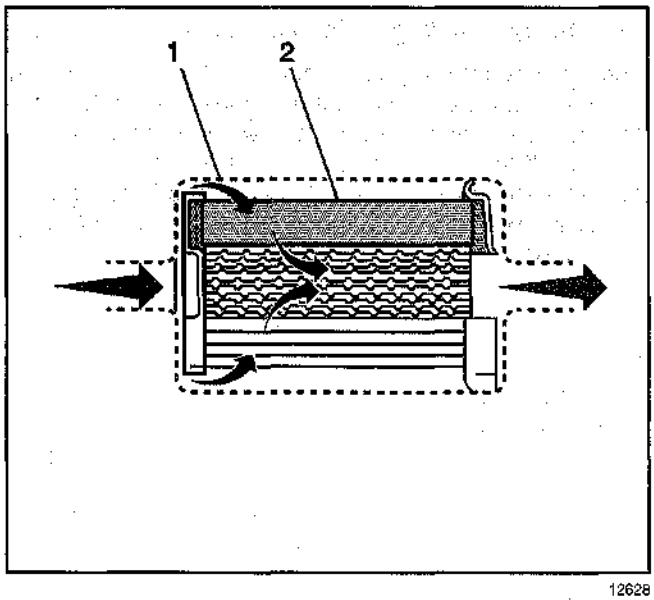
### Fuel Pump Strainer



50673

The fuel pump strainer attaches to the lower end of the modular fuel sender assembly. The fuel pump strainer is made of woven plastic. The functions of the fuel pump strainer is to filter contaminants and to wick fuel. The life of the fuel pump strainer is generally considered to be that of the fuel pump, is self-cleaning and normally requires no maintenance. Fuel stoppage at this point indicates that the fuel tank contains an abnormal amount of sediment or water, in which case the tank should be thoroughly cleaned and replace the plugged fuel pump strainer with a new one.

### In-Pipe Fuel Filter



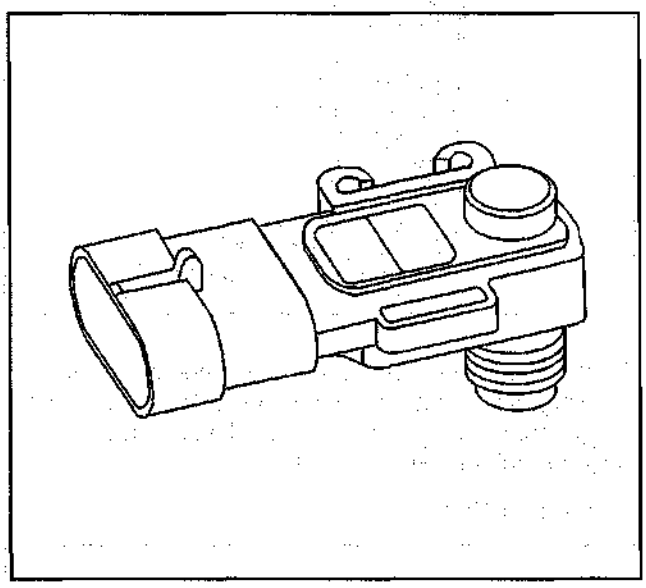

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The fuel feed pipe has a steel fuel filter installed ahead of the fuel injection system. The paper filter element (2) traps particles in the fuel that may damage the injection system. The filter housing (1) is made to withstand maximum fuel system pressure, exposure to fuel additives, and changes in temperature. The fuel filter has a quick-connect inlet fitting and a threaded outlet fitting. The threaded fitting is sealed with an O-ring. There is no service interval for fuel filter replacement. Replace a restricted fuel filter.

### Fuel Feed and Fuel Return Pipes

The fuel feed and fuel return pipes carry fuel from the modular fuel sender assembly to the fuel injection system and back to the modular fuel sender assembly.

### Fuel Tank Vapor Pressure Sensor



18839

The fuel tank pressure sensor is used to detect small leaks in the evaporative emission system. The fuel tank pressure sensor is a three wire strain gauge sensor much like that of the common GM MAP sensor. However, this sensor has very different electrical characteristics due to its pressure differential design. The sensor measures the difference between the air pressure (or vacuum) in the fuel tank and the outside air pressure. The sensor mounts at the top of the fuel tank. A three wire electrical harness connects it to the Powertrain Control Module (PCM). The PCM supplies a five volt reference voltage and ground to the sensor. The sensor will return a voltage between 0.1 and 4.9 volts. When the air pressure in the fuel tank is equal to the outside air pressure, such as when the fuel fill cap is removed, the output voltage of the sensor will be 1.3 to 1.7 volts.

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### Fuel Feed and Return Pipes

The fuel feed pipe carries fuel from the fuel tank to the fuel rail assembly. The fuel return pipe carries fuel from the fuel rail assembly back to the fuel tank. The fuel feed and return pipes consist of three sections:

- The rear fuel pipe assemblies are located from the top of the fuel tank to the chassis fuel pipes. The rear fuel pipes are constructed of nylon.
- The chassis fuel pipes are located under the vehicle and connect the rear fuel pipes to the engine compartment connecting fuel pipes. These pipes are constructed of steel.
- The engine compartment connecting fuel pipes connect the chassis pipes to the engine fuel rail. These fuel pipes are constructed of nylon.

### Nylon Fuel Pipes

***Caution: In order to Reduce the Risk of Fire and Personal Injury:***

- ***If nylon fuel pipes are nicked, scratched or damaged during installation, Do Not attempt to repair the sections of the nylon fuel pipes. Replace them.***
- ***When installing new fuel pipes, Do Not hammer directly on the fuel harness body clips as it may damage the nylon pipes resulting in a possible fuel leak.***
- ***Always cover nylon vapor pipes with a wet towel before using a torch near them. Also, never expose the vehicle to temperatures higher than 115°C (239°F) for more than one hour, or more than 90°C (194°F) for any extended period.***
- ***Before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends. This will ensure proper reconnection and prevent a possible fuel leak. (During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.)***

Nylon fuel pipes are designed to perform the same job as the steel or flexible fuel pipes or hoses that they replace. Nylon pipes are constructed to withstand maximum fuel system pressure, exposure to fuel additives, and changes in temperature. There are three sizes of nylon fuel pipes used: 3/8 in ID for the fuel feed, 5/16 in ID for the fuel return, and 1/2 in ID for the vent.

The fuel feed and return pipes are assembled as a harness. Retaining clips hold the pipes together and provide a means for attaching the pipes to the vehicle. Heat resistant rubber hose and/or corrugated plastic conduit protect the sections of the pipes that are exposed to chafing, high temperature or vibration.

Nylon fuel pipes are somewhat flexible and can be formed around gradual turns under the vehicle. However, if nylon fuel pipes are forced into sharp bends, the pipes will kink and restrict the fuel flow. Also, once exposed to fuel, nylon pipes may become stiffer and are more likely to kink if bent too far. Take special care when working on a vehicle with nylon fuel pipes.

### Quick-Connect Fittings

Quick-connect fittings provide a simplified means of installing and connecting fuel system components. The fittings consist of a unique female connector and a compatible male pipe end. O-rings, located inside the female connector, provide the fuel seal. Integral locking tabs or fingers hold the fittings together.

### Fuel Pipe O-Rings

An O-ring seals the threaded connection at the fuel filter. Fuel system O-ring seals are made of special material. Service the O-ring seals with the correct service part.

## Fuel Metering Modes of Operation

### Purpose

The basic function of the air/fuel metering system is to control air/fuel delivery to the engine. The best air/fuel mixture to minimize exhaust emissions is 14.7 to 1, which allows the catalytic converter to operate most efficiently. Fuel is delivered to the engine by individual fuel injectors mounted in the intake manifold near each intake valve.

The main control sensor is the Heated Oxygen Sensor (HO2S), located in the exhaust manifold. The HO2S tells the Powertrain Control Module (PCM) how much oxygen is in the exhaust gas and the PCM changes the air/fuel ratio to the engine by controlling the fuel injector on time. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a Closed Loop system.

### Modes of Operation

The PCM monitors voltages from several sensors to determine the engine's fuel needs. Fuel is delivered under one of several conditions called modes. All modes are controlled by the PCM and are described below.

### Starting Mode

When the ignition is first turned ON the PCM energizes the fuel pump relay for two seconds, allowing the fuel pump to build up pressure. The PCM then checks the Engine Coolant Temperature (ECT) sensor and the Throttle Position (TP) sensor. During cranking, the PCM checks the crankshaft position signal in order to determine the proper air/fuel ratio for starting.

The PCM controls the amount of fuel delivered in the starting mode by changing how long the fuel injectors are energized. This is done by pulsing the fuel injectors for very short times.

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### Run Mode

The run mode has two conditions called Open Loop and Closed Loop.

When the engine is first started and engine speed is above 725 RPM, the system is in Open Loop operation. In Open Loop the PCM ignores the signal from the Heated Oxygen Sensor (HO2S), and calculates the air/fuel ratio based on inputs from the TP, ECT, and MAF sensors.

The system remains in Open Loop until the following conditions are met:

- The HO2S has a varying voltage output showing that it is hot enough to operate properly (this depends on temperature).
- The ECT has reached a specified temperature.
- A specific amount of time has elapsed since starting the engine.

