Engine Controls - 5.7L

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	Specifications	
	Metric	English
AIR Check Valves	23 N·m	17 lb ft
AIR Pipe To Exhaust Manifold Bolts	20 N·m	15 lb ft
AIR Pump to Bracket	9 N·m	80 lb in
AIR Right Side Pipe Bracket-to-Cylinder Head Bolt	25 N·m	18 lb ft
AIR Shut Off Valve Bracket–to–Cylinder Head Bolt	20 N·m	14 lb ft
AIR Shut Off Valve Retaining Nut	12 N·m	8 lb ft
Camshaft Position (CMP) Sensor Bolt	25 N·m	18 lb ft
Crankshaft Position (CKP) Sensor Bolt	25 N·m	18 lb ft
EGR Valve to Mounting Flange, First Step	10 N·m	89 lb ft
EGR Valve to Mounting Flange, Second Step	25 N·m	18 lb ft
Engine Coolant Temperature (ECT) Sensor	17 N·m	13 lb ft
Fuel Fill Hose Clamps	2.5 N·m	22 lb in
Fuel Filter Fitting	30 N·m	22 lb ft
Fuel Pipe Front Clip Bolts	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

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Fastener Tightening Specifications (cont'd)

Application	Specifications	
	Metric	English
Fuel Pipe Shield Studs	5 N·m	44 lb in
Fuel Rail Attaching Bolts	10 N·m	89 lb in
Fuel Tank Fill Pipe Shield Bolt	2.5 N·m	22 lb ft
Fuel Tank Fill Pipe Support Bracket Bolt	10 N·m	89 lb in
Fuel Tank Strap Bolts	33 N·m	24 lb ft
Heated Oxygen Sensor (HO2S)	41 N·m	30 lb ft
Idle Air Control (IAC) Valve Attaching Screws	3 N·m	27 lb ft
Knock Sensor (KS)	15 N·m	11 lb ft
Powertrain Control Module (PCM) Connector End Bolts	8 N·m	70 lb in
PCV Hose Assembly Mounting Cable Nut	12 N·m	106 lb in
Throttle Body Attaching Bolts	12 N·m	106 lb in
Throttle Position (TP) Sensor Attaching Screws	2 N·m	18 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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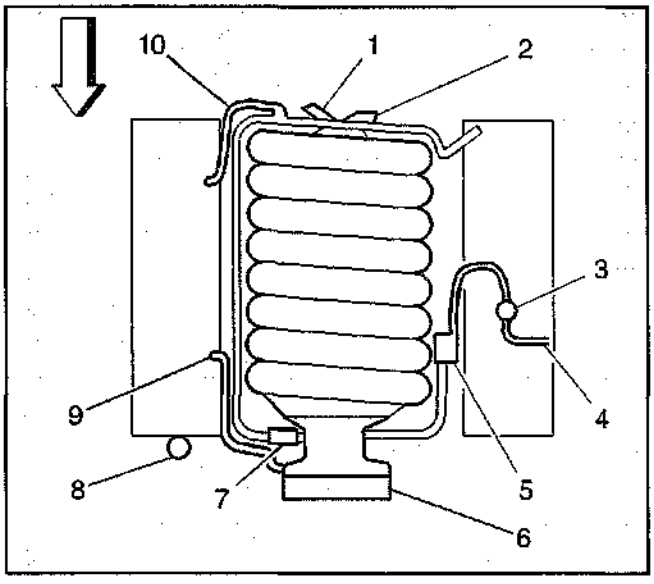
GM SPO Group Numbers

Application	GM SPO Group Number
Accelerator Control Cable	3.430
Accelerator Pedal	3.451
Air Cleaner Assembly	3.402
Air Filter	3.410
Camshaft Position (CMP) Sensor	2.383
Crankshaft Position (CKP) Sensor	2.383
Engine Coolant Temperature (ECT) Sensor	3.682
Engine Oil Level Sensor	1.516
EVAP Canister	3.130
EVAP Fuel Tank Pressure Sensor	3.140
EVAP Hoses and Pipes	3.145
EVAP Purge Solenoid	3.140
EVAP Vent Valve	3.140
Exhaust Gas Recirculation (EGR) Valve	3.670
Fuel Hoses and Pipes	3.163
Fuel Injectors	3.300
Fuel Pump	3.900
Fuel Pump Relay	3.900
Fuel Rail Assembly	3.330
Fuel Sender	3.107
Fuel Tank	3.001
Fuel Tank Straps	3.022
Heated Oxygen Sensor	3.682
Idle Air Control (IAC) Valve	3.338
Ignition Coil/Module	2.170
Inline Fuel Filter	3.890
Intake Air Duct	3.417
Intake Air Temperature (IAT) Sensor	3.682
Knock Sensors	2.383
Manifold Absolute Pressure (MAP) Sensor	3.682
Mass Air Flow (MAF) Sensor	3.682
Positive Crankcase Vent Valve	1.745
Powertrain Control Module (PCM)	3.670
Secondary AIR hoses/pipes and check valves	3.670–3.675
Secondary AIR Pump	3.660
Secondary AIR Relay	3.682
Secondary AIR Solenoid	3.670
Secondary AIR Shut Off Valve	3.670
Throttle Body Assembly	3.335
Throttle Position (TP) Sensor	3.339
Vehicle Speed (VSS) Sensor	3.682

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Schematic and Routing Diagrams

Emission Hose Routing Diagram

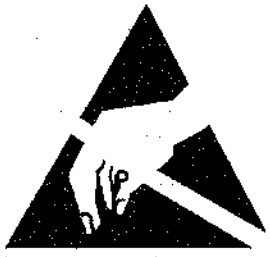


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Legend

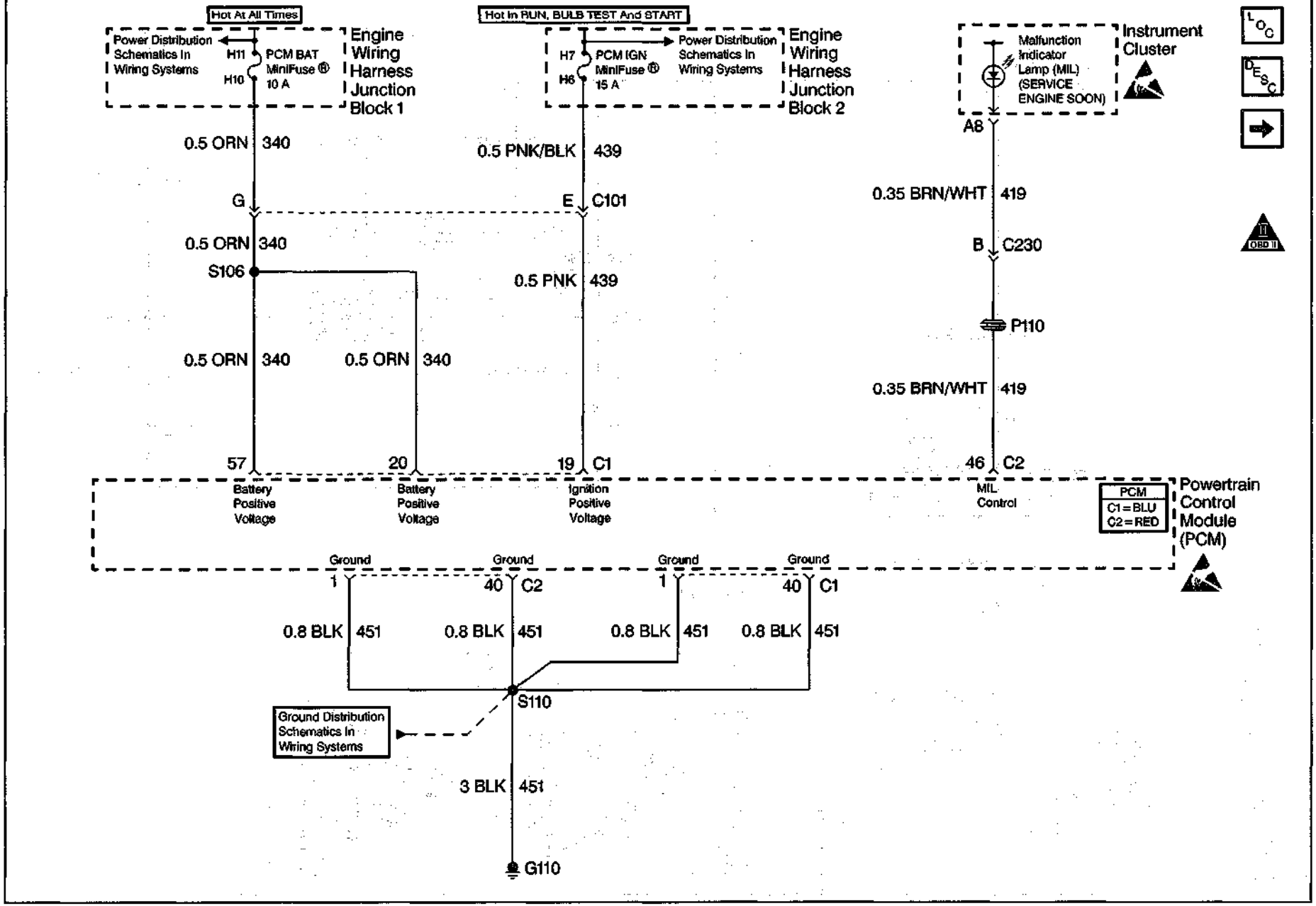
(1) To HVAC
(2) To Power Brake Booster
(3) EVAP System Test Port
(4) To EVAP Canister
(5) EVAP Canister Purge Solenoid
(6) Throttle Body
(7) Positive Crankcase Ventilation (PCV) Valve
(8) Exhaust Gas Recirculation (EGR) Valve
(9) Crankcase Ventilation Hose
(10) Crankcase Ventilation Hose

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.

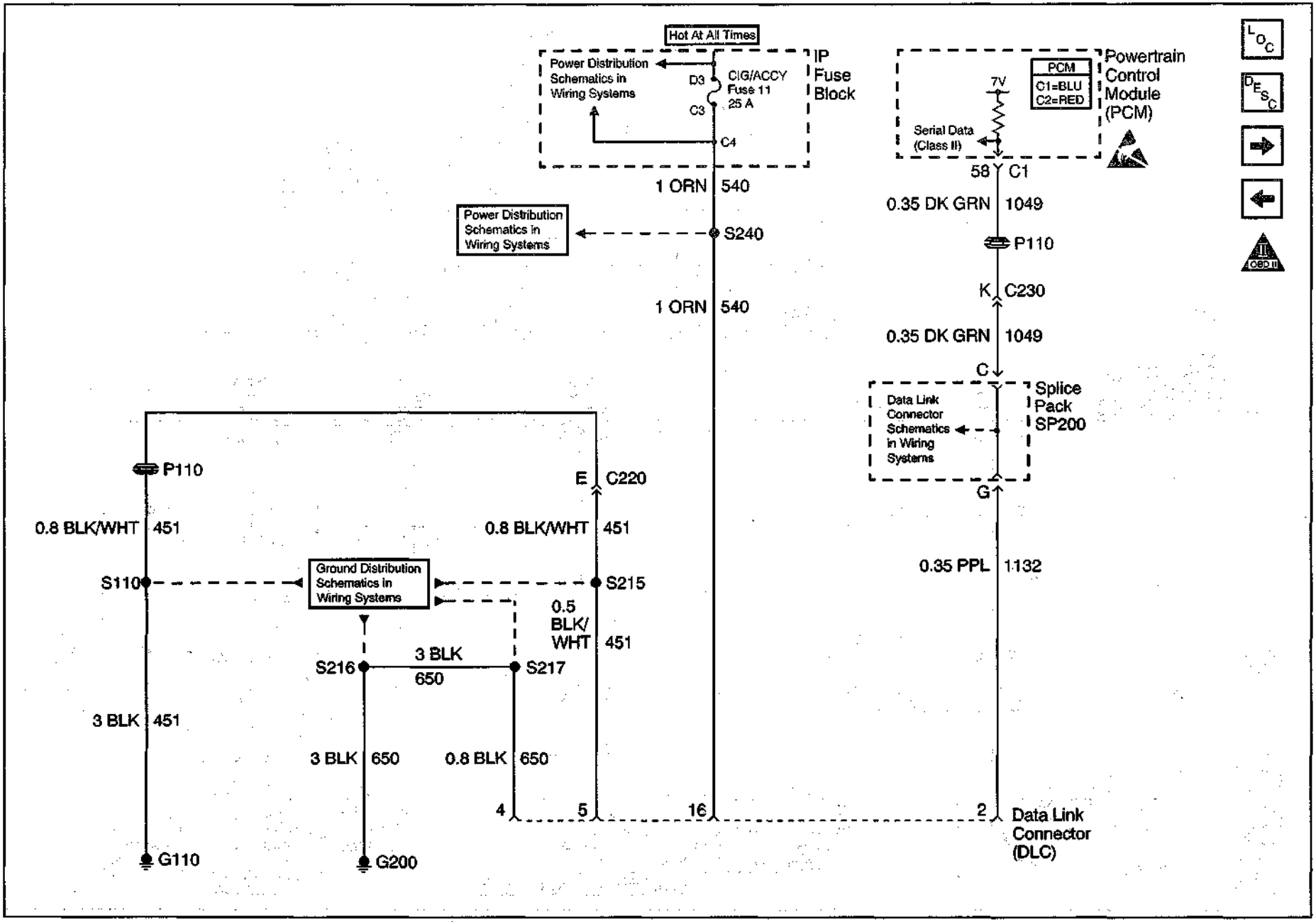
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Engine Controls Schematics (Power and Ground)



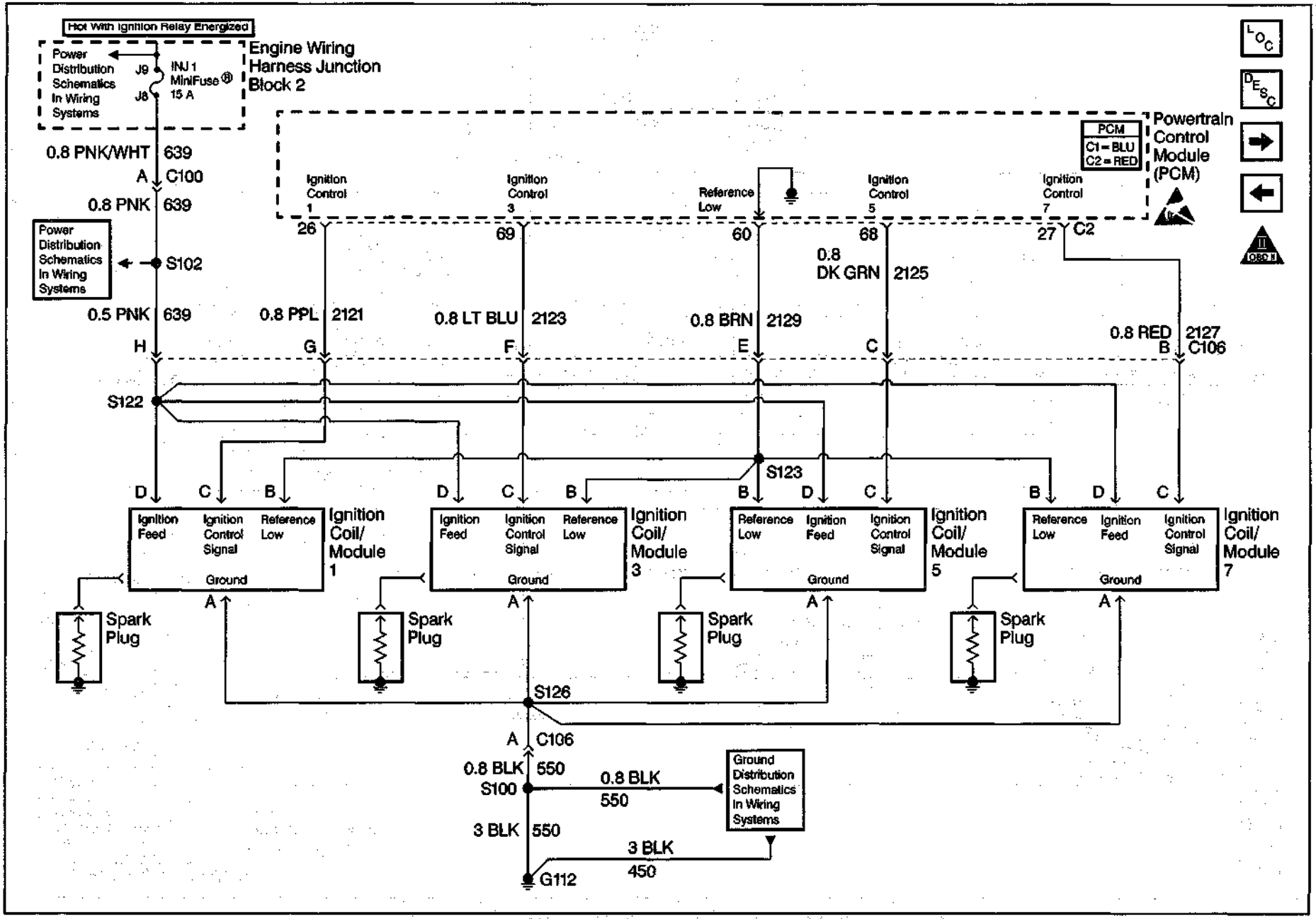
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Engine Controls Schematics (Data Link Connector)