The specific values for the above conditions vary with different engines. When these conditions are met, the system enters Closed Loop operation. In Closed Loop the PCM changes fuel injector on-time based on the signal from the HO2S. This allows the air/fuel ratio to stay very close to 14.7:1.

### Acceleration Mode

The PCM provides extra fuel when it detects a rapid increase in throttle position and air flow.

### Deceleration Mode

The PCM reduces the amount of fuel injected when it detects a decrease in throttle position and air flow. When deceleration is very fast, the PCM may cut off fuel completely for short periods.

### Battery Voltage Corrction Mode

When battery voltage is low, the PCM will compensate for the weak spark in the following ways:

- Increasing the amount of fuel delivered.
- Increasing the idle RPM.
- Increasing ignition dwell time.

### Fuel Cut Off Mode

The PCM has the ability to shut OFF the fuel injectors completely or selectively when certain conditions are met. This fuel shut off mode allows the powertrain to protect itself from damage and also improve its driveability.

The PCM will disable the injectors under the following conditions.

- Ignition OFF (prevents engine run-on).
- Ignition ON but no ignition reference signal (prevents flooding or backfiring).
- High engine speed (above red line).
- High vehicle speed (above rated tire speed).
- Extended high speed closed throttle coastdown (reduce emissions and increases engine braking).

**Fuel RPM cut off ranges:**

**Important:** These RPM cut off ranges may vary according to PCM calibration, axle ratio, tire size, and tire rating.

- Park and Neutral – 4000 RPM
- Reverse – 4000 RPM
- Drive – 5950 RPM

### Catalytic Converter Protection Mode

The PCM constantly monitors engine operation and estimates conditions that could result in high catalytic converter temperatures. If the PCM determines the catalytic converter may overheat, it causes the system to return to Open Loop operation and enriches the fuel mixture.

## Fuel Metering System Component Description

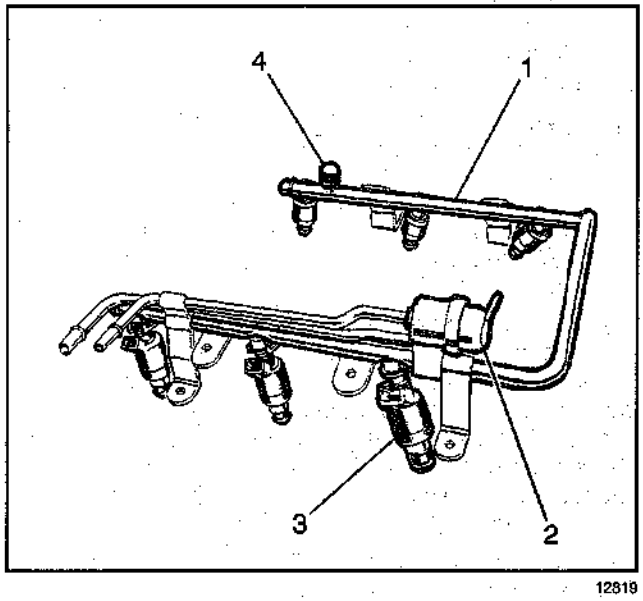
### Basic System Operation

The fuel metering system starts with the fuel in the fuel tank. An electric fuel pump, located in the fuel tank with the gauge sending unit, pumps fuel to the fuel rail through an in-pipe fuel filter. The fuel pump is designed to provide fuel at a pressure above the pressure needed by the fuel injectors. A fuel pressure regulator in the fuel rail keeps fuel available to the fuel injectors at a constant pressure. Unused fuel is returned to the fuel tank by a separate pipe. For further information on the fuel tank, in-pipe filter, and fuel pipes, refer to *Fuel Supply Component Description.*

### Throttle Body Unit

The throttle body has a throttle plate to control the amount of air delivered to the engine. The MAF sensor is mounted on the throttle body.

### Fuel Rail

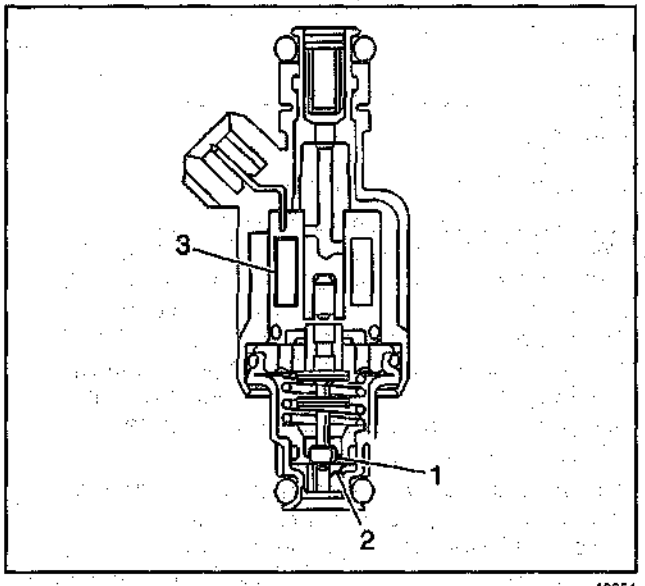



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The fuel rail (1) is mounted to the top of the engine and distributes fuel to the individual fuel injectors (3). Fuel is delivered to the fuel inlet tube of the fuel rail by the fuel pipes. The fuel then goes through the fuel rail to the fuel pressure regulator (2). The fuel pressure regulator maintains a constant fuel pressure at the fuel injectors. Remaining fuel is then returned to the fuel tank. Fuel pressure can be observed using a fuel pressure gauge at the fuel pressure gauge connection (4).

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### Fuel Injector



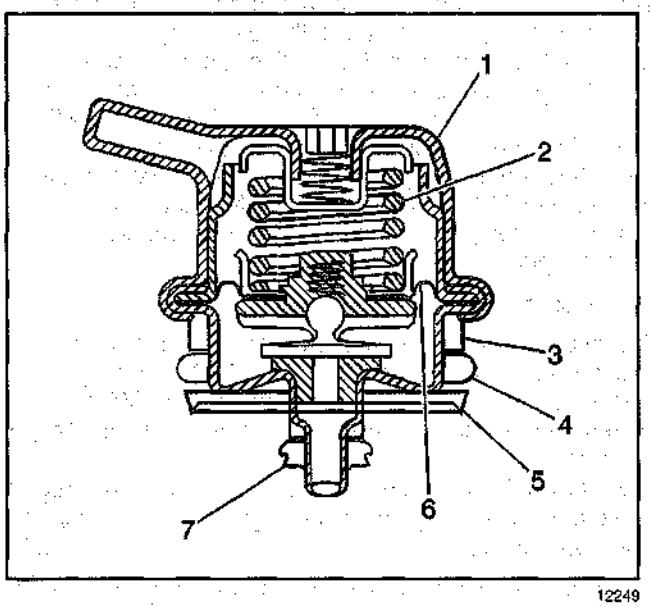

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The Sequential Multiport Fuel Injection (SFI) fuel injector is a solenoid operated device controlled by the PCM. The PCM energizes the solenoid which opens a valve to allow fuel delivery.

The fuel is injected under pressure in a conical spray pattern at the opening of the intake valve. Excess fuel not used by the injectors passes through the fuel pressure regulator before being returned to the fuel tank.

A fuel injector which is stuck partly open will cause a loss of fuel pressure after engine shut down, causing long crank times to be noticed on some engines.

### Fuel Pressure Regulator




12249

The cartridge type fuel pressure regulator (1) is a diaphragm-operated relief valve (6) with fuel pump pressure on one side, and regulator spring (2) pressure, and intake manifold vacuum on the other side. The regulator's function is to maintain a constant fuel pressure across the injectors at all times. The pressure regulator compensates for engine load by increasing fuel pressure as engine vacuum drops.

The cartridge regulator is serviced as a separate component. When servicing the fuel pressure regulator, insure that the O-ring backup (3), large O-ring (4), filter screen (5), and small O-ring (7) are properly placed on the pressure regulator.

If the fuel pressure is too low, poor performance and a DTC P0171, could result. If the pressure is too high, excessive odor and a DTC P0172, may result. Refer to *Fuel System Pressure Test* for information on diagnosing fuel pressure conditions.

### (3X) Reference PCM Input (CKT 430)

From the electronic ignition module, the PCM uses this signal to calculate engine speed and crankshaft position. The PCM compares pulses on this circuit to reference low CKT 453. The PCM also uses the pulses on this circuit to initiate fuel injector pulses. If the PCM receives no pulses on this circuit, no fuel injection pulses will occur and the engine will not run.

### CAM Signal (CKT 630)

The PCM uses this signal to determine the position of the #1 piston during its power stroke, allowing the PCM to calculate true Sequential Multiport Fuel Injection (SFI). A loss of this signal will set a DTC P0341. If the CAM signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection based on the last fuel injection pulse and the engine will continue to run. The engine can be restarted and will run in the calculated sequential mode as long as the fault is present with a 1 in 6 chance of being correct. Refer to *DTC P0341 Camshaft Position (CMP) Sensor Performance.*

### Fuel Pump Electrical Circuit

When the key is first turned ON the PCM energizes the fuel pump relay for two seconds to build up the fuel pressure quickly. If the engine is not started within two seconds, the PCM shuts the fuel pump OFF and waits until the engine is cranked. When the engine is cranked and the RPM signal has been detected by the PCM, the PCM supplies 12 volts to the fuel pump relay in order to energize the electric in-tank fuel pump.