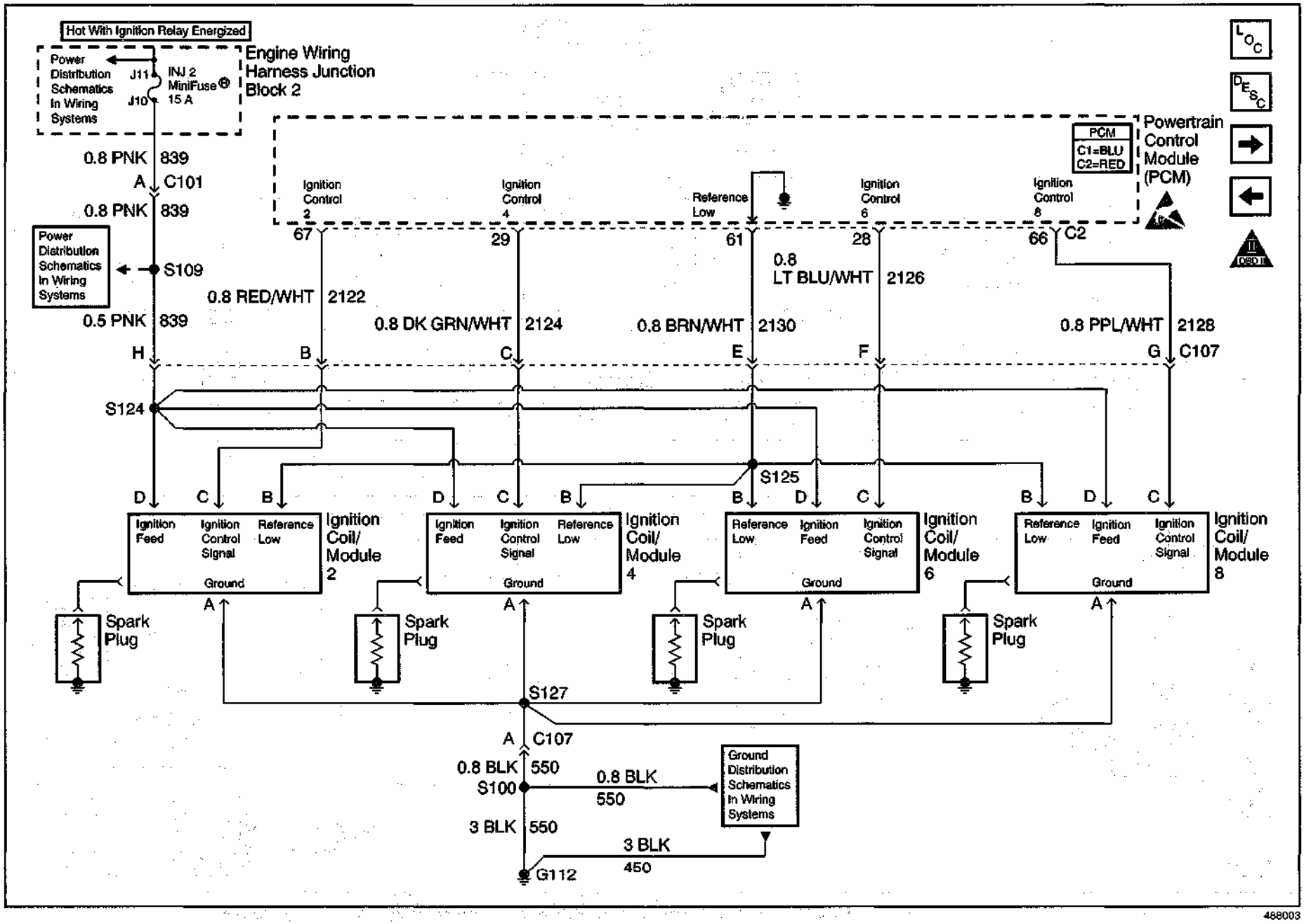
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Engine Controls Schematics (Ignition Modules/Coils, Bank 1)



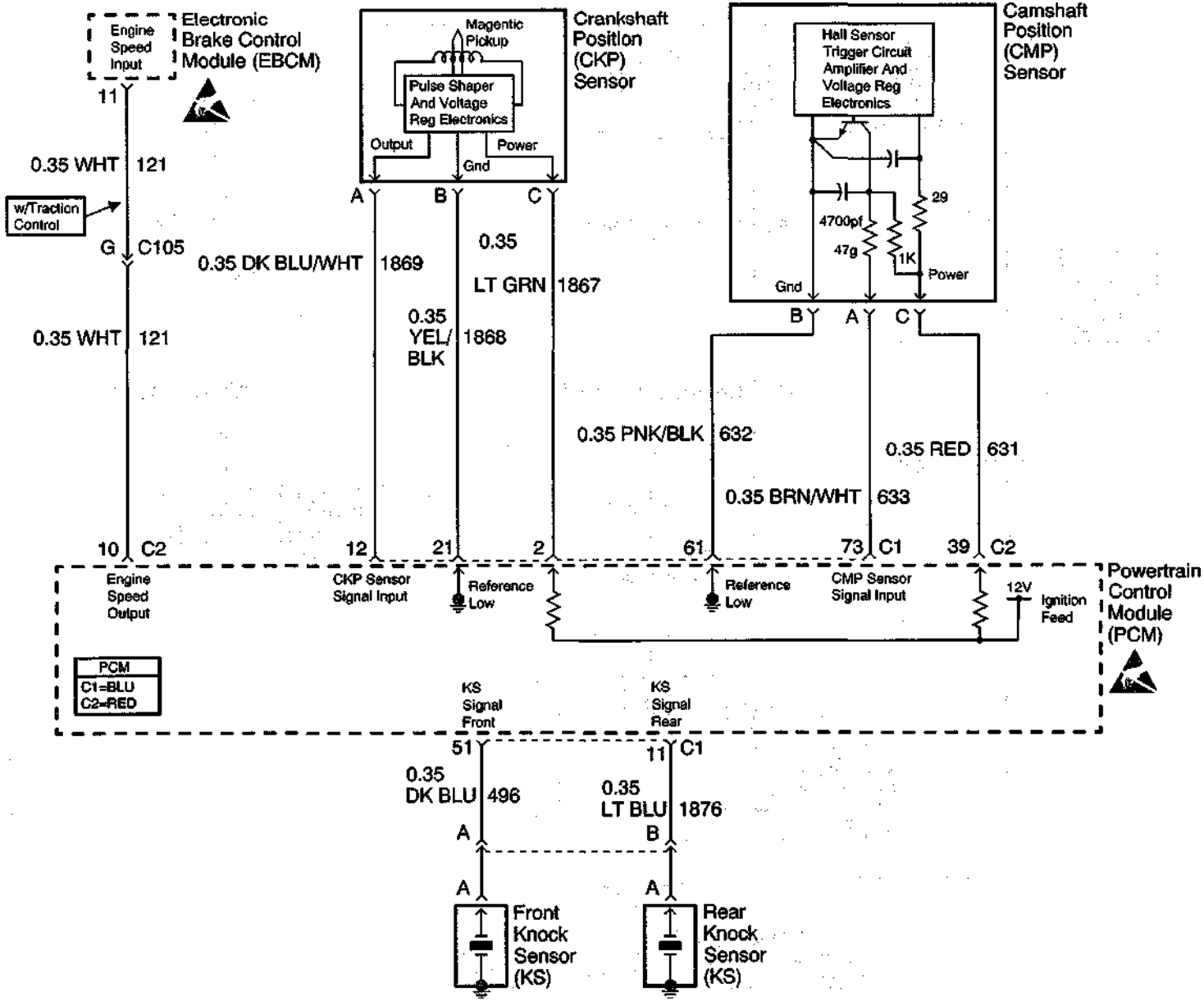
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Engine Controls Schematics (Ignition Modules/Coils, Bank 2)



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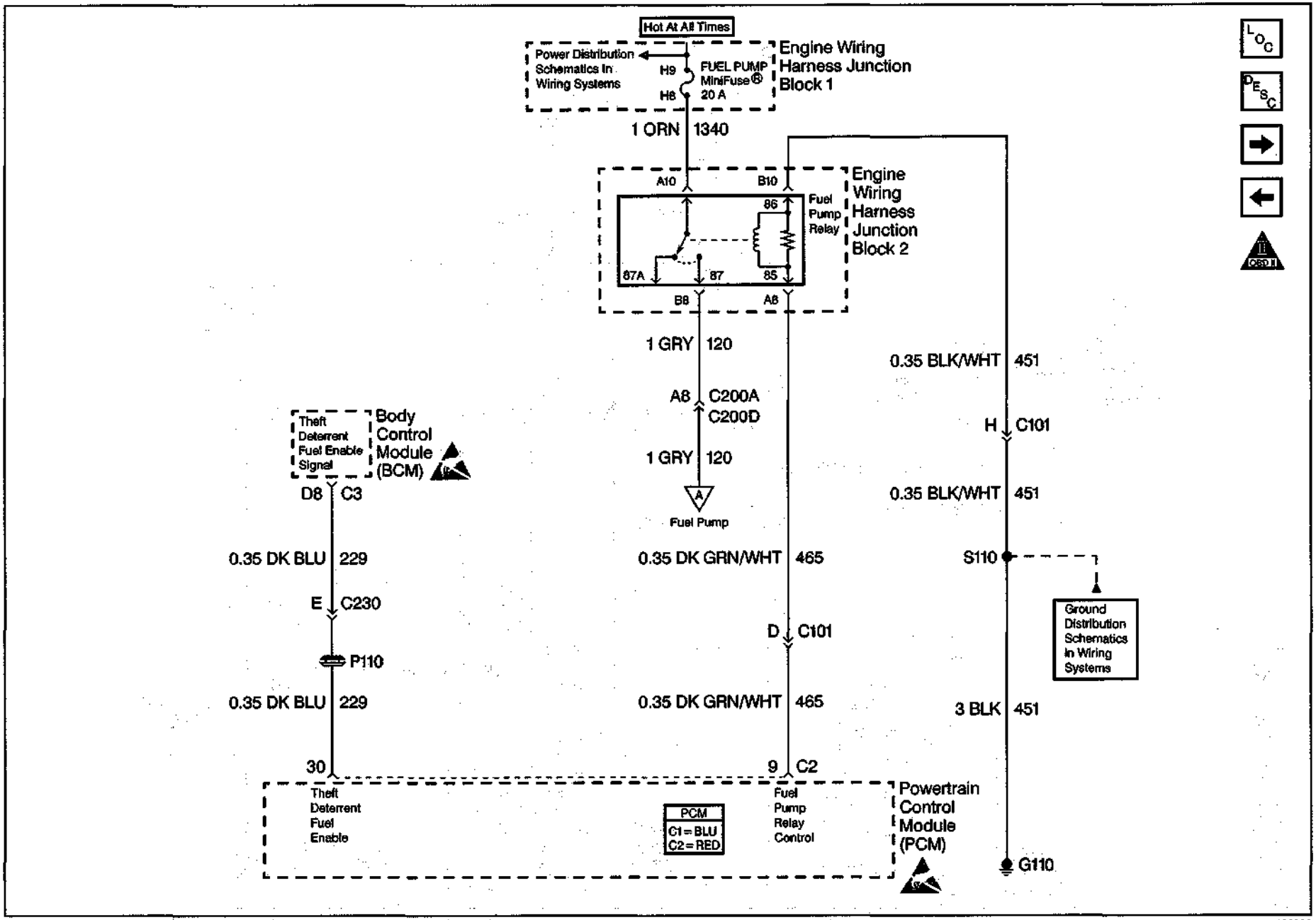
Engine Controls Schematics (Camshaft Position Sensor, Crankshaft Position Sensor, and Knock Sensors)



488005

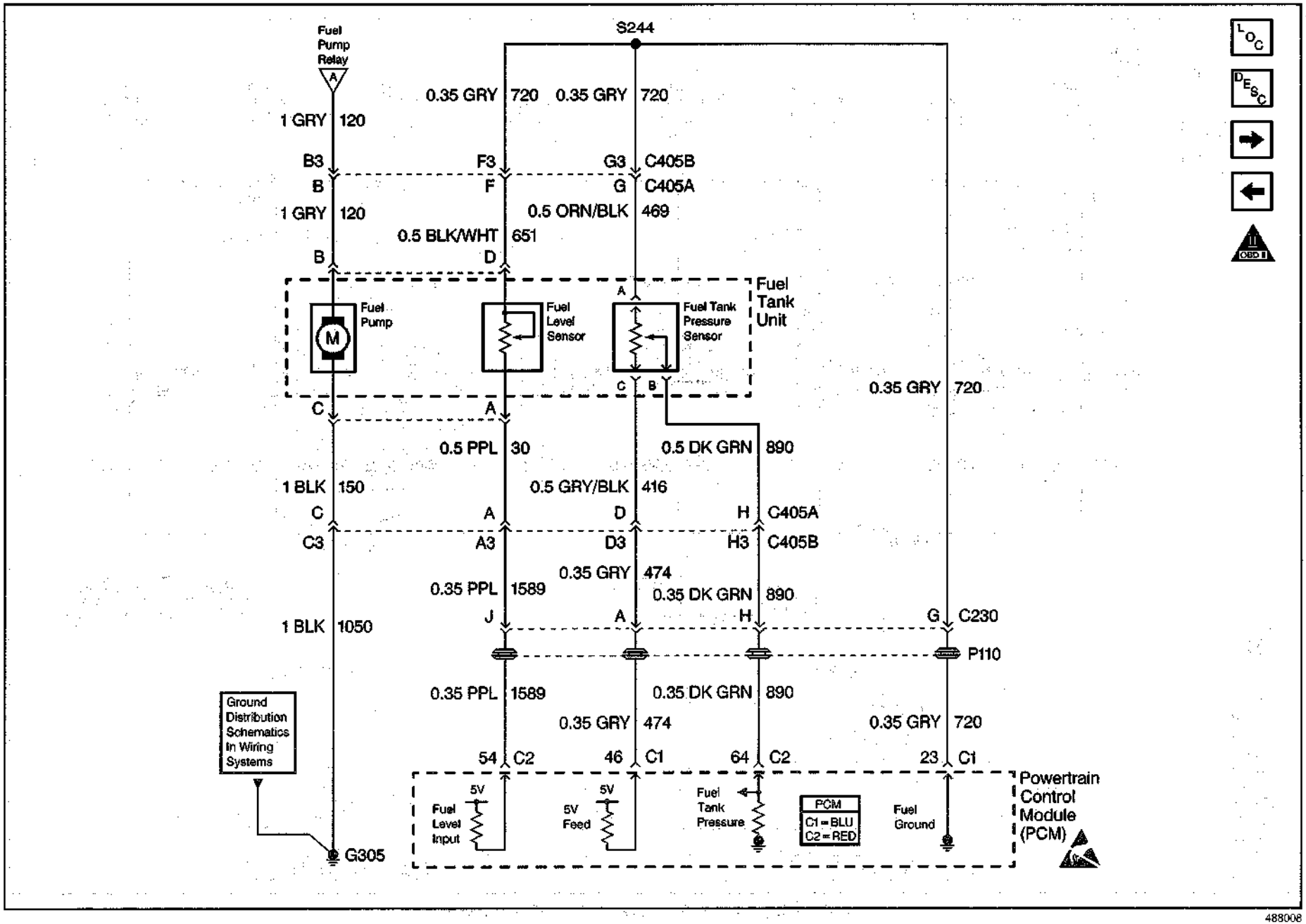
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Engine Controls Schematics (BCM and Fuel Pump)