An inoperative fuel pump relay can result in a no start condition.

An inoperative fuel pump would cause a no start condition. A fuel pump which does not provide enough pressure can result in poor performance.

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## Short Term Fuel Trim Description

The short term fuel trim is a PCM erasable memory register. The neutral value for the short term fuel trim is 0%. Any deviation from 0% indicates the short term fuel trim is changing the injector pulse width. The amount of pulse width change depends on how far the short term fuel trim value is from 0%. The short term fuel trim is rich when the scan tool indicates – 99%. The short fuel trim is lean when the scan tool indicates 99%. The short term fuel trim changes the pulse width by varying the Closed Loop factor of the base pulse width equation. As the PCM monitors the oxygen sensors input, it is constantly varying the short term fuel trim value. The value is updated very quickly, therefore, the short term fuel trim only corrects for short term mixture trends. The correction of long term mixture trends is the function of long term fuel trim.

When the PCM determines that the Short Term Fuel Trim is out of the operating range, the following DTCs will set:

- DTC P0171 Bank 1 Lean.
- DTC P0172 Bank 1 Rich.
- DTC P0174 Bank 2 Lean.
- DTC P0175 Bank 2 Rich.

## Long Term Fuel Trim Description

The long term fuel trim is a matrix of cells arranged by RPM and MAP. Each cell of the long term fuel trim is a register like the short term fuel trim. As the engine operating conditions change, the PCM will switch from cell to cell to determine what long term fuel trim factor to use in the base pulse width equation.

While in any given cell, the PCM also monitors the short term fuel trim. If the short term fuel trim is far enough from 0%, the PCM will change the long term fuel trim value. Once the long term fuel trim value is changed, it should force the short term fuel trim back toward 0%. If the mixture is still not correct (as judged by the HO2S), the short term fuel trim will continue to have a large deviation from the ideal 0%. In this case, the long term fuel trim value will continue to change until the short term fuel trim becomes balanced. Both the short term fuel trim and long term fuel trim have limits which vary by calibration. If the mixture is off enough so that long term fuel trim reaches the limit of its control and still cannot correct the condition, the short term fuel trim would also go to its limit of control in the same direction. If the mixture is still not corrected by both short term fuel trim and long term fuel trim at their extreme values, a Fuel Trim Diagnostic Trouble Code (DTC) will likely result. When the PCM determines that the Long Term Fuel Trim is out of the operating range, the following DTCs will set:

- DTC P0171 Bank 1 Lean.
- DTC P0172 Bank 1 Rich.
- DTC P0174 Bank 2 Lean.
- DTC P0175 Bank 2 Rich.

Under the conditions of power enrichment, the PCM sets the short term fuel trim to 0% and freezes it there until power enrichment is no longer in effect. This is done so the Closed Loop factor and the long term fuel trim will not try to correct for the commanded richness of power enrichment.

## EVAP Control System Operation Description

### Enhanced EVAP System Operation

The basic Evaporative Emission (EVAP) Control system used on all vehicles is the charcoal canister storage method. This method transfers fuel vapor from the fuel tank to an activated carbon (charcoal) storage device (canister) to hold the vapors when the vehicle is not operating. When the engine is running, the fuel vapor is purged from the carbon element by intake air flow and consumed in the normal combustion process.

The EVAP purge valve allows manifold vacuum to purge the canister. The Powertrain Control Module (PCM) supplies a ground to energize the EVAP purge valve (purge ON ). The EVAP purge valve control is Pulse Width Modulated (PWM) or turned ON and OFF several times a second. The PCM controlled PWM output is commanded when the appropriate conditions have been met:

- Engine coolant temperature above 50°C (77°F).
- After the engine has been running about 3 minutes on a cold start or 30 seconds on a warm start.
- The vehicle is operating in closed loop fuel control.

Canister purge PWM duty cycle varies according to operating conditions determined by mass air flow, fuel trim, and intake air temperature. Canister purge will be disabled if TP angle increases to above 55%. Canister purge will be re-enabled when TP angle decreases below 53%.

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The fuel level sensor input to the PCM is used to determine if the fuel level in the tank is correct to run the EVAP diagnostic tests. To ensure sufficient volume in the tank to begin the various diagnostic tests, the fuel level must be between 15% and 85%. The PCM monitors system vacuum level via the fuel tank pressure sensor input.

### Diagnosis

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. Before the EVAP system diagnostic tests are run the following conditions must be present:

- No VSS, TP, HO2S, Misfire, IAT, MAP, Fuel Trim, Injector circuit, EGR Pintle Position, ECT, or MAF sensor DTCs set.
- Engine coolant temperature is between 4°C and 30°C (40°F and 86°F).
- Intake air temperature is between 4°C and 30°C (40°F and 86°F).
- Fuel tank level is between 15% and 85%.
- BARO is above 75 kPa.

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The EVAP system diagnostic tests will be run following a cold start, as indicated by the ECT and IAT sensors. The fuel level sensor input to the PCM is used to determine if the fuel level in the tank is appropriate to run the EVAP diagnostic tests. To ensure sufficient volume in the tank to begin the various diagnostic tests, the fuel level must be between 15% and 85%. The PCM monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP purge valve and the EVAP canister vent valve are turned ON, allowing engine vacuum to draw a slight vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP purge valve is turned OFF, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period. A small leak in the system will cause DTC P0442 to be set. If the desired vacuum level cannot be achieved in the test described above, a large leak or a malfunctioning EVAP purge valve is indicated. This can be caused by the following conditions:

- Disconnected or malfunctioning fuel tank pressure sensor.
- Missing, incorrect, or malfunctioning fuel cap.
- Disconnected, damaged, pinched, or blocked EVAP purge line.
- Disconnected or damaged EVAP vent hose.
- Disconnected, damaged, pinched, or blocked fuel tank vapor line.
- Disconnected or malfunctioning EVAP canister vent valve.
- Disconnected or malfunctioning EVAP canister vent valve.
- Open ignition feed circuit to the EVAP canister vent or EVAP purge valve.
- Damaged EVAP canister.

Any of the above conditions can set DTC P0440.

A restricted or blocked EVAP canister vent path is detected by drawing vacuum into the EVAP system, turning OFF the EVAP canister vent valve and the EVAP purge valve (EVAP canister vent valve Open, EVAP canister purge 0% ) and monitoring the fuel tank pressure sensor input. With the EVAP canister vent valve open, any vacuum in the system should decrease quickly unless the vent path is blocked. A blockage can be caused by the following conditions:

- Malfunctioning EVAP canister vent valve (stuck closed).
- Plugged, kinked, or pinched vent hose.
- Shorted EVAP canister vent valve control circuit.
- Plugged evaporative canister.

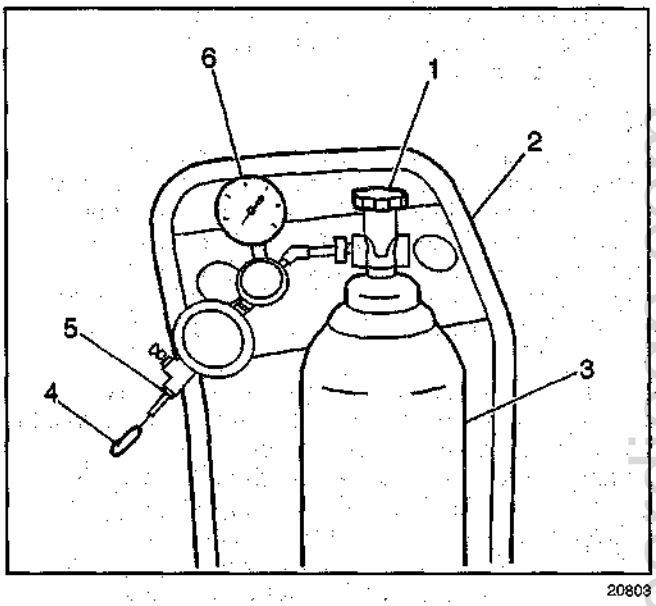
If any of the above conditions are present, DTC P0446 will set.

The system checks for conditions that cause the EVAP system to purge continuously by commanding the EVAP canister vent valve ON and the EVAP purge valve OFF (EVAP canister vent valve Closed, EVAP canister purge 0%). If fuel tank vacuum level decreases during the test, a continuous purge flow condition is indicated. This can be caused by the following conditions:

- EVAP purge valve leaking.
- EVAP purge and engine vacuum source lines switched at the EVAP purge valve.
- EVAP purge valve control circuit grounded.

If any of these conditions are present, DTC P1441 will set. Refer to the DTC tables for further diagnostic procedures regarding the EVAP system.

### Evaporative Emissions System Purge/Pressure Diagnostic Station J 41413




**Legend**

(1) Main Valve
(2) Evaporative Emission System Purge/Presure Diagnostic Station J 41413
(3) Nitrogen Cylinder
(4) Black Connecting Hose
(5) Threaded Fitting
(6) Gauge Set

The EVAP system purge/pressure diagnostic station is used to clear carbon released into the EVAP system by the canister. Carbon released into the EVAP system may cause EVAP system components to be inoperative. If diagnosis indicates that an EVAP system component needs to be replaced, the system should be checked for released carbon. A released carbon condition must be corrected before replacing any EVAP system component. Procedures for checking the EVAP system for released carbon and for correcting a released carbon condition are in the Diagnostic Aids for the applicable DTC tables.

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## Electronic Ignition (EI) System Description

### Purpose

The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. Electronic ignition has the following advantages over a mechanical distributor system:

- No moving parts.
- Less maintenance.
- Remote mounting capability.
- No mechanical load on the engine.
- More coil cool down time between firing events.
- Elimination of mechanical timing adjustments.
- Increased available ignition coil saturation time. Increased available ignition coil saturation time.

### Operation

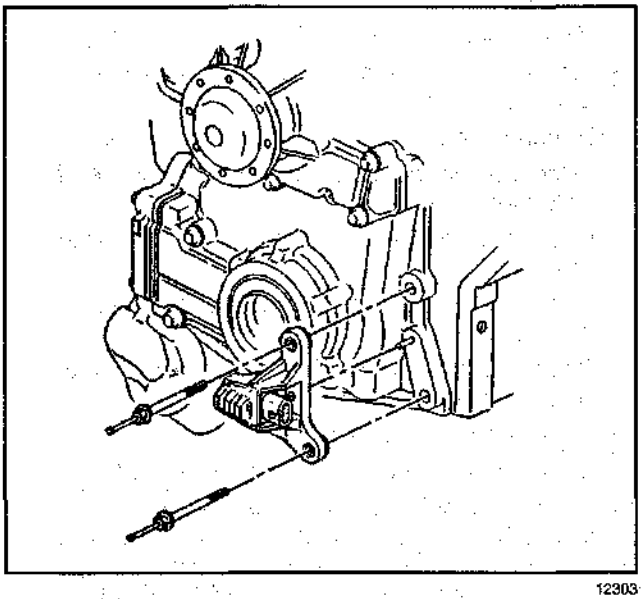
The electronic ignition system does not use the conventional distributor and coil. The ignition system consists of three ignition coils, an ignition control module, a dual Hall-effect crankshaft position sensor, an engine crankshaft balancer with interrupter rings attached to the rear, related connecting wires, and the Ignition Control (IC) and fuel metering portion of the PCM.

Conventional ignition coils have one end of the secondary winding connected to the engine ground. In this ignition system, neither end of the secondary winding is grounded. Instead, each end of a coil's secondary winding is attached to a spark plug. Each cylinder is paired with the cylinder that is opposite it (1/4, 2/5, 3/6). These two plugs are on companion cylinders, i.e., on top dead center at the same time. When the coil discharges, both plugs fire at the same time to complete the series circuit. The cylinder on compression is said to be the event cylinder and the one on exhaust is the waste cylinder. The cylinder on the exhaust stroke requires very little of the available energy to fire the spark plug. The remaining energy will be used as required by the cylinder on the compression stroke. The same process is repeated when the cylinders reverse roles. This method of ignition is called a waste spark ignition system.

Since the polarity of the ignition coil primary and secondary windings is fixed, one spark plug always fires with normal polarity and its companion plug fires with reverse polarity. This differs from a conventional ignition system that fires all the plugs with the same polarity. Because the ignition coil requires approximately 30% more voltage to fire a spark plug with reverse polarity, the ignition coil design is improved, with saturation time and primary current flow increased. This redesign of the system allows higher secondary voltage to be available from the ignition coils - more than 40 kilovolts (40,000 volts) at any engine RPM. The voltage required by each spark plug is determined by the polarity and the cylinder pressure. The cylinder on the compression stroke requires more voltage to fire the spark plug than the cylinder on the exhaust stroke.

It is possible for one spark plug to fire even though a plug wire from the same coil may be disconnected from its companion plug. The disconnected plug wire acts as one plate of a capacitor, with the engine being the other plate. These two capacitor plates are charged as a spark jumps across the gap of the connected spark plug. The plates are then discharged as the secondary energy is dissipated in an oscillating current across the gap of the spark plug that is still connected. Secondary voltage requirements are very high with an open spark plug or spark plug wire. The ignition coil has enough reserve energy to fire the plug that is still connected at idle, but the coil may not fire the spark plug under high engine load. A more noticeable misfire may be evident under load; both spark plugs may then be misfiring.

### System Components



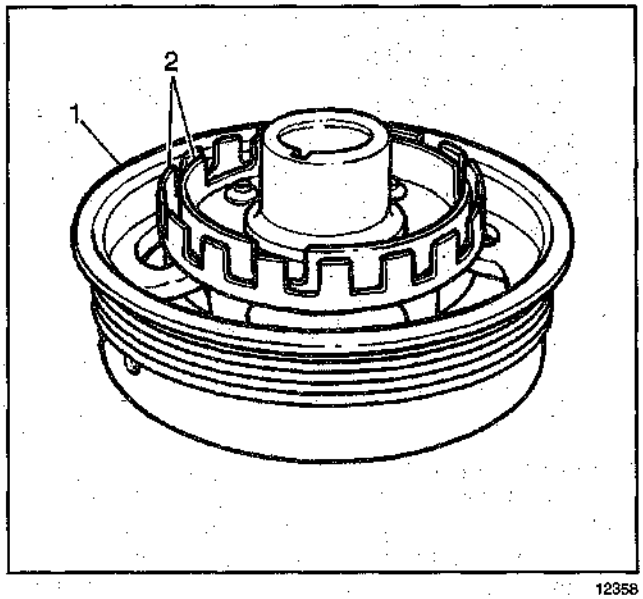
12303

#### Crankshaft Position Sensor and Crankshaft Balancer Interrupter Rings

The dual crankshaft position sensor is secured in an aluminum mounting bracket and bolted to the front left side of the engine timing chain cover, partially behind the crankshaft balancer. A 4-wire harness connector plugs into the sensor, connecting it to the ignition control module. The dual crankshaft position sensor contains two Hall-effect switches with one shared magnet mounted between them. The magnet and each Hall-effect switch are separated by an air gap. A Hall-effect switch reacts like a solid state switch, grounding a low current signal voltage when a magnetic field is present. When the magnetic field is shielded from the switch by a piece of steel placed in the air gap between the magnet and the switch, the signal voltage is not grounded.

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If the piece of steel (called an interrupter) is repeatedly moved in and out of the air gap, the signal voltage will appear to go ON - OFF - ON - OFF - ON - OFF. In the case of the electronic ignition system, the piece of steel is two concentric interrupter rings mounted to the rear of the crankshaft balancer.

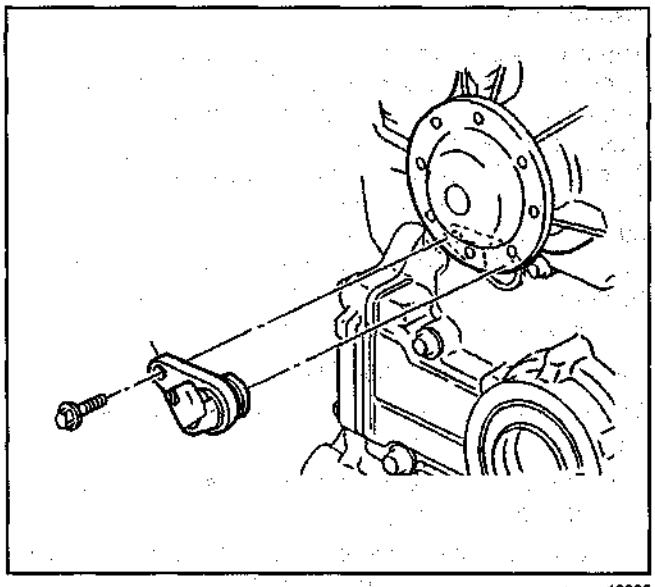



12358

**Legend**

(1) Crankshaft Balancer
(2) Interrupter Rings

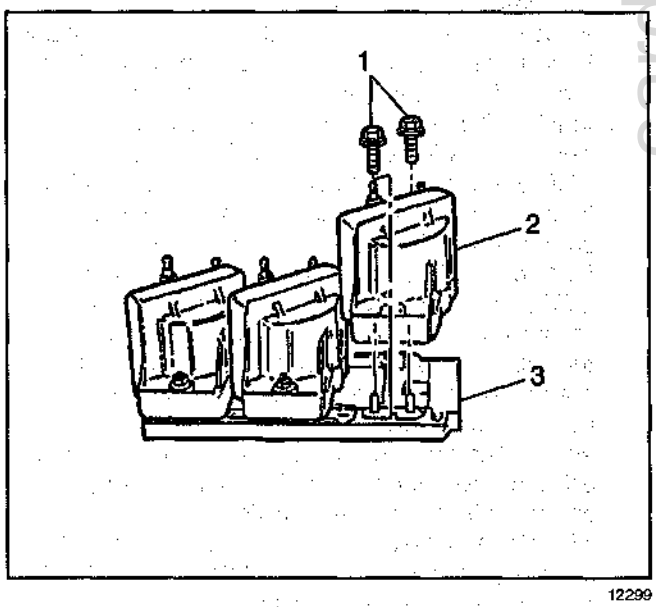
Each interrupter ring has blades and windows that either block the magnetic field or allow it to close one of the Hall effect switches. The outer Hall effect switch produces a signal called the CKP 18X because the outer interrupter ring has 18 evenly spaced blades and windows. The CKP 18X portion of the crankshaft position sensor produces 18 ON - OFF pulses per crankshaft revolution. The Hall-effect switch closest to the crankshaft, the CKP Sync portion of the sensor, produces a signal that approximates the inside interrupter ring. The inside interrupter ring has 3 unevenly spaced blades and windows of different widths. The CKP Sync portion of the crankshaft position sensor produces 3 different length ON - OFF pulses per crankshaft revolution. When a CKP Sync interrupter ring window is between the magnet and inner switch, the magnetic field will cause the CKP Sync Hall effect switch to ground the CKP Sync signal voltage supplied from the ignition control module. The CKP 18X interrupter ring and Hall-effect switch react similarly. The ignition control module interprets the CKP 18X and CKP Sync ON - OFF signals as an indication of crankshaft position, and the ignition control module must have both signals to fire the correct ignition coil. The ignition control module determines crankshaft position for correct ignition coil sequencing by counting how many CKP 18X signal transitions occur, i.e.; ON - OFF or OFF - ON, during a CKP Sync pulse.