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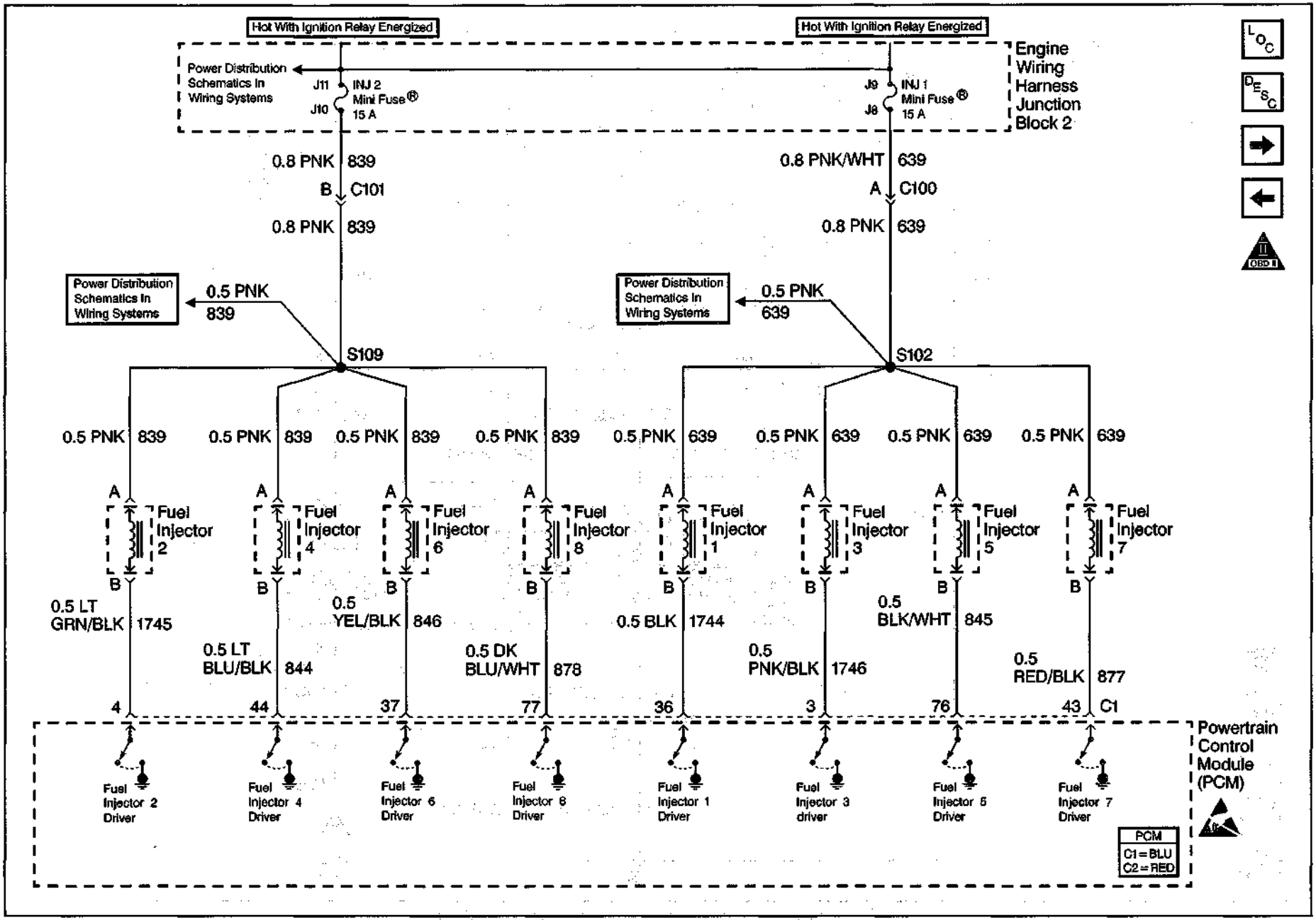
Engine Controls Schematics (Fuel Tank Unit)



488008

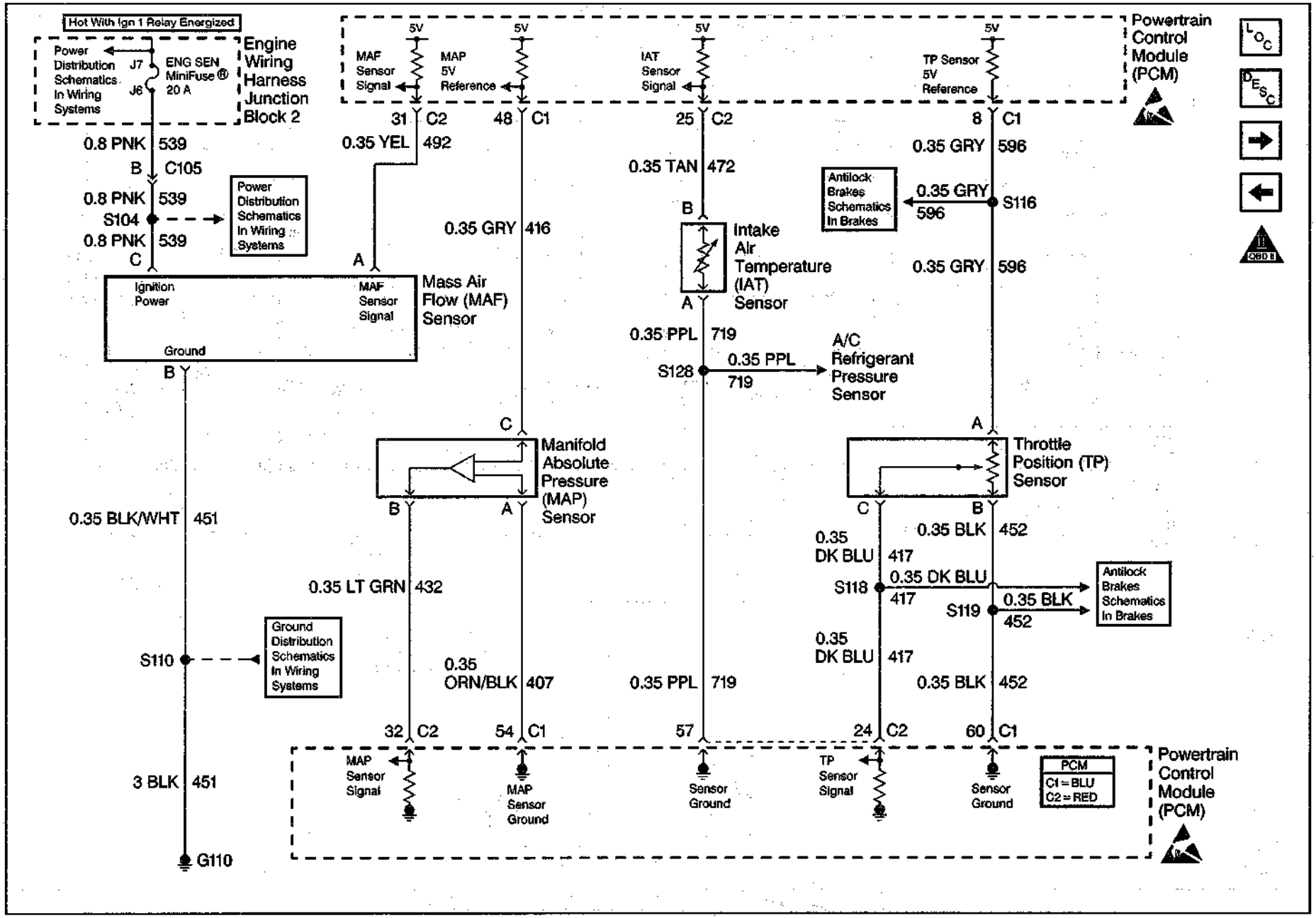
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Engine Controls Schematics (Fuel Injectors)



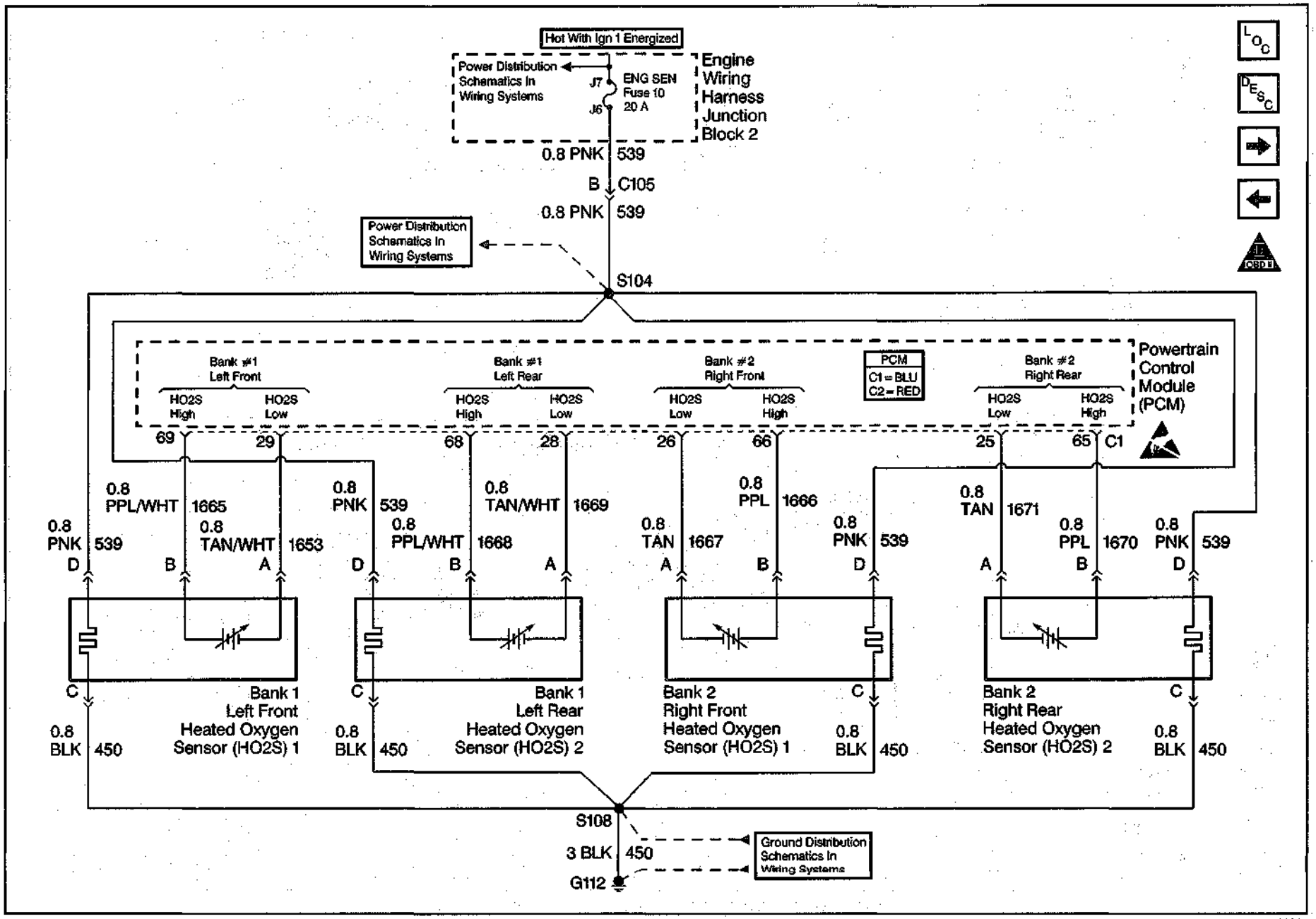
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Engine Controls Schematics (Engine Sensors)



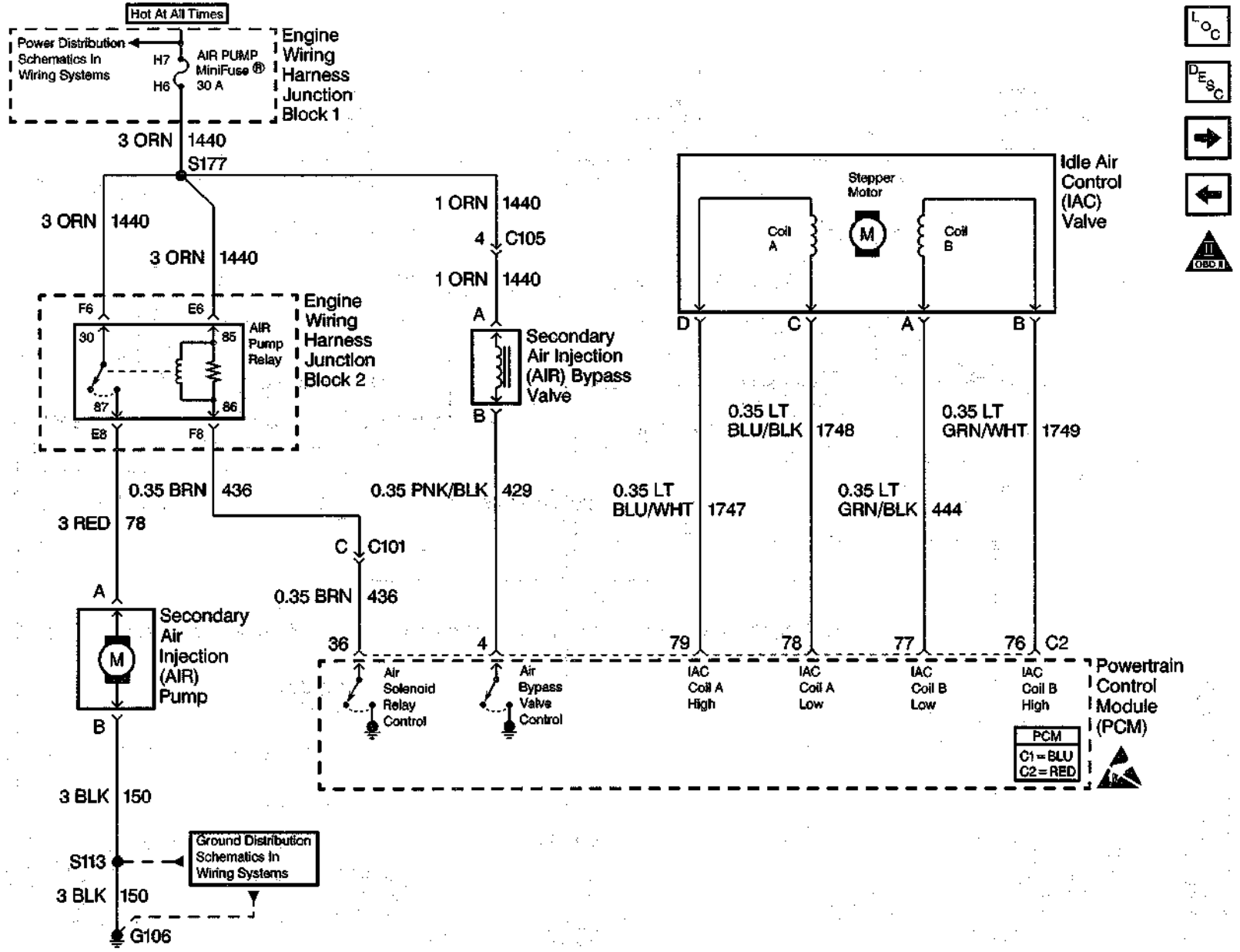
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Engine Controls Schematics (Oxygen Sensors)