12305

**Camshaft Position (CMP) Sensor**

The camshaft position sensor is located on the timing cover behind the water pump near the camshaft sprocket. As the camshaft sprocket turns, a magnet in it activates the Hall effect switch in the camshaft position sensor. When the Hall-effect switch is activated, it grounds the signal line to the ICM, pulling the camshaft position sensor signal circuit's applied voltage low. This is interpreted as a CMP Sensor signal. The CMP Sensor signal is created as piston #1 is approximately 25 degrees after top dead center on the power stroke.




12299

**Legend**

(1) Screws
(2) Ignition Coil
(3) Ignition Control Module

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### Ignition Coils

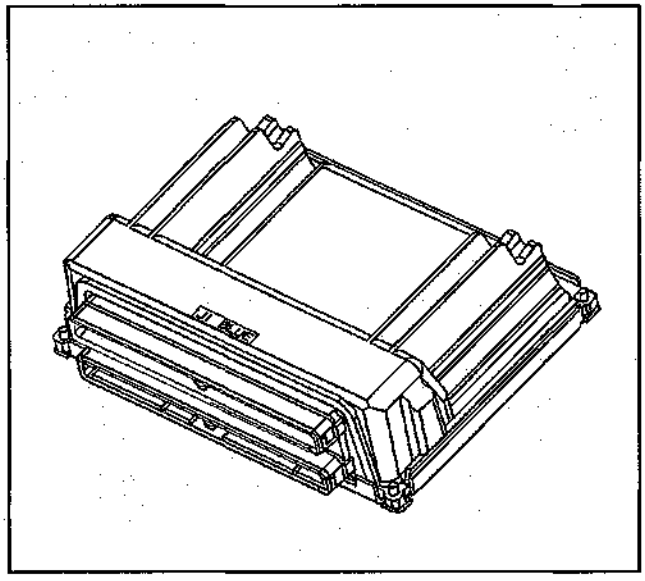
Three twin-tower ignition coils are individually mounted to the ignition control module. Each coil provides spark for two plugs simultaneously (waste spark distribution). Each coil is serviced separately. Two terminals connect each coil pack to the module. Each coil is provided a fused ignition feed. The other terminal at each coil is individually connected to the module, which will energize one coil at a time by completing and interrupting the primary circuit ground path to each coil at the proper time.

### Ignition Control Module (ICM)

The ignition control module performs the following functions:

- It powers the dual crankshaft position sensor internal circuits.
- It supplies the voltage signals that each respective Hall effect switch pulses to ground to generate the CKP Sync and CKP 18X signal pulses.
- It determines the correct ignition coil firing sequence, based on how many CKP 18X signal transitions occur during a CKP Sync pulse. This coil sequencing occurs at start-up. After the engine is running, the module remembers the sequence, and continues triggering the ignition coils in proper sequence.
- It determines whether or not the crankshaft is rotating in the proper direction, and cuts off fuel delivery and spark to prevent backfiring if reverse rotation is detected.
- It sends the 3X reference and 18X reference signals to the PCM. The PCM determines engine RPM from these signal. These signals used by the PCM to determine crankshaft speed for Ignition Control (IC) spark advance calculations. The falling edge of each 3X reference and 18X reference signal pulse occurs at a specific time in relation to top dead center of any cylinder stroke. The 3X reference signal sent to the PCM by the ignition control module is an ON - OFF pulse occurring 3 times per crankshaft revolution. This is neither the CKP Sync pulse nor the 18X crankshaft position sensor pulse, but both of these are required before the ignition control module will generate the 3X reference signal. The ignition control module generates the 3X reference signal by an internal divide-by-6 circuit. This divider circuit divides the CKP 18X signal pulses by 6. The divider circuit is enabled, or ready to begin dividing, only after it receives a crankshaft position sensor CKP Sync pulse. After beginning, the divider circuit does not need the Sync pulses to continue operating. If either the CKP 18X or CKP Sync pulses are missing at start-up, the ignition control module will not generate 3X reference or 18X reference signal pulses and no fuel injector pulses will occur.

### Powertrain Control Module (PCM)



159242

The PCM is responsible for maintaining proper spark and fuel injection timing for all driving conditions. Ignition Control (IC) spark timing is the PCM method of controlling spark advance and ignition dwell. To provide optimum driveability and emissions, the PCM monitors input signals from the following components in calculating Ignition Control (IC) spark timing:

- Ignition Control module (ICM).
- Engine Coolant Temperature (ECT) sensor.
- Intake Air Temperature (IAT) sensor.
- Mass Air Flow (MAF) sensor.
- Trans Range or PNP inputs from Trans Range switch or Park/Neutral Position switch.
- Throttle Position (TP) sensors.
- Vehicle Speed Sensor (VSS) / Trans Output Speed Sensor (TOSS).

The ignition system uses many of the same ignition module-to-PCM circuits as did previous Delco engine management systems using distributor type ignition. The following describes the PCM to ignition control module circuits:

- 3X reference PCM input

  From the ignition control module, the PCM uses this signal to calculate engine RPM and crankshaft position. The PCM compares pulses on this circuit to any that are on the Reference Low circuit, ignoring any pulses that appear on both. The PCM also uses the pulses on this circuit to initiate injector pulses.
- 18X reference PCM input - The 18X reference signal is used to accurately control spark timing at low RPM and allow IC operation during crank. Below 1200 RPM, the PCM is monitoring the 18X reference signal and using it as the reference for ignition timing advance. When engine speed exceeds 1200 RPM, the PCM begins using the, 3X reference signal to control spark timing.

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- Camshaft Position PCM input

  The PCM uses this signal to determine the position of the cylinder #1 piston during its power stroke. This signal is used by the PCM to calculate true Sequential Fuel Injection (SFI) mode of operation. The PCM compares the number of CAM pulses to the number of 18X and 3X reference pulses. If the number of 18X and 3X reference pulses occurring between CAM pulses is incorrect, or if no CAM pulses are received while the engine is running, the PCM will set DTC P0341. If the cam signal is lost while the engine is running the fuel injection system will shift to a calculated sequential fuel injection mode based on the last cam pulse, and the engine will continue to run. The engine can be re-started and will run in the calculated sequential mode as long as the condition is present with a 1 in 6 chance of being correct.

- Reference low PCM input

  This is a ground circuit for the digital RPM counter inside the PCM, but the wire is connected to engine ground only through the ignition control module. Although this circuit is electrically connected to the PCM, it is not connected to ground at the PCM. The PCM compares voltage pulses on the 3X or 18X reference input to those on this circuit, ignoring pulses that appear on both.

- Bypass signal PCM output

  The ignition control module maintains a fixed spark timing while the engine is cranking (Bypass Mode). Once the PCM receives 3X reference pulses, the PCM commands the ignition module to allow the PCM to control the spark advance (IC Mode). The ignition control module determines correct operating mode based on the voltage level that the PCM sends to the ignition control module on the bypass circuit. The PCM provides 5 volts on the bypass circuit if the PCM is going to control spark timing (IC Mode).

- Ignition Control (IC) PCM output

  The IC output circuitry of the PCM sends out timing pulses to the ignition control module. When in the Bypass Mode, the ignition control module grounds these pulses. When in the IC Mode, the ignition control module uses the timing pulses for coil dwell and spark timing. Proper sequencing of the 3 ignition coils, i.e.; which coil to fire, is always the job of the ignition control module.

### Modes of Operation

The ignition system uses the same four ignition module–to–PCM circuits as did previous Delco engine management systems using distributor–type ignition. Ignition Control (IC) spark timing is the PCM's method of controlling spark advance and ignition dwell when the ignition system is operating in the IC Mode. There are two modes of ignition system operation:

- Bypass Mode.
- IC Mode.

In Bypass Mode, the ignition system operates independently of the PCM, at a fixed spark timing. The PCM switches to IC Mode (PCM controlled spark advance) as soon as the engine begins cranking. After the switch is made to IC Mode, it will stay in effect until one of the following conditions occur:

- The engine is turned off.
- The engine quits running.

The IC output circuitry in the PCM generates IC output pulses anytime crankshaft reference signal input pulses are being received. When the ignition system is operating in the Bypass Mode (no voltage on the bypass control circuit), the ignition control module grounds the IC pulses coming from the PCM. The ignition control module will remove the ground from the IC circuit only after switching to the IC Mode. The PCM commands switching to IC Mode by applying 5 volts on the bypass circuit to the ignition control module. The PCM monitors the IC and Bypass circuits for electrical malfunctions affecting proper ignition system operation. If a malfunction occurs, diagnosis is included in DTC P1351, P1352, P1361 and P1362 diagnostic tables. If diagnostic trouble codes are encountered, go to the DTC tables for diagnosis.

In the IC Mode, the ignition spark timing and ignition dwell time is fully controlled by the PCM. IC spark advance and ignition dwell is calculated by the PCM using the following inputs:

- Engine speed (18X reference or 3X reference).
- Crankshaft position (18X reference or 3X reference and Camshaft position PCM input signal).
- Engine Coolant Temperature (ECT sensor).
- Throttle Position (TP sensors).
- Knock Signal (Knock sensor).
- Park/Neutral Position (PRNDL input).
- Vehicle Speed (Vehicle Speed Sensor).
- PCM and ignition system supply voltage.

The following describes the PCM to ignition control module circuits:

- 3X reference PCM input – From the ignition control module, the PCM uses this signal to calculate engine RPM and crankshaft position. The PCM compares pulses on this circuit to any that are on the Reference Low circuit, ignoring any pulses that appear on both. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, the PCM will use the 18X reference pulses to calculate RPM and crankshaft position. The engine will continue to run and start normally, but DTC P1374 will be set.

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- 18X reference PCM input – The 18X reference signal is used to accurately control spark timing at low RPM and allow IC operation during crank. Below 1200 RPM, the PCM is monitoring the 18X reference signal and using it as the reference for ignition timing advance. When engine speed exceeds 1200 RPM, the PCM begins using the, 3X reference signal to control spark timing. If the 18X reference signal is not received by the PCM while the engine is running, a DTC P0336 will be set and 3X reference will be used to control spark advance under 1200 RPM, and Bypass Mode will be in effect at under 400 RPM. The engine will continue to run and start normally.
- Reference low PCM input – This is a ground circuit for the digital RPM counter inside the PCM, but the wire is connected to engine ground only through the ignition control module. Although this circuit is electrically connected to the PCM, it is not connected to ground at the PCM. The PCM compares voltage pulses on the 3X or 18X reference input to those on this circuit, ignoring pulses that appear on both. If the circuit is open, or connected to ground at the PCM, it may cause poor engine performance and possibly a MIL (Service Engine Soon) with no DTC.
- Bypass signal PCM output – The ignition control module maintains a fixed spark timing while the engine cranking (Bypass mode). Once the PCM receives 3X reference pulses, the PCM commands the ignition module to allow the PCM to control the spark advance (IC Mode). The ignition control module determines correct operating mode based on the voltage level that the PCM sends to the ignition control module on the bypass circuit. The PCM provides 5 volts on the bypass circuit if the PCM is going to control spark timing (IC Mode).
- Ignition Control (IC) PCM output – The IC output circuitry of the PCM sends out timing pulses to the ignition control module on this circuit. When in the Bypass Mode, the ignition control module grounds these pulses. When in the IC Mode, these pulses are sent to the ignition control module to control coil dwell and spark timing. Proper sequencing of the 3 ignition coils, i.e., which coil to fire, is always the job of the ignition control module.
- Knock Sensor (KS) PCM input – The PCM contains integrated knock sensor (KS) diagnostic circuitry. The KS system is comprised of A knock sensor, PCM, and related wiring. The PCM monitors the knock sensor signal to detect engine detonation (spark knock). When the spark knock occurs, the PCM retards the spark timing (IC) to reduce detonation. Retarded timing can also be a result of excessive valve lifter, pushrod or other mechanical engine or transaxle noise.
- Camshaft Position PCM input (CAM signal) – The PCM uses this signal to determine the position of the cylinder #1 piston during its intake stroke. This signal is used by the PCM to calculate true Sequential Fuel Injection (SFI) mode of operation. The PCM compares the number of CAM pulses to the number of 18X and 3X reference pulses. If the cam signal is lost while the engine is running the fuel injection system will shift to a calculated sequential fuel injection mode based on the last cam pulse, and the engine will continue to run. The engine can be re–started and will run in the calculated sequential mode as long as the fault is present with a 1 in 6 chance of being correct.

## Knock Sensor (KS) System Description

### Purpose

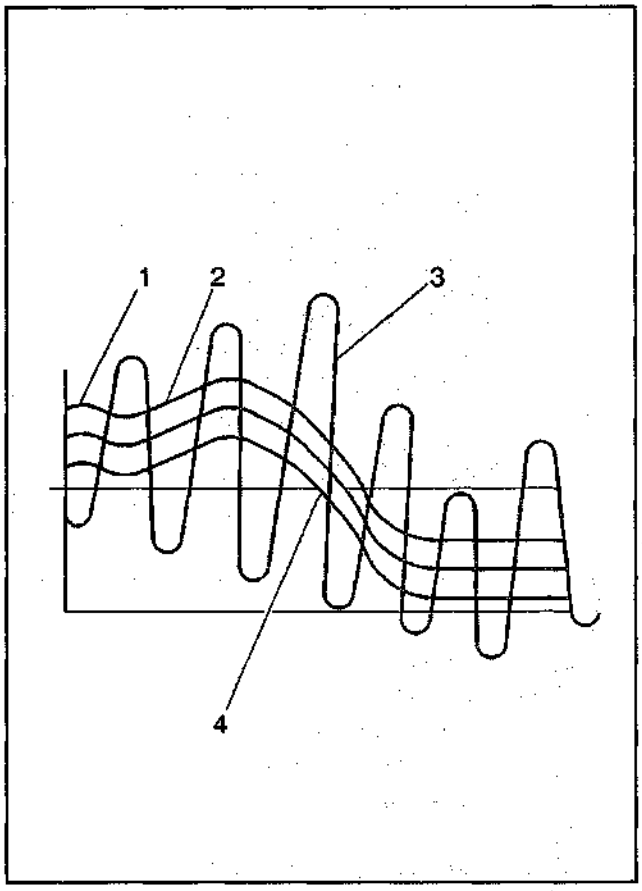
Varying octane levels in today's gasoline may cause detonation in some engines. Detonation is caused by an uncontrolled explosion (burn) in the combustion chamber. This uncontrolled explosion could produce a flame front opposite that of the normal flame front produced by the spark plug. The rattling sound normally associated with detonation is the result of two or more opposing pressures (flame fronts) colliding within the combustion chamber. Though light detonation is sometimes considered normal, heavy detonation could result in engine damage. To control spark knock, a Knock Sensor (KS) system is used. This system is designed to retard spark timing when spark knock is detected in the engine. The KS system allows the engine to use maximum spark advance for optimal driveability and fuel economy.

### Operation

The PCM contains integrated Knock Sensor (KS) Diagnostic Circuitry. Input signals from the knock sensors are used to detect engine detonation, allowing the PCM to retard Ignition Control (IC) spark timing based on the amplitude and frequency of the KS signal being received. The knock sensors produce an AC signal under all engine operating conditions. The PCM calculates an average voltage of each knock sensor's signal and takes instantaneous signal voltage readings. The PCM uses the instantaneous signal voltage readings to determine the state of the knock sensor circuitry. If the knock sensor system is operating normally, the PCM should monitor instantaneous KS signal voltage readings varying outside a voltage range above and below the calculated average voltage (as shown in the normal knock sensor figure). If the PCM detects a knock sensor signal voltage within the calculated average voltage range, DTC P0327 or P0332 will set (as shown in the abnormal knock sensor figure).

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**Normal Knock Sensor Signal**

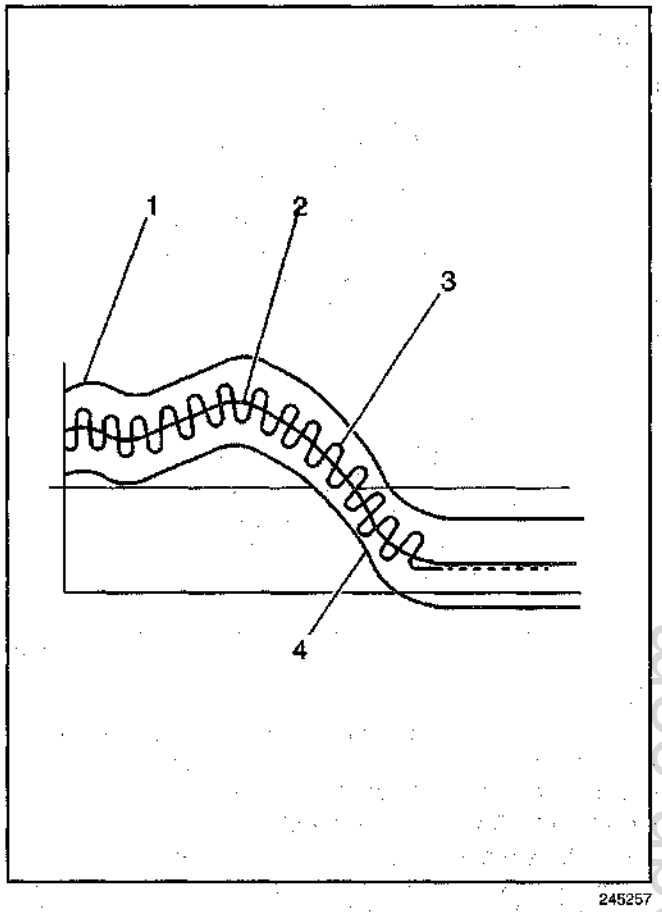



245253

**Legend**

(1) Upper Fail Region
(2) Knock Sensor Calculated Average
(3) Knock Sensor Signal (Normal)
(4) Lower Fail Region