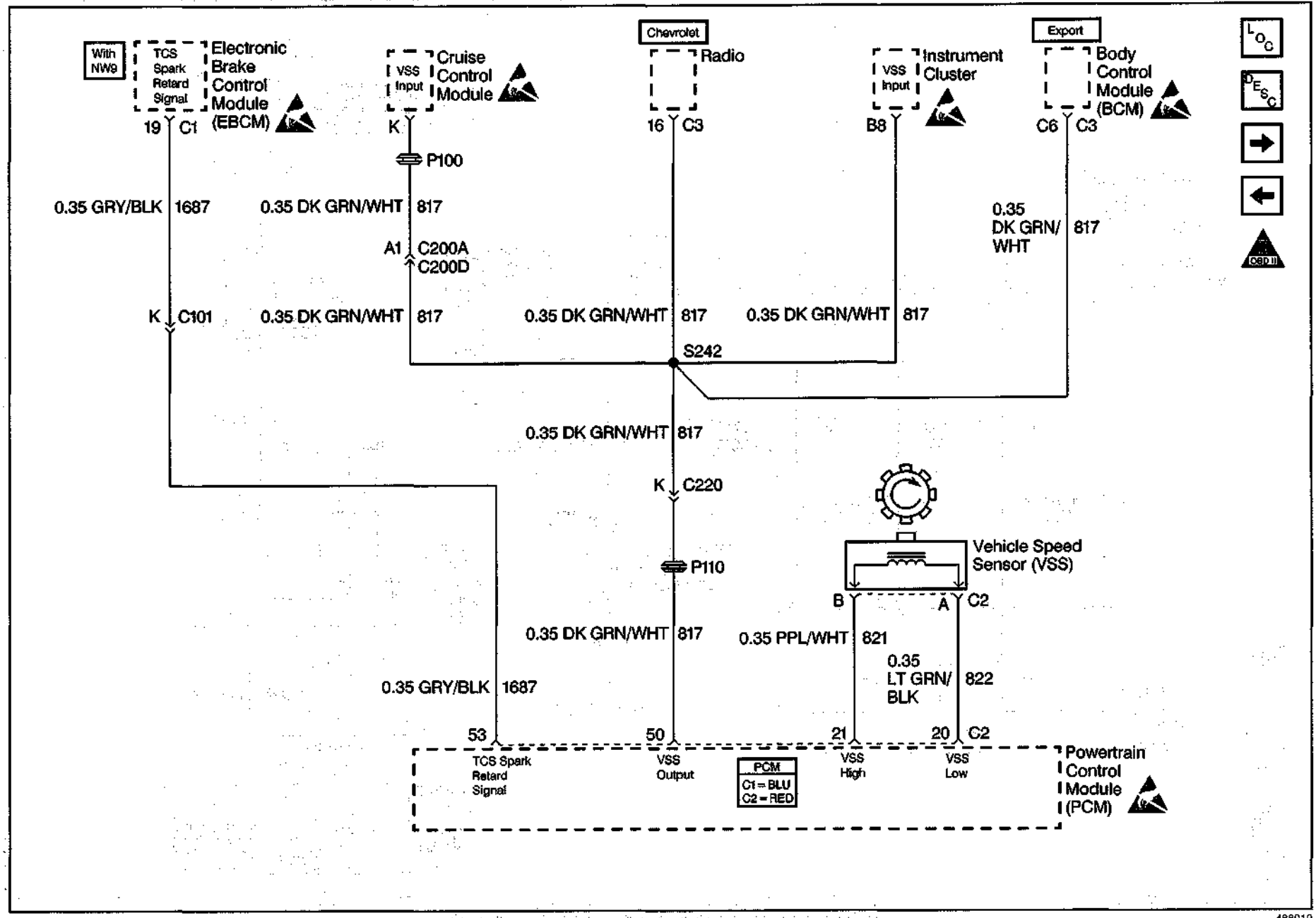
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Engine Controls Schematics (AIR Pump and IAC)



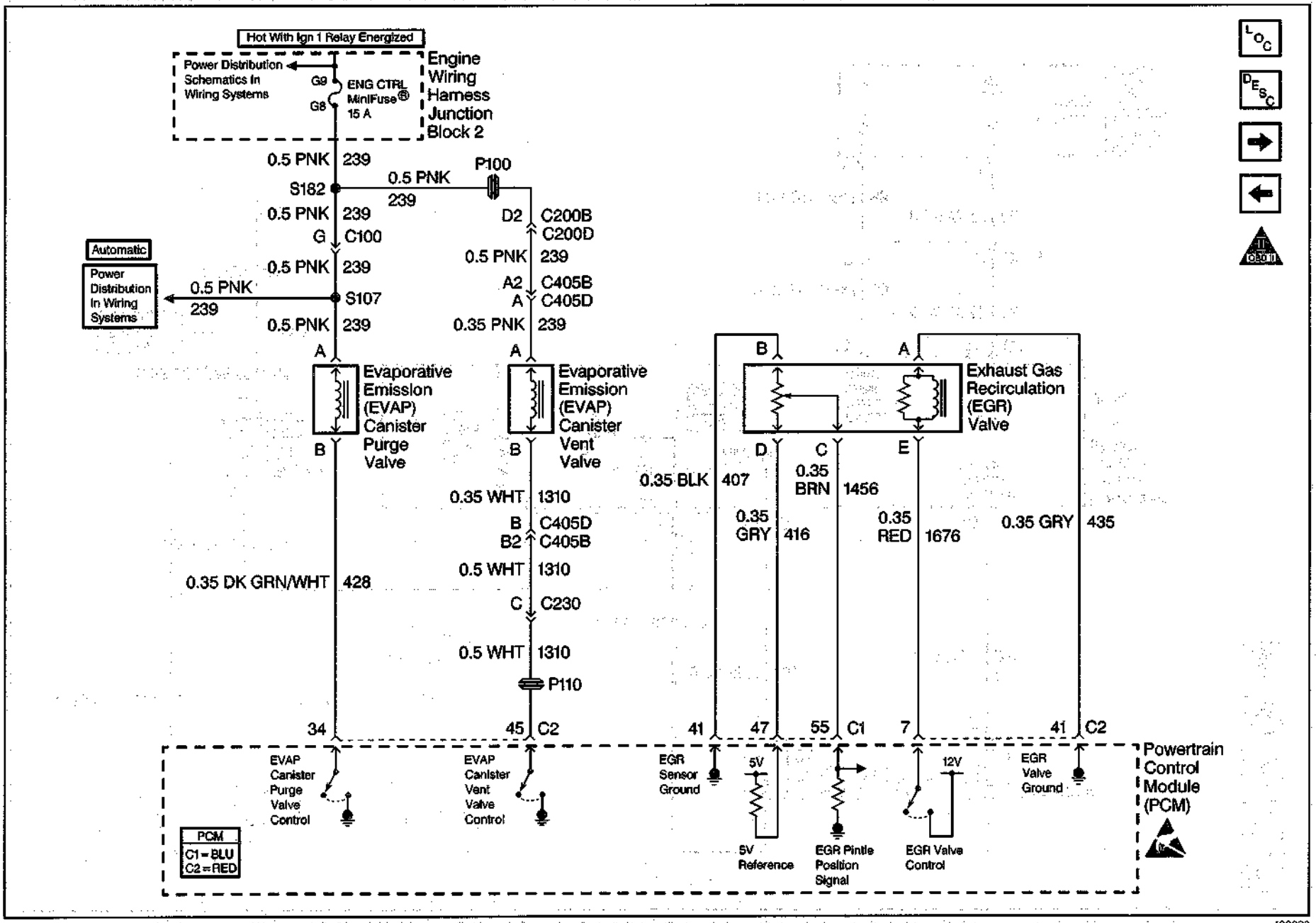
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Engine Controls Schematics (BCM, Cruise Control Module, EBCM, IPC, Radio, and VSS)



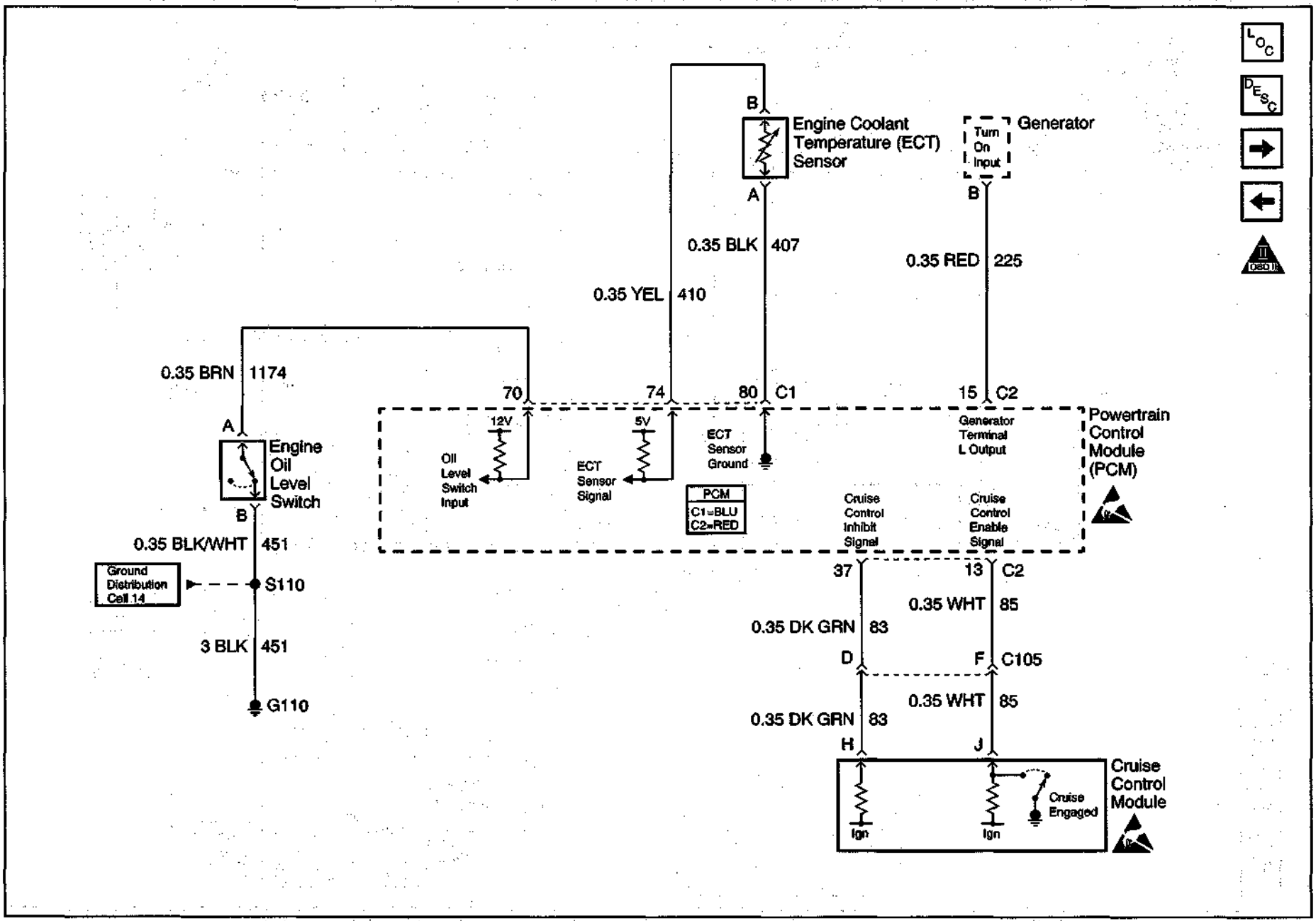
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Engine Controls Schematics (EGR and EVAP)



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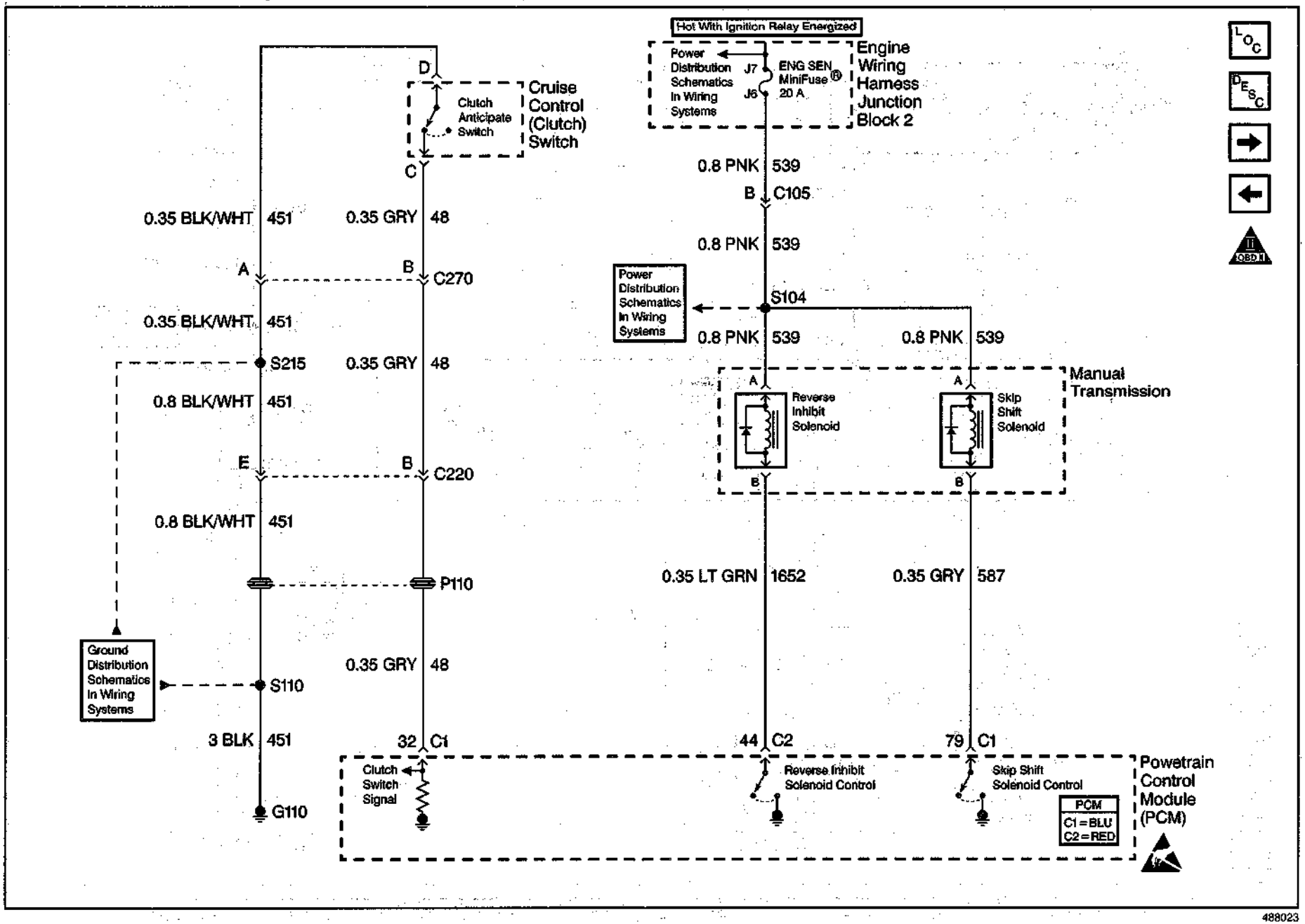
Engine Controls Schematics (Cruise Control Module, ECT Sensor, Engine Oil Level Switch and Generator)



488021

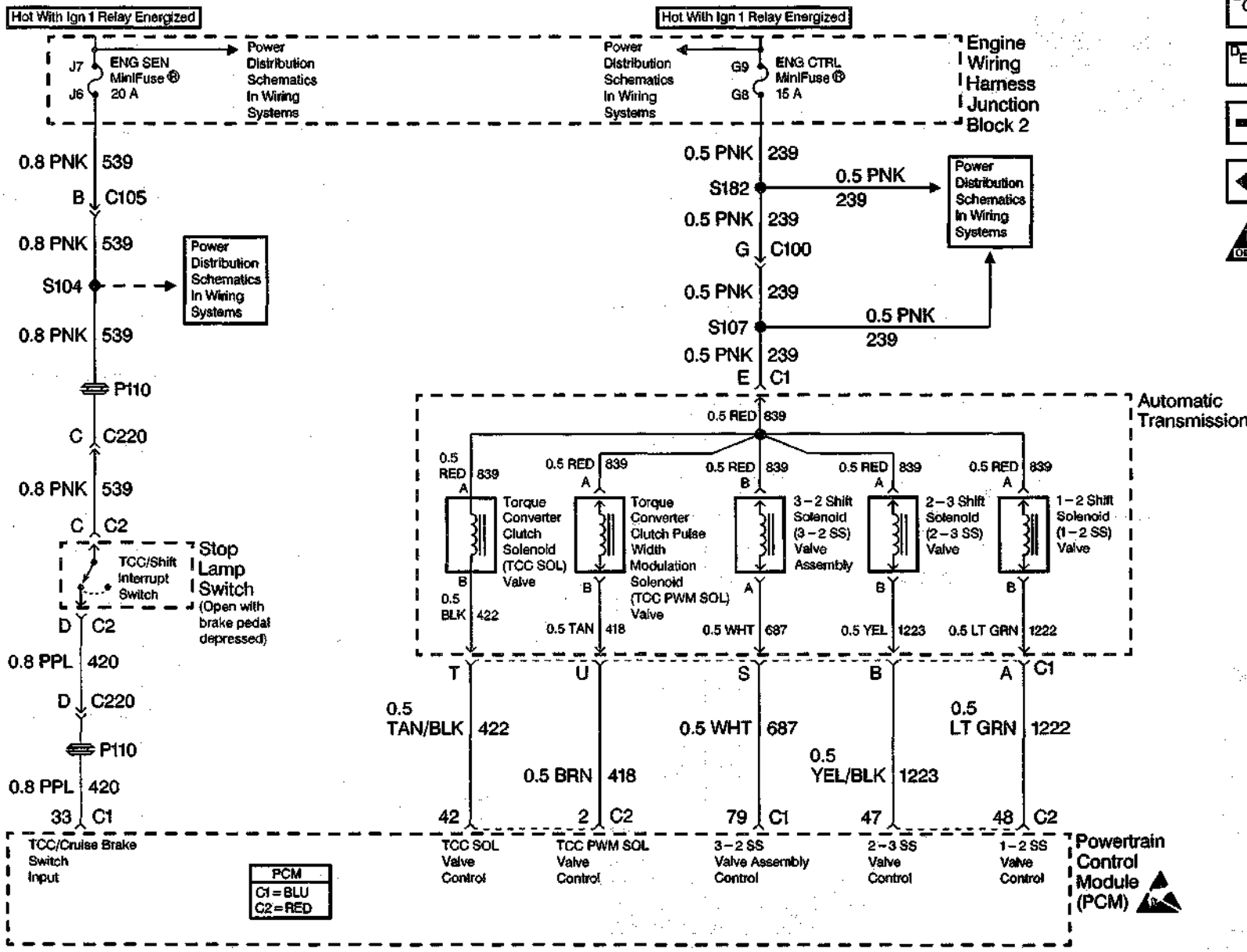
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Engine Controls Schematics (Cruise Control Clutch Switch and Manual Transmission)



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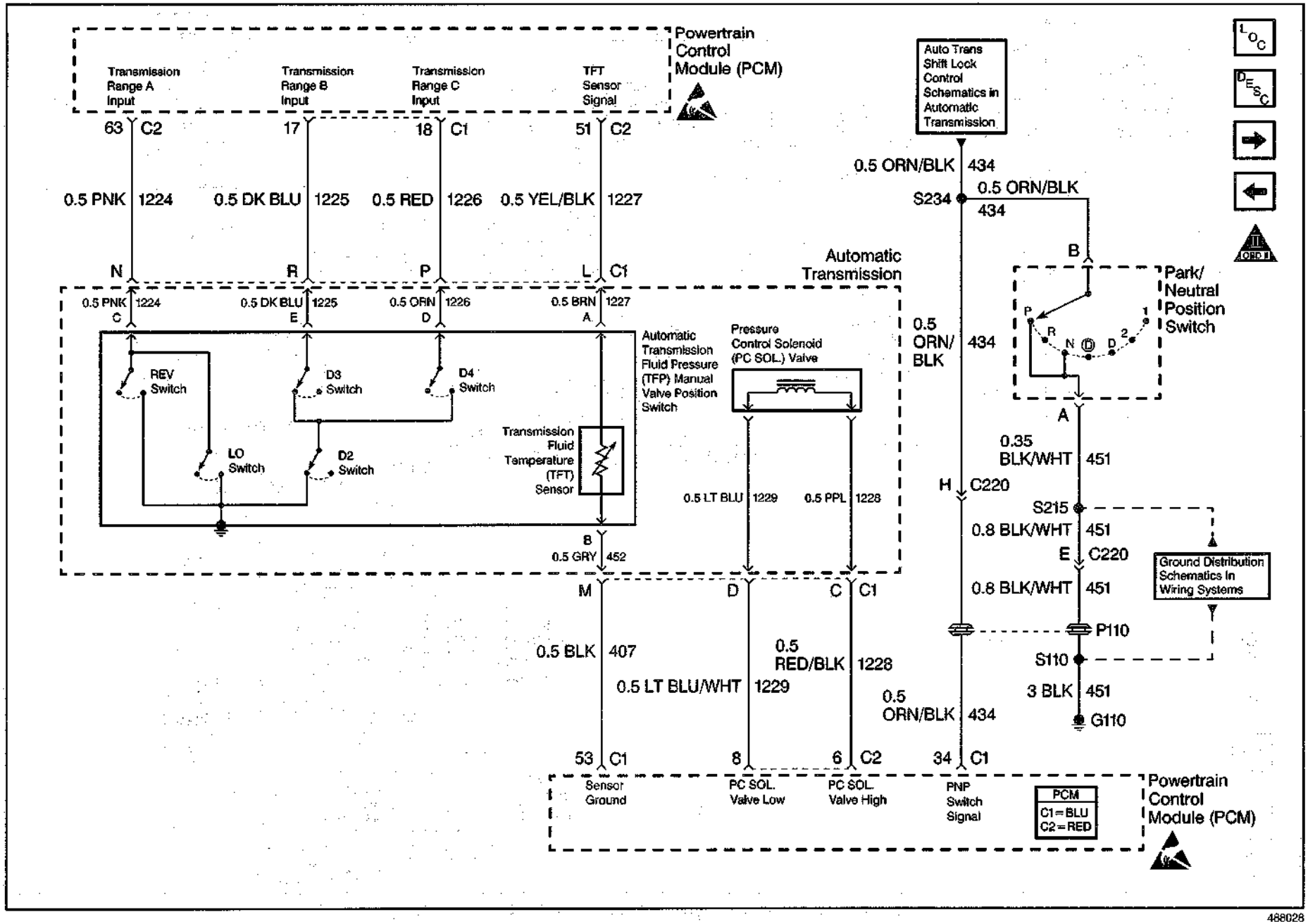
Engine Controls Schematics (Automatic Transmission and Stop Lamp Switch)



488026

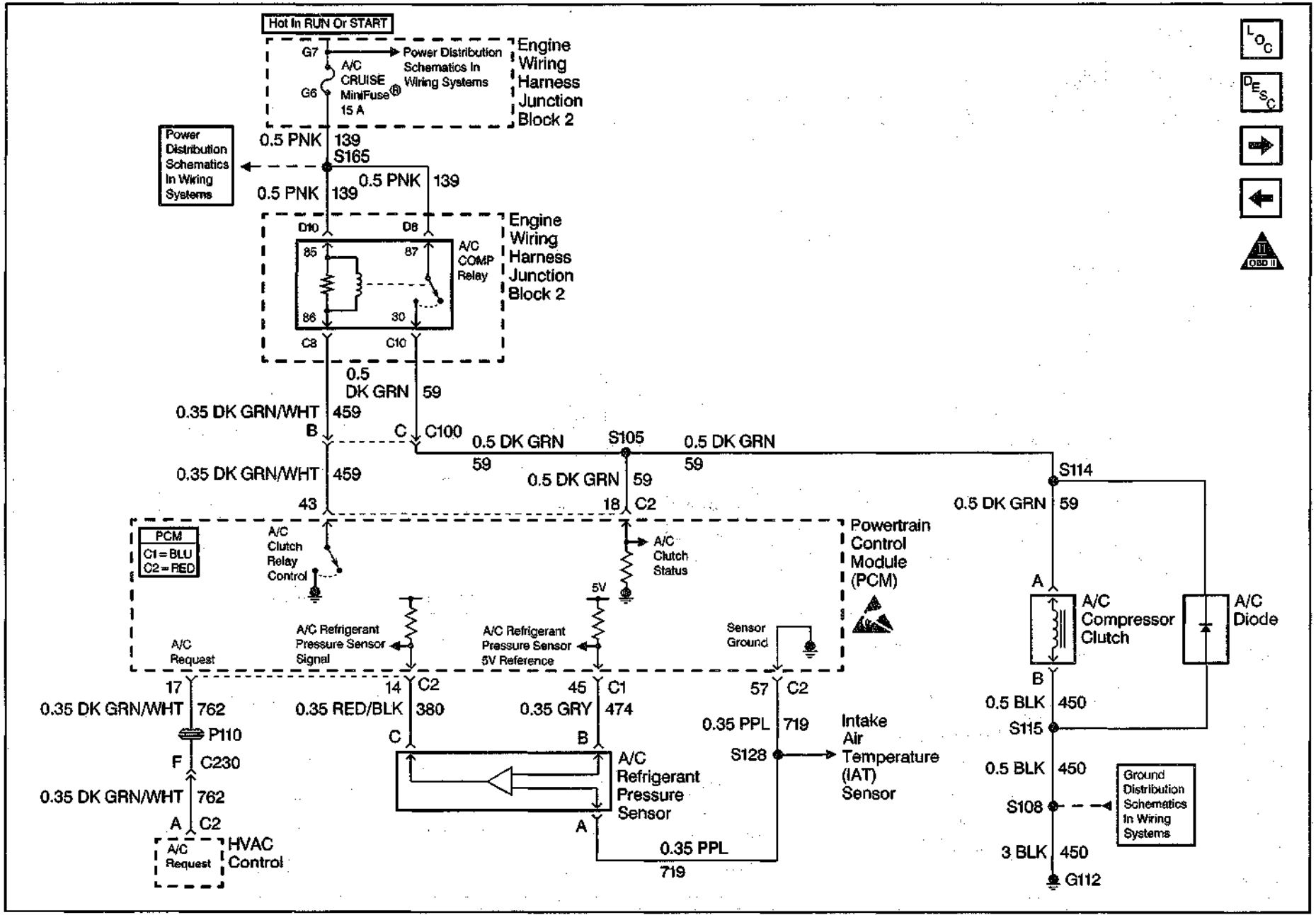
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Engine Controls Schematics (Automatic Transmission and Park/Neutral Position Switch)



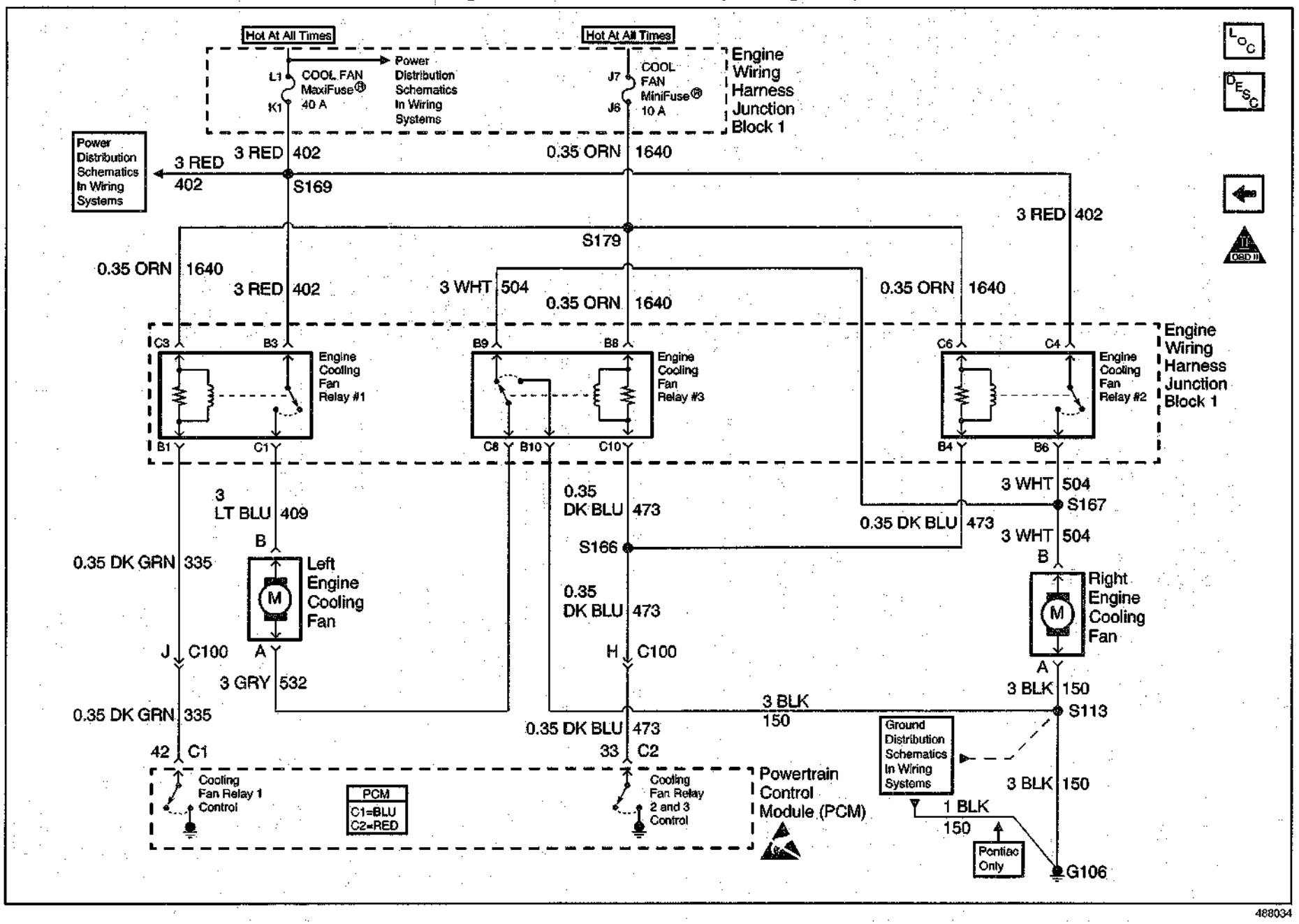
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Engine Controls Schematics (A/C Compressor Control)



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Engine Controls Schematics (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 17 cm (6.8 in) from the A/C compressor clutch connector	—	—
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 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
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
Engine Coolant Temperature (ECT) Sensor	On the lower left side of the engine, above the generator	*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 right side of the engine, in the oil pan	*Instrument Panel, Gauges, and Console Component Views* in Instrument Panel, Gauges and Console	*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 left side of the engine, mounted to the intake manifold	*Engine Controls Component Views*	*Engine Controls Connector End Views*
Evaporative Emission (EVAP) Canister Vent Solenoid Valve	On the top right side of the engine, part of the EVAP canister	*Engine Controls Component Views*	*Engine Controls Connector End Views*

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Engine Controls Components (cont'd)

Name	Location	Locator View	Connector End View
Exhaust Gas Recirculation (EGR) Valve	On the left rear of the engine, mounted to the intake manifold	*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 Component Views*	*Engine Controls Connector End Views*
Generator	On the front left side of the engine	*Instrument Panel, Gauges, and Console Component Views* in Instrument Panel, Gauges and Console	*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*	—
Heated Oxygen Sensor Bank 1, Sensor 2	At the rear of the left catalytic converter	*Engine Controls Component Views*	*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*
Heated Oxygen Sensor Bank 2, Sensor 2	At the rear of the right catalytic converter	*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
Idle Air Control (IAC) Valve	On the right front of the engine, on the throttle body	*Engine Controls Component Views*	*Engine Controls Connector End Views*
Ignition Coils/Modules (Bank 1)	On the valve cover at the top of each engine cylinder, on the left side of the engine	*Engine Controls Component Views*	—
Ignition Coils/Modules (Bank 2)	On the valve cover at the top of each engine cylinder, on the right side of the engine	*Engine Controls Component Views*	—
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 Component Views*	*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, Front	On the center of the engine below the intake manifold	*Engine Controls Component Views*	*Engine Controls Connector End Views*
Knock Sensor, Rear	On the center of the engine below the intake manifold	*Engine Controls Component Views*	*Engine Controls Connector End Views*
Manifold Absolute Pressure (MAP) Sensor	Mounted to the right side of the intake manifold	*Engine Controls Component Views*	*Engine Controls Connector End Views*
Manual Transmission	Behind the engine	*Instrument Panel, Gauges, and Console Component Views* in Instrument Panel, Gauges and Console	—
Mass Air Flow (MAF) Sensor	Mounted on the air duct, in front of the intake manifold	*Engine Controls Component Views*	*Engine Controls Connector End Views*