**Abnormal Knock Sensor Signal**




245257

**Legend**

(1) Upper Fail Region
(2) Knock Sensor Calculated Average
(3) Knock Sensor Signal (Failed)
(4) Lower Fail Region

## Diagnosis

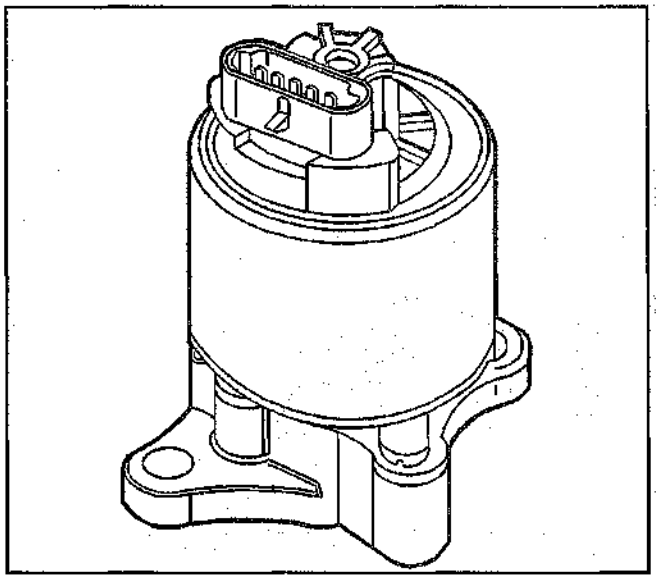
If the PCM malfunctions in a manner which will not allow proper diagnosis of the knock sensor system, DTC P0325 will set.

DTCs P0327 and P0332 are designed to diagnose the knock sensors, and related wiring. Problems encountered with the KS system should set a DTC. However, if the customer's complaint is detonation/ spark knock, use the tables for DTC P0327 or P0332 to diagnose the condition.

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## EGR System Description

### Linear EGR Valve



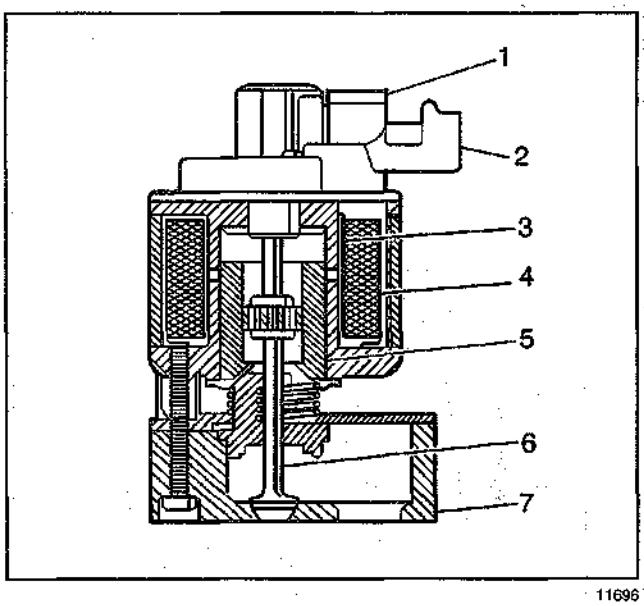
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### Purpose

The Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperature. It does this by decreasing combustion temperature.

The main element of the system is the linear EGR valve. The EGR valve feeds small amounts of exhaust gas back into the combustion chamber. With the fuel/air mixture diluted by the exhaust gases, combustion temperatures are reduced.

### Operation




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**Legend**

(1) Cap-Sensor
(2) Sensor-EGR Pintle Position
(3) Pole Piece-Primary
(4) Bobbin and Coil Assembly
(5) Steeve-Armature
(6) Valve-Pintle
(7) Armature and Base Assembly

The linear EGR valve is designed to accurately supply EGR to an engine independent of intake manifold vacuum. The valve controls EGR flow from the exhaust to the intake manifold through an orifice with a PCM controlled pintle. During operation, the PCM controls pintle position by monitoring the pintle position feedback signal. The feedback signal can be monitored with a scan tool as ACTUAL EGR POS. ACTUAL EGR POS should always be near the commanded EGR position (DESIRED EGR POS). The PCM uses information from the following sensors to control the pintle position:

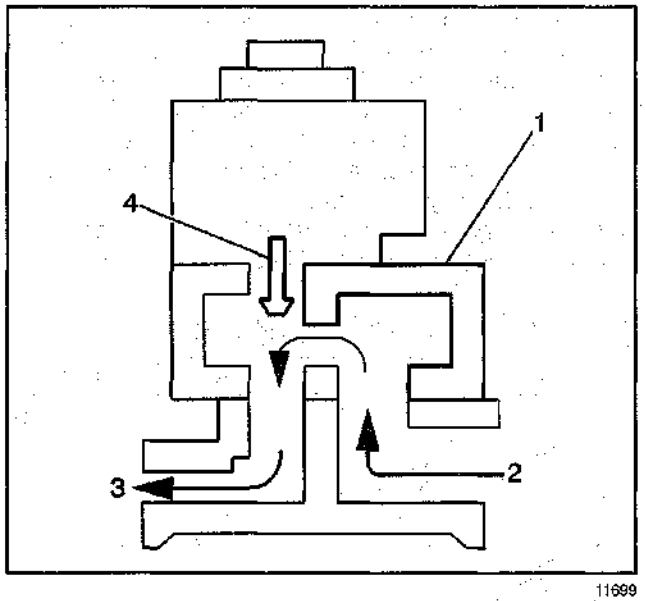
- Engine Coolant Temperature (ECT) sensor.
- Throttle Position (TP) sensor.
- Mass Air Flow (MAF).

The linear EGR valve is usually activated under the following conditions:

- Warm engine operation
- Above idle speed

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## Diagnosis




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**Legend**

(1) Linear EGR Valve
(2) Exhaust Gas
(3) To Cylinders
(4) Pintle

Too much EGR flow at idle, cruise, or cold operation may cause any of the following conditions to occur:

- Engine stalls after cold start.
- Engine stalls during closed throttle conditions.
- Vehicle surges during cruise.
- Rough idle.
- DTC P0300 (misfire detected).

Too little or no EGR flow may allow combustion temperatures to get too high. This could cause the following symptoms:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.
- DTC P0401.
- Poor fuel economy.

EGR flow diagnosis is included in the DTC P0401 diagnostic table. Pintle position error diagnosis is covered in DTC P1406. If EGR diagnostic trouble codes P0401 and/or P1406 are encountered, go to the DTC tables for diagnosis.

## Throttle Actuator Control System Description

### Throttle Actuator Control (TAC) Overview

The Throttle Actuator Control (TAC) system uses vehicle electronics and components to calculate and control the position of the throttle blade. This eliminates the need for a mechanical cable attachment from the accelerator pedal to the throttle body. This system also performs the cruise control functions as well.

The TAC system components include but is not limited to the following:

- The Accelerator Pedal Position (APP) sensor
- The Throttle Body
- The Throttle Actuator Control (TAC) module
- The Powertrain Control Module (PCM)

Each of these components interface together to ensure accurate calculations and control of the throttle position.

### Accelerator Pedal Position (APP) Sensor

The APP sensor is mounted on the accelerator pedal assembly. The APP is actually three individual accelerator pedal position sensors within one housing. There are three separate signal, ground and reference circuits. The APP sensor voltage increases as the accelerator pedal is depressed.

### Throttle Body/TAC Assembly

The throttle body for the TAC system is similar to a conventional throttle body with several exceptions. One exception being the use of a motor to control the throttle position instead of a mechanical cable. Another exception is the new design Throttle Position (TP) sensor. The TP sensor mounts on the side of the throttle body. The TP sensor is actually two individual TP sensors within one housing.
Two separate signal, ground and reference circuits are used to connect the TP sensors and the TAC module. The TP sensor signal voltage increases as the throttle opens.

### Throttle Actuator Control (TAC) Module

The TAC module is the 'Control Center' for the electronic throttle system. The Module is also located on the accelerator pedal assembly. The TAC module and the PCM communicate via a dedicated redundant serial data circuit. The TAC module and the PCM monitor the commanded throttle position and compare it to the actual throttle position. This is accomplished by monitoring the APP and the TP sensor. These two values must be within a calibrated value of each other. The TAC module also monitors each individual circuit of the TP sensor and the APP to verify proper operation.

### Battery Saver Mode

When the PCM detects the ignition ON for 10 seconds without the engine running it sends a message to the TAC Module. At this time the TAC module will allow the throttle blade to return to it's default position. This removes the draw that is present while holding the throttle blade at it calculated idle position.