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Engine Controls Components (cont'd)

Name	Location	Locator View	Connector End View
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	*Engine Controls Component Views*	*PCM Connector End Views*
Radio	In the center of the IP, below the HVAC control	*Entertainment Component Views* in Entertainment	*Entertainment Connector End Views* in Entertainment
Reverse Inhibit Solenoid	On the rear left side of the transmission	*Instrument Panel, Gauges, and Console Component Views* in Instrument Panel, Gauges and Console	—
Secondary Air Injection Bypass Valve	Mounted to the right front frame rail	—	*Engine Controls Connector End Views*
Secondary Air Injection (AIR) Pump	On the front left frame rail, in the engine compartment	—	*Engine Controls Connector End Views*
Skip Shift Solenoid	On the center left side of the transmission	*Instrument Panel, Gauges, and Console Component Views* in Instrument Panel, Gauges and Console	—
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 Position (TP) Sensor	Mounted to the front of the throttle body	*Engine Controls Component Views*	*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	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
C106 (7 cavities)	Engine to the engine jumper harness	—	—
C107 (7 cavities)	Engine to the engine jumper harness	—	—
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

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Engine Controls Components (cont'd)

Name	Location	Locator View	Connector End View
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
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	—	*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
C405D (4 cavities)	Fuel tank harness to the IP harness pass through connector, forward of the rear axle	—	*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	Attached to the rear of the left cylinder head	*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	—
S100 (Automatic Transmission)	In the engine harness, approximately 12 cm (4.7 in) from the automatic transmission breakout	—	—
S100 (Manual Transmission)	In the engine harness, approximately 5 cm (2 in) from the vehicle speed sensor breakout	—	—
S102	In the engine harness, main branch, approximately 7 cm (2.8 in) from the engine oil pressure sensor breakout	—	—
S104	in the engine harness, approximately 14 cm (5.5 in) from the powertrain control module (PCM) breakout	—	—
S105	In the engine harness at the A/C refrigerant pressure sensor breakout	—	—
S106	In the engine harness, main branch approximately 4 cm (1.6 in) from the powertrain control module (PCM) breakout	—	—
S107	In the engine harness, main branch, approximately 7 cm (2.8 in) from the powertrain control module (PCM) breakout	—	—
S108 (Automatic Transmission)	In the engine harness, main branch, approximately 5 cm (2 in) from the automatic transmission breakout	—	—

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Engine Controls Components (cont'd)

Name	Location	Locator View	Connector End View
S108 (Manual Transmission)	In the engine harness, main branch, approximately 12 cm (4.7 in) from the vehicle speed sensor breakout	—	—
S109	In the engine harness, approximately 8 cm (3.2 in) from the fuel injector 4 breakout	—	—
S110	In the engine harness, main branch, approximately 20 cm (7.9 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 17 cm (6.7 in) back from the A/C compressor clutch breakout	—	—
S115	In the engine harness, approximately 20 cm (7.9 in) back from the A/C compressor clutch breakout	—	—
S116	In the engine harness, approximately 9 cm (3.5 in) from the manifold absolute pressure (MAP) sensor breakout	—	—
S118	In the engine harness, approximately 15 cm (6 in) from the manifold absolute pressure (MAP) sensor breakout	—	—
S119 (Automatic Transmission)	In the engine harness, main branch, approximately 8 cm (3.1 in) from the automatic transmission breakout	—	—
S119 (Manual Transmission)	In the engine harness, main branch, approximately 9 cm (3.5 in) from the vehicle speed sensor breakout	—	—
S122	In the engine jumper harness	—	—
S123	In the engine jumper harness	—	—
S124	In the engine jumper harness	—	—
S125	In the engine jumper harness	—	—
S126	In the engine jumper harness	—	—
S127	In the engine jumper harness	—	—
S128	In the engine harness, approximately 4 cm (1.8 in) from the manifold absolute pressure (MAP) 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	—	—
S177	In the forward lamp harness, approximately 5 cm (2 in) from the engine wiring harness junction block 1 breakout	—	—

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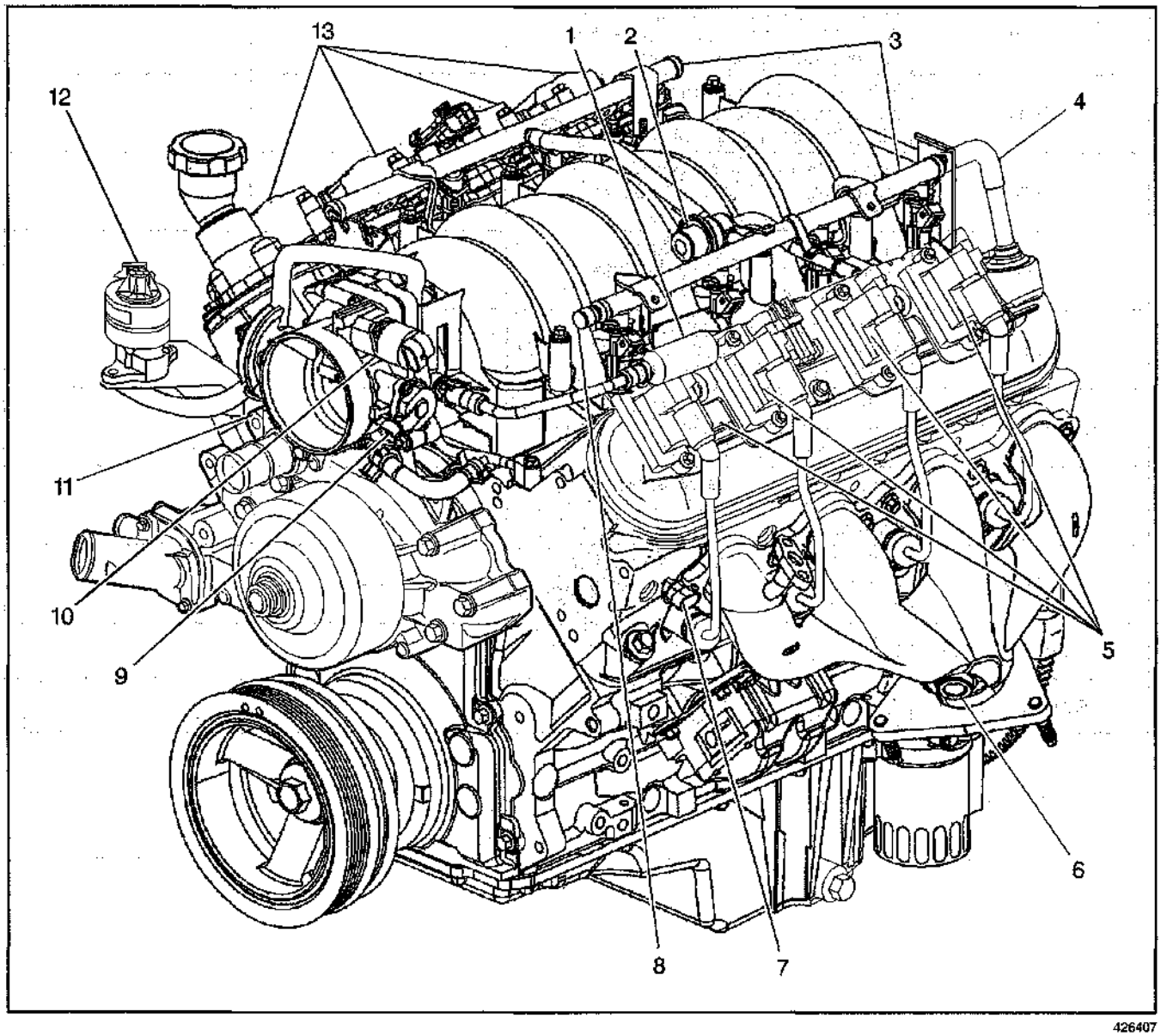
Engine Controls Components (cont'd)

Name	Location	Locator View	Connector End View
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	—	—
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	—	—
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	—	—

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Engine Controls Component Views

Full Engine View LH Side



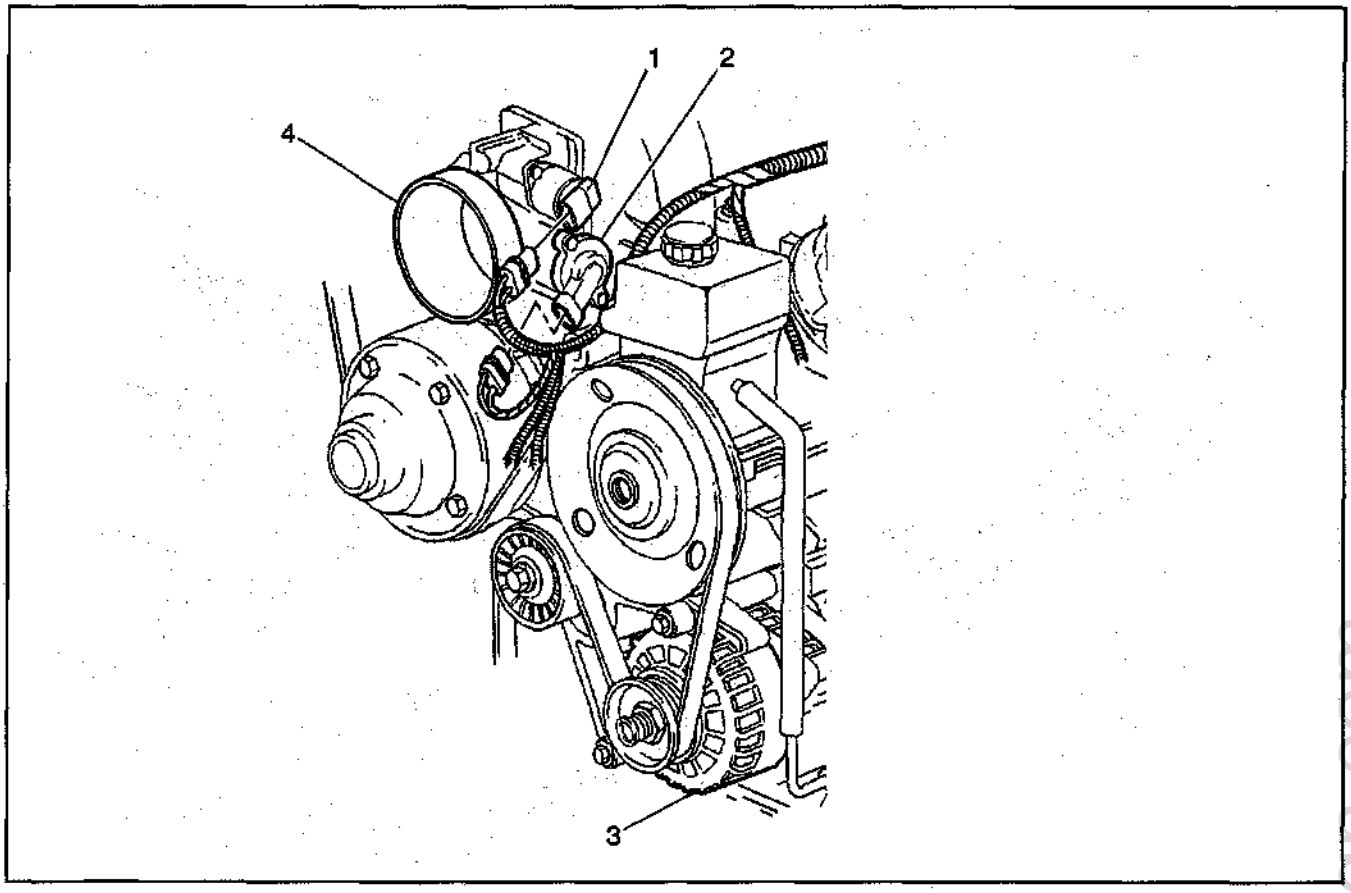
426407

Legend

(1) EVAP Canister Purge Solenoid
(2) Fuel Pulse Dampener
(3) Fuel Rail With Injectors
(4) PCV Crossover Hose
(5) Left Bank Ignition Coils/Modules
(6) Left Bank HO2S Sensor 1 Mounting Flange
(7) Engine Coolant Temperature (ECT) Sensor
(8) Fuel Pressure Gauge Test Connector
(9) Throttle Position (TP) Sensor
(10) Idle Air Control (IAC)
(11) Throttle Body
(12) Exhaust Gas Recirculation (EGR) Valve
(13) Right Bank Ignition Coils/Modules

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Idle Air Control (IAC) Motor, Throttle Position (TP) Sensor, Generator



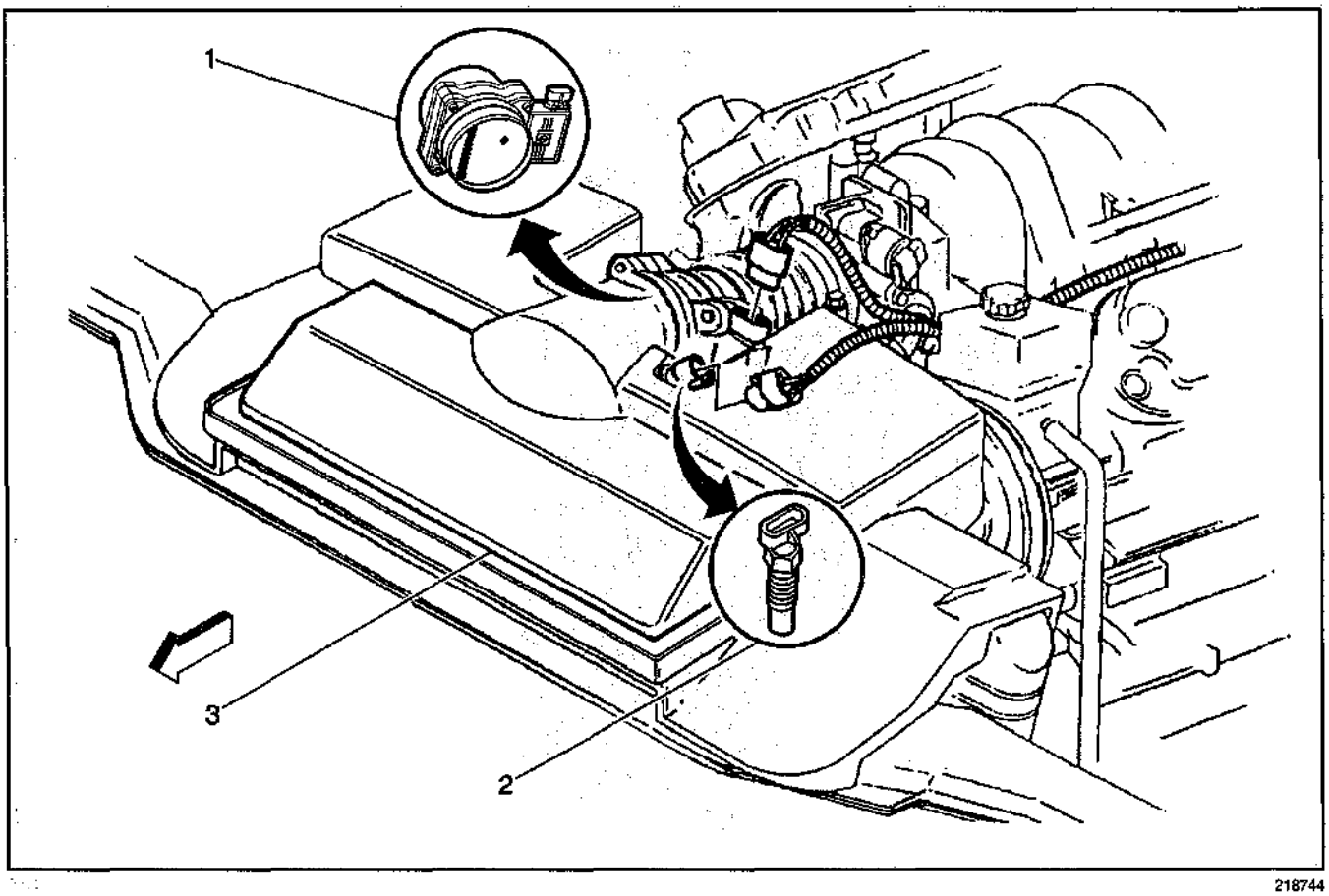
218866

Legend

(1) Idle Air Control (IAC) Motor
(2) Throttle Position (TP) Sensor
(3) Generator
(4) Throttle Body

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Mass Air Flow Sensor and Intake Air Temperature Sensor



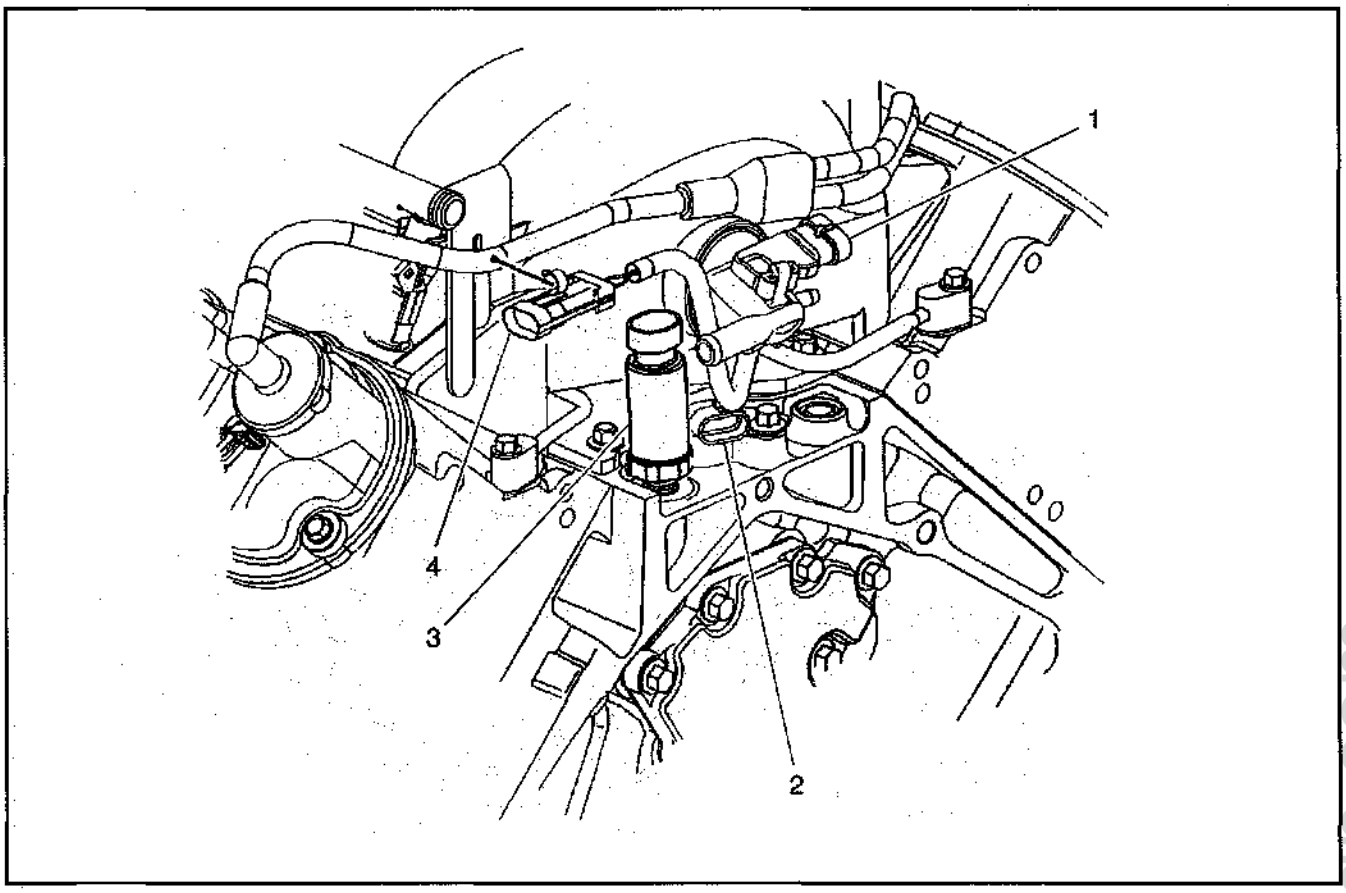
218744

Legend

(1) Mass Air Flow (MAF) Sensor
(2) Intake Air Temperature (IAT) Sensor
(3) Air Cleaner Housing

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Manifold Absolute Pressure (MAP) Sensor, Camshaft Position (CMP) Sensor, Oil Pressure Switch



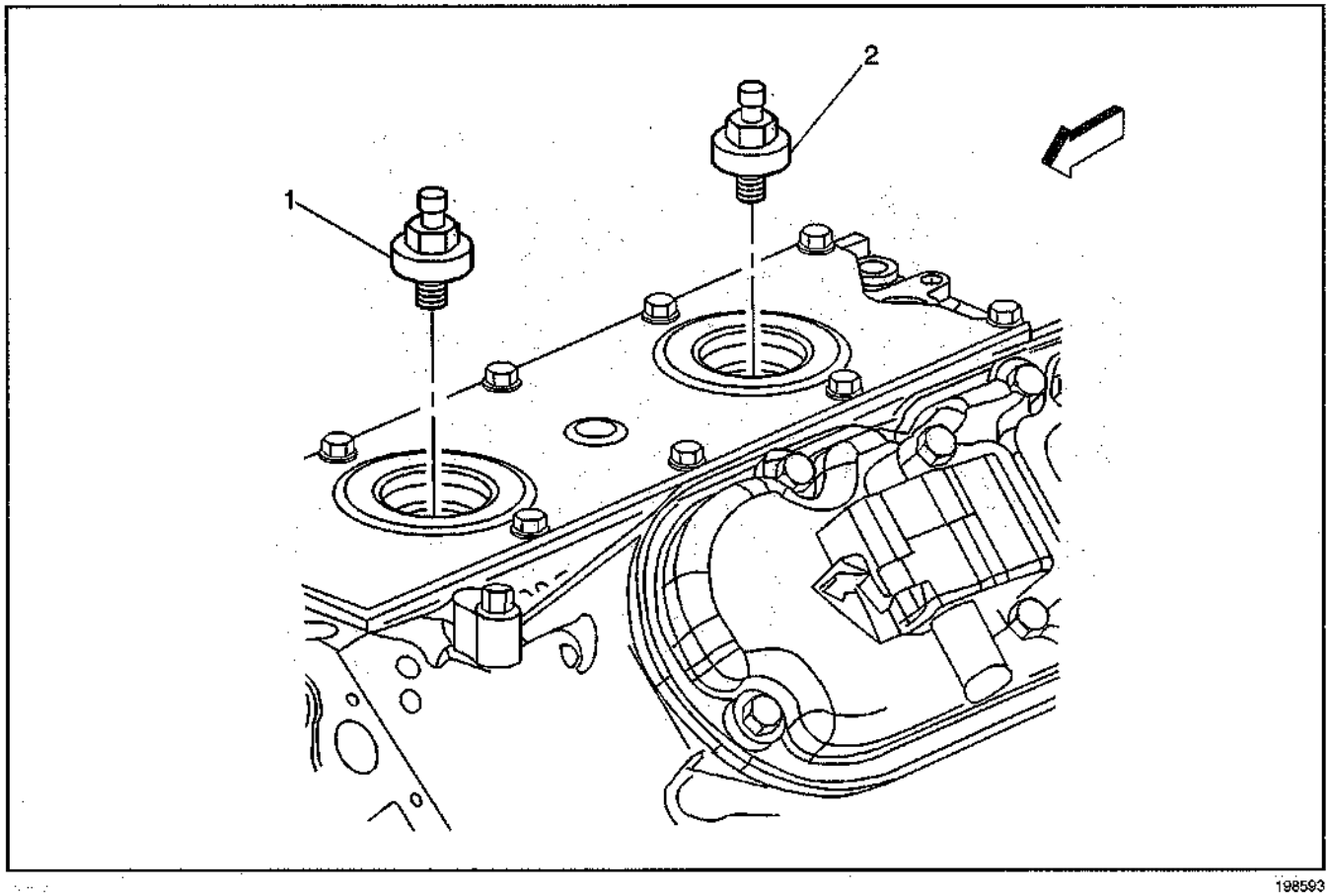
247435

Legend

(1) Manifold Absolute Pressure (MAP) sensor
(2) Camshaft Position (CMP) sensor
(3) Oil Pressure switch
(4) Connector to Knock sensor jumper harness

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Knock Sensors



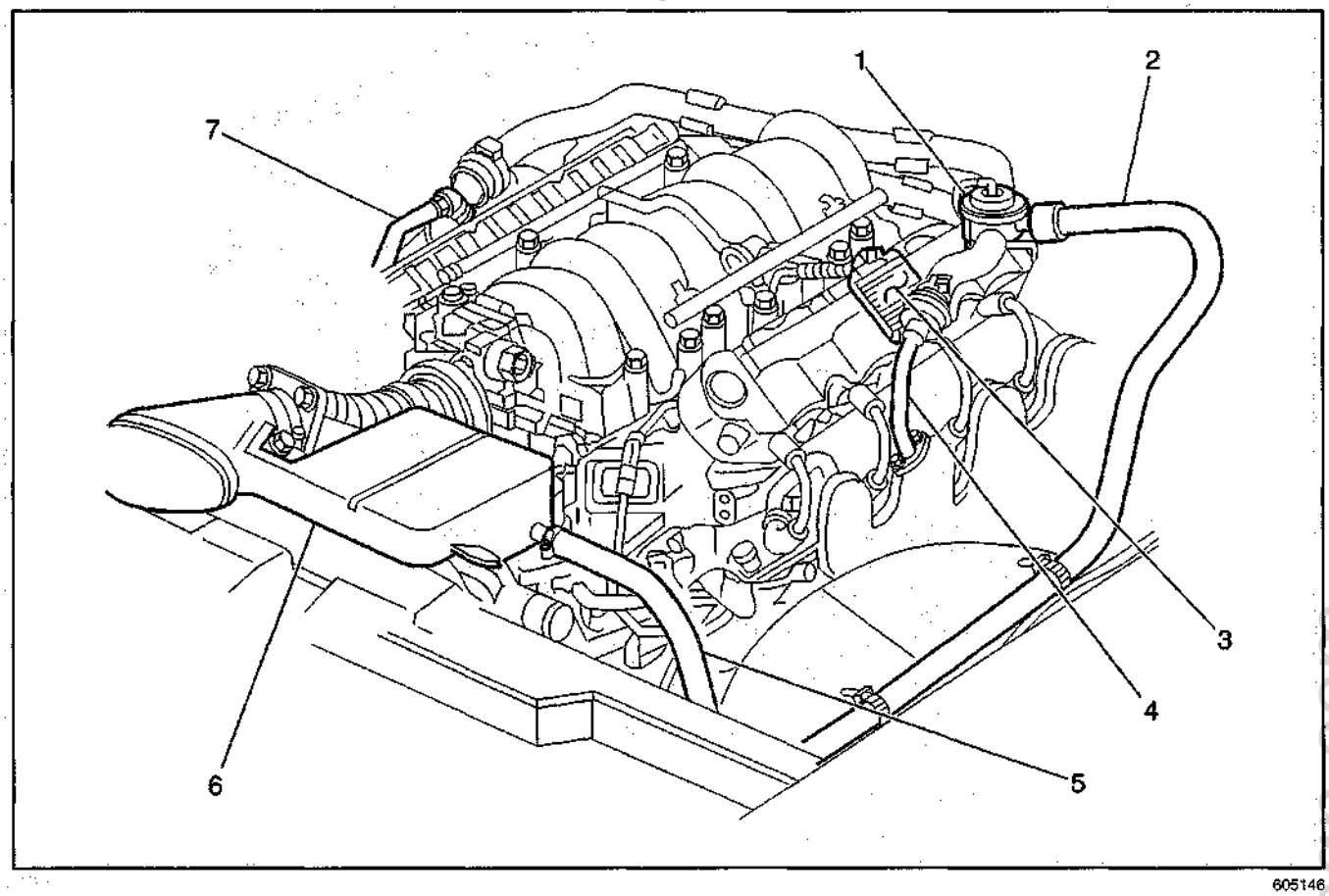
198593

Legend

(1) Front Knock Sensor
(2) Rear Knock Sensor

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AIR System

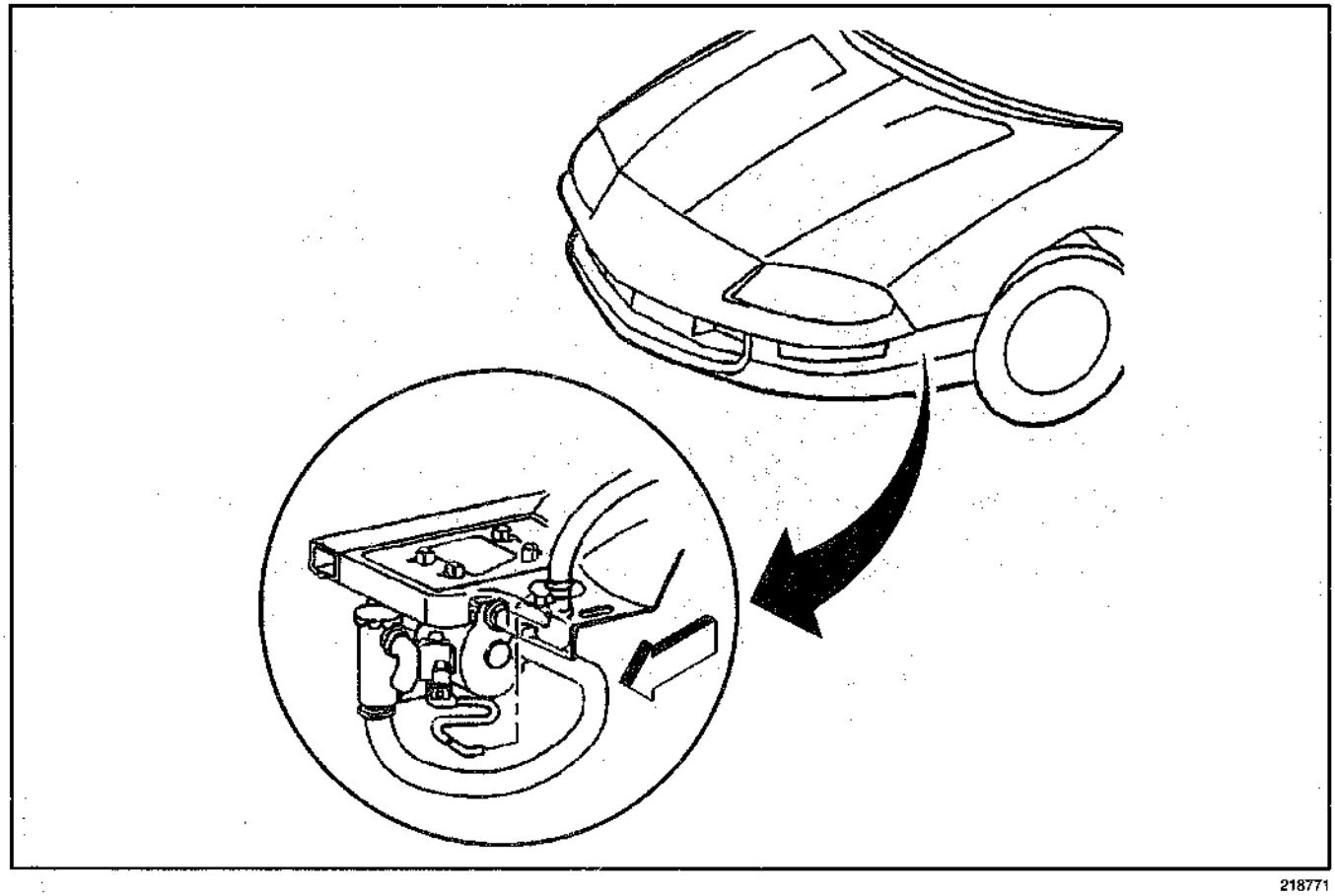


Legend

(1) AIR Shut Off Valve
(2) Air supply hose from AIR Pump
(3) AIR Solenoid Valve
(4) Left Bank AIR Tube and Check Valve
(5) Air inlet hose to AIR pump
(6) Air Cleaner Housing
(7) Right Bank AIR Tube and Check Valve