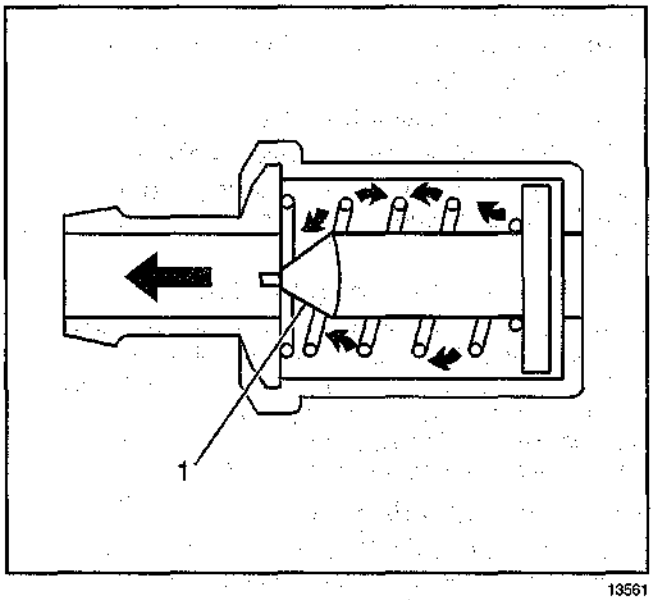
## Crankcase Ventilation System Description

### Purpose

A crankcase ventilation system is used to consume crankcase vapors in the combustion process instead of venting them to atmosphere. Fresh air from the throttle body is supplied to the crankcase, mixed with blow-by gases and then passed through a crankcase ventilation valve into the intake manifold.

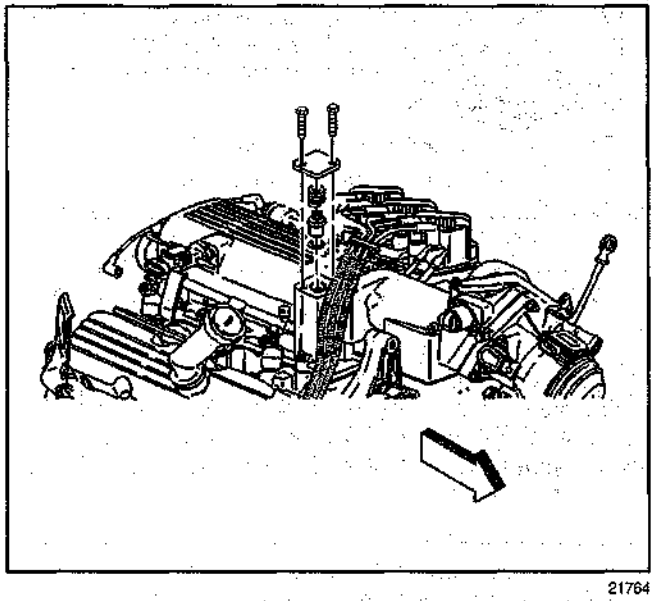
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## Operation




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The primary control is through the crankcase ventilation valve which meters the flow at a rate depending on inlet vacuum. To maintain idle quality, the crankcase ventilation valve restricts the flow when inlet vacuum is high.



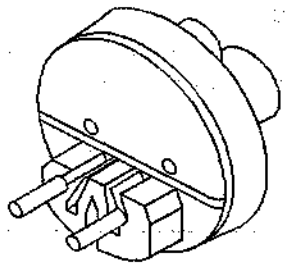
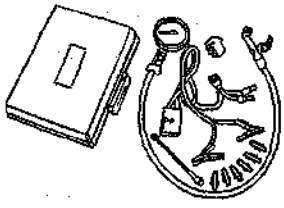
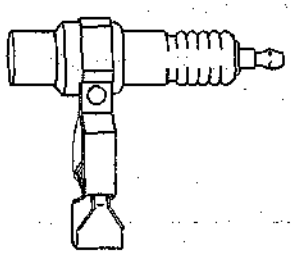
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If abnormal operating conditions arise, the system is designed to allow excessive amounts of blow-by gases to back flow through the crankcase vent into the throttle body to be consumed by normal combustion.

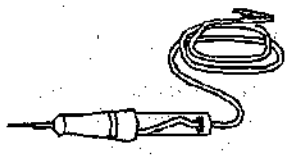
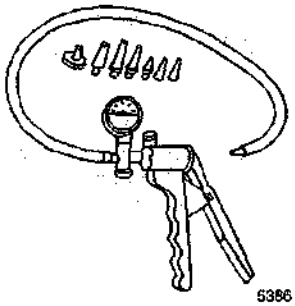
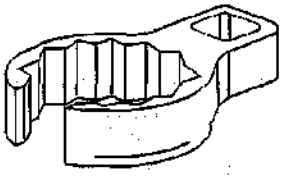
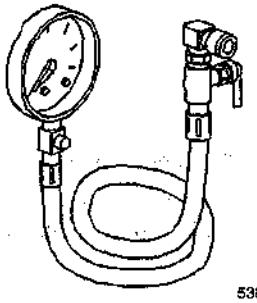
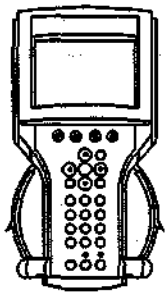
## Air Intake System Description

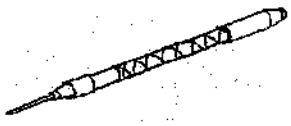
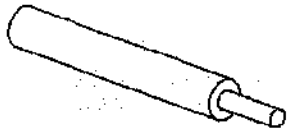
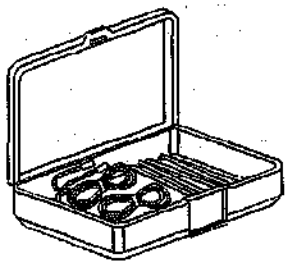
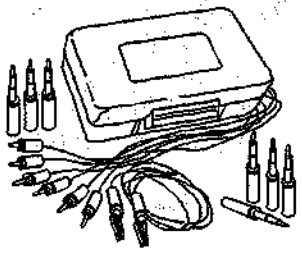
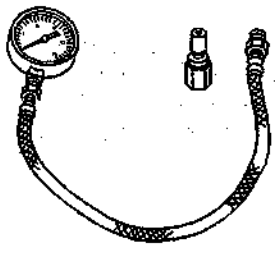
The air induction system provides contaminant and sound filtration of the outside air as it is drawn into the engine. A remotely mounted air cleaner reduces induction noise while preventing contaminants in the air from entering the engine. The filtered air is routed into an intermediate air duct assembly. The air then enters the engine by flowing through the throttle body, into the intake manifold, through the cylinder head intake ports, and into the cylinders.

## Special Tools and Equipment

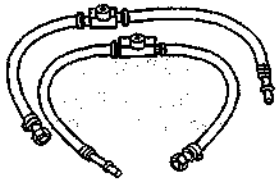
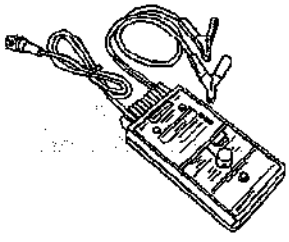
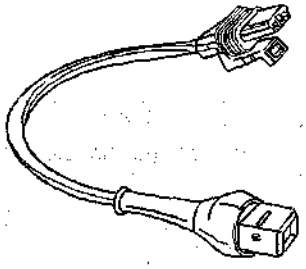
| Illustration | Tool Number/Description |
|---|---|
|  385603 | J 34730-405<br>Injector Test Light |
|  3430 | J 39200<br>Digital Multi-meter |
|  5377 | J 34730-E<br>Fuel Pressure Gauge Kit |
|  5381 | J 26792<br>Spark Tester |

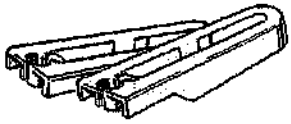
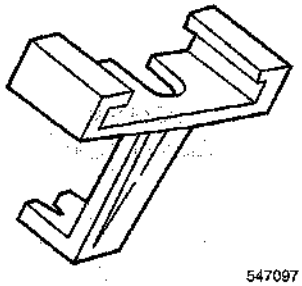
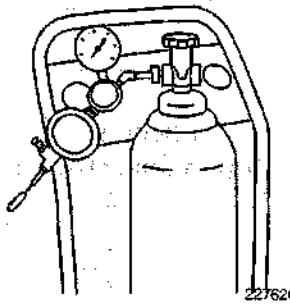
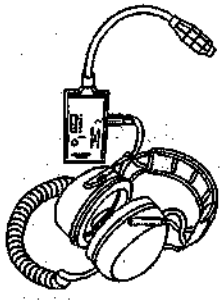
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| Illustration | Tool Number/Description |
|---|---|
|  5382 | J 34142-B Test Light |
|  5386 | J 23738-A Vacuum Pump |
|  5388 | J 39194-B Oxygen Sensor Wrench |
|  5389 | J 34730-1A Fuel Pressure Gauge |
|  50062 | Tech 2 Kit 7000081 |

| Illustration | Tool Number/Description |
|---|---|
|  5395 | J 35689-A Metri-Pack Terminal Kit |
|  5396 | J 28742-A Weather Pack Terminal Remover |
|  5399 | J 37027-A IAC Motor Analyzer |
|  8917 | J 35616-A Connector Test Adapter Kit |
|  13544 | J 35314-A Exhaust Back Pressure Tester |

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| Illustration | Tool Number/Description |
|---|---|
|  9194 | J 33431-B<br>Signal Generator and Instrument Panel Tester |
|  13541 | J 37287<br>Inlet and Return Fuel Line Shut-off Adapters |
|  5380 | J 39021<br>Fuel Injector Coil/Balance Tester |
|  385606 | J 39021-380<br>Fuel Injector Test Harness |

| Illustration | Tool Number/Description |
|---|---|
|  12366 | J 37088-A<br>Fuel Line Quick Connect Separator |
|  547097 | J 39363<br>Supercharger Actuator Adjuster |
|  227620 | J 41413<br>Pressure/Purge Diagnostic Station |
|  69758 | J 41416<br>Ultrasonic Leak Detector |

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