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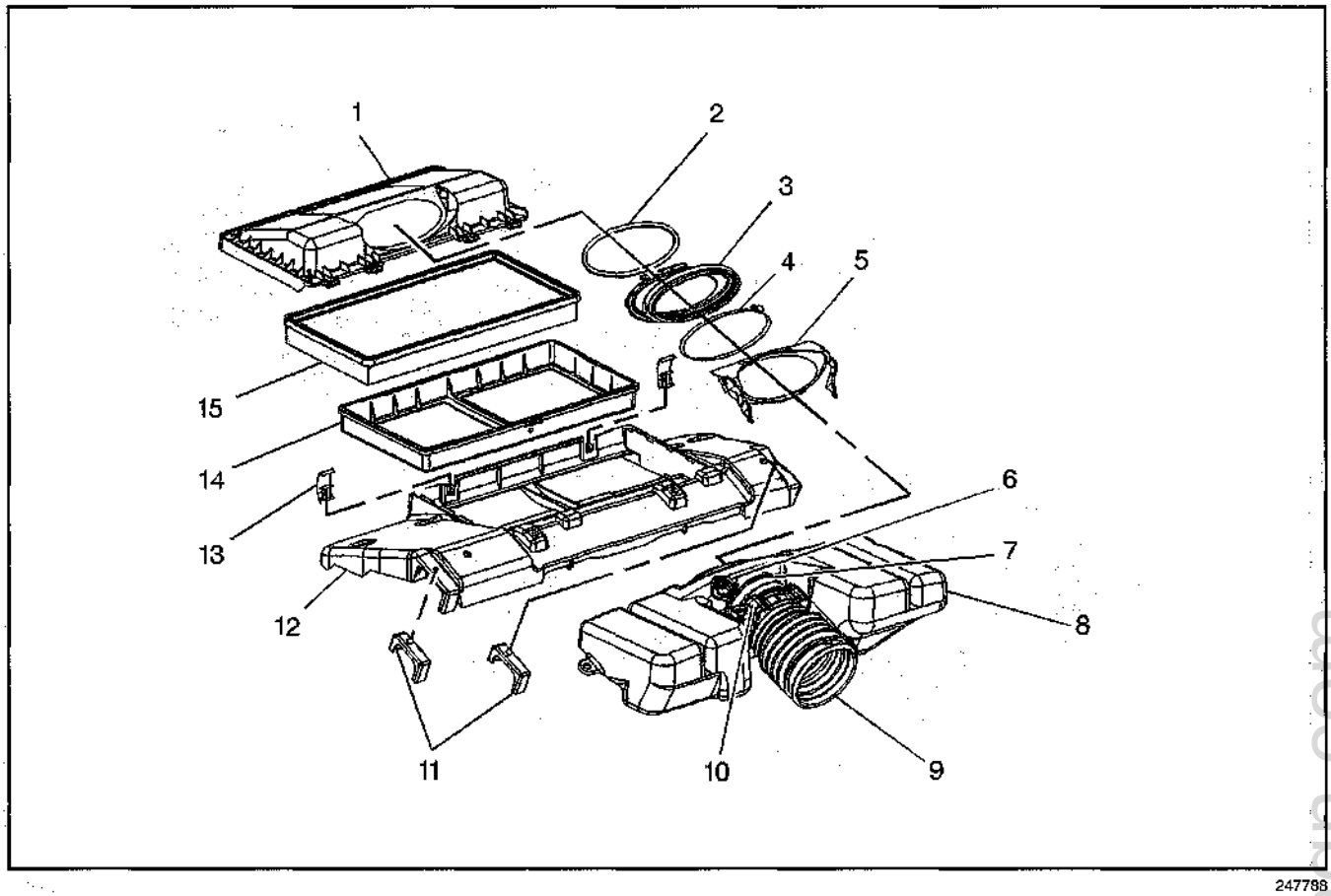
AIR Pump Location



218771

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Air Cleaner Housing and Resonator



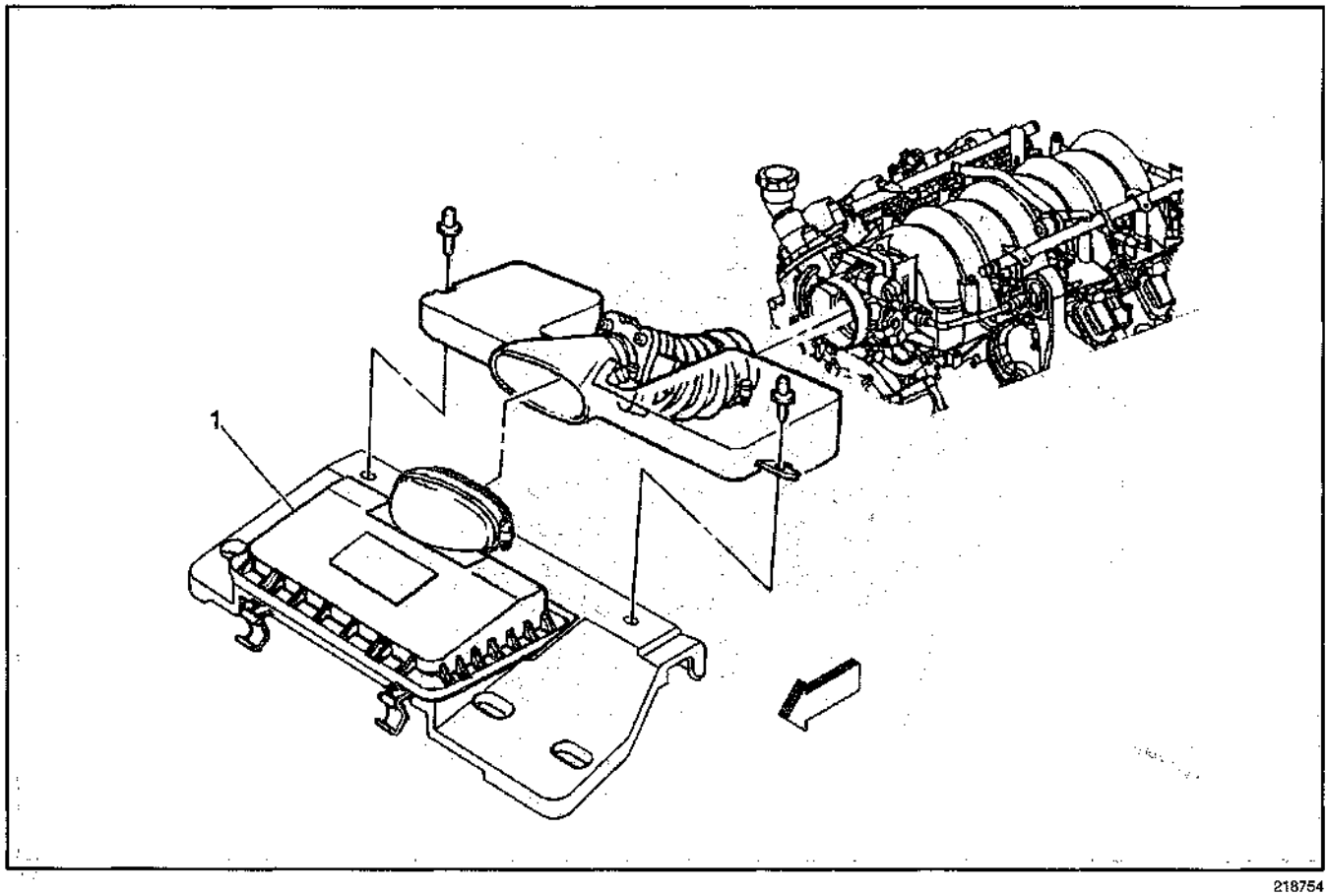
247788

Legend

(1) Air cleaner housing top cover
(2) Seal
(3) Air intake duct to resonator
(4) Clamp
(5) Air intake duct to top cover retainer
(6) Intake Air Temperature (IAT) sensor
(7) Clamp
(8) Air intake resonator
(9) Air intake duct to throttle body
(10) Mass Airflow (MAF) sensor
(11) Isolator
(12) Air cleaner housing lower assembly
(13) Front retaining clips
(14) Air filter element frame
(15) Air filter element

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Air Cleaner Location

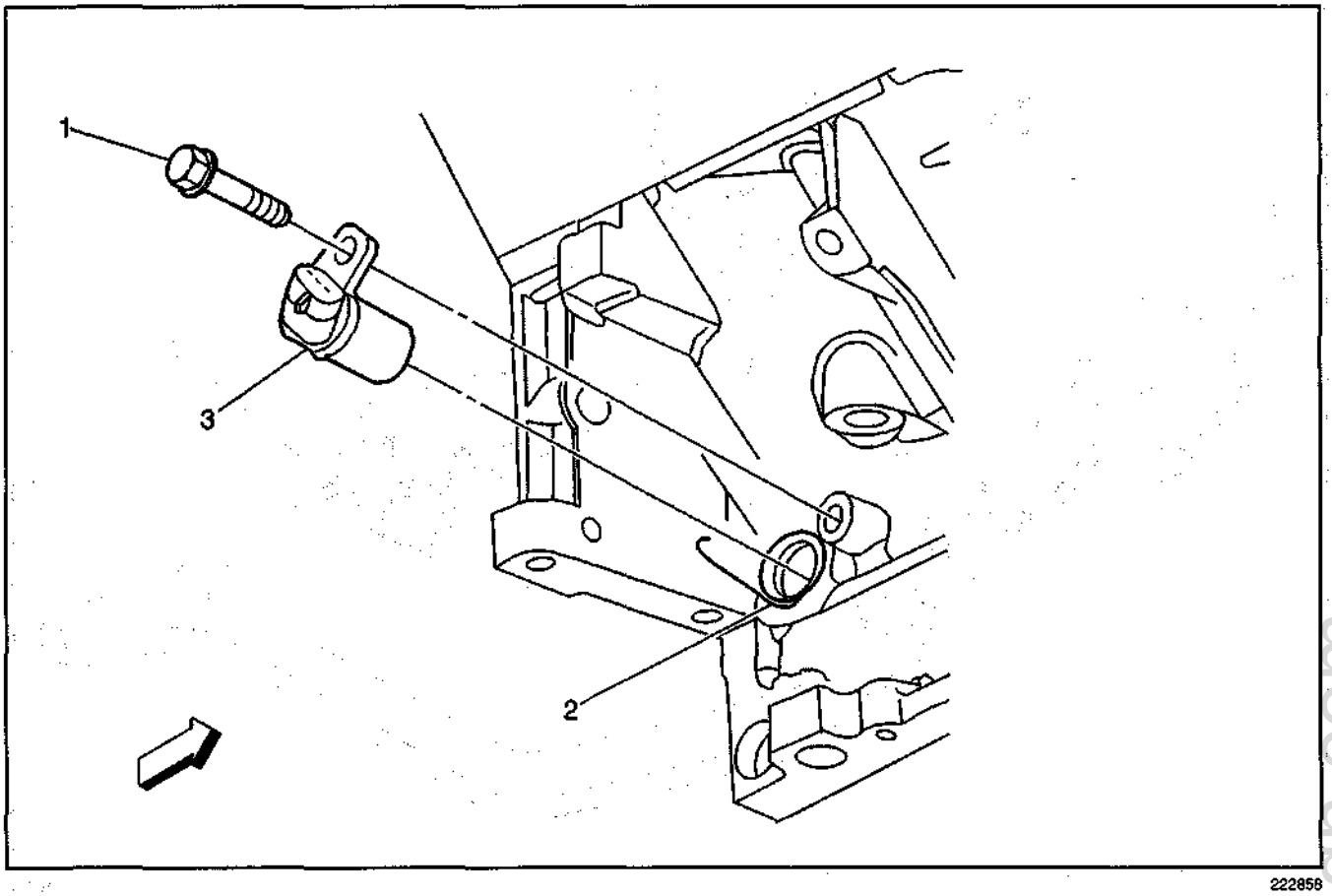


Legend

(1) Air Cleaner Housing

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Crankshaft Position Sensor Location



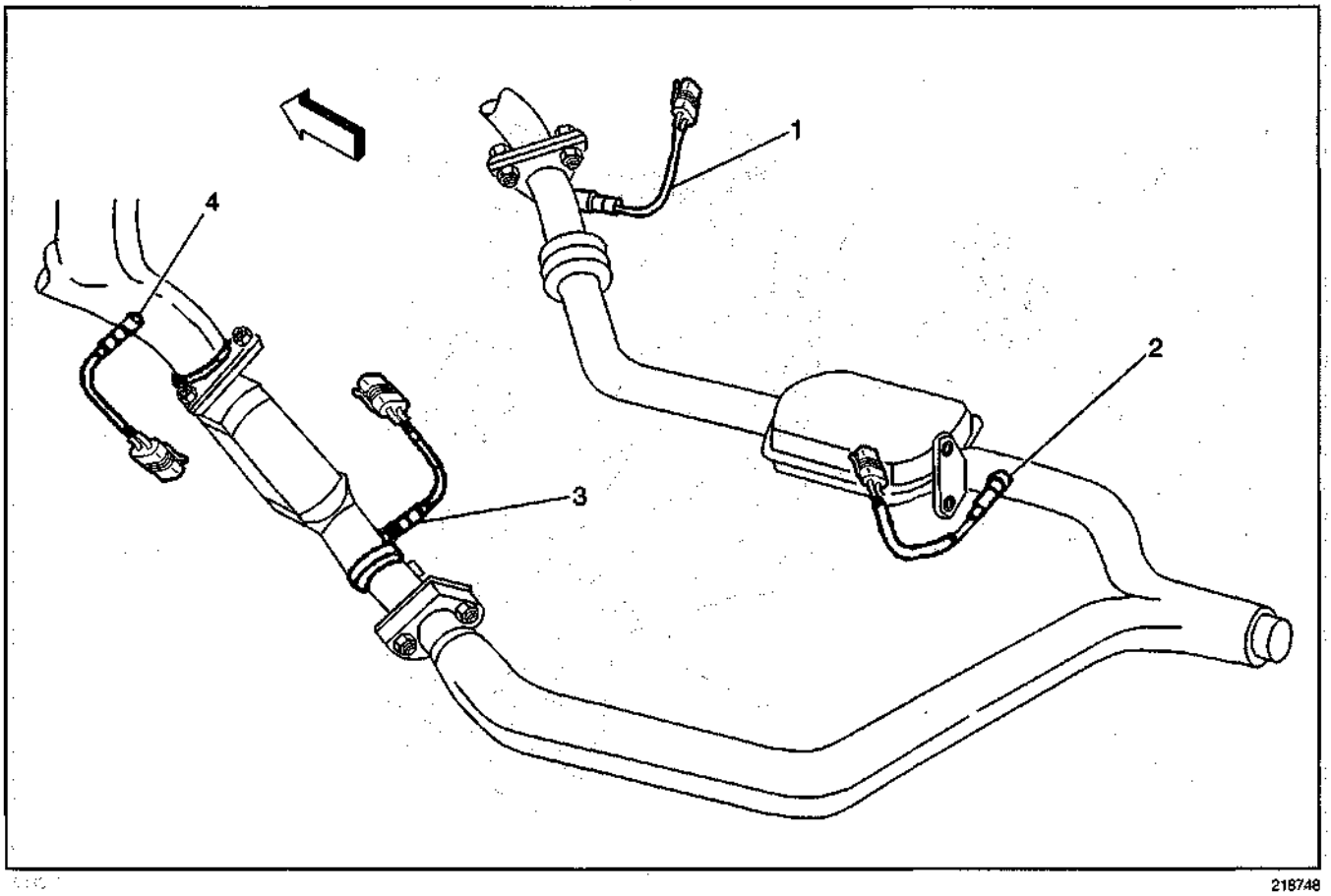
222858

Legend

(1) CKP Mounting Bolt
(2) CKP Mounting Location
(3) Crankshaft Position Sensor (CKP)

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HO2S Location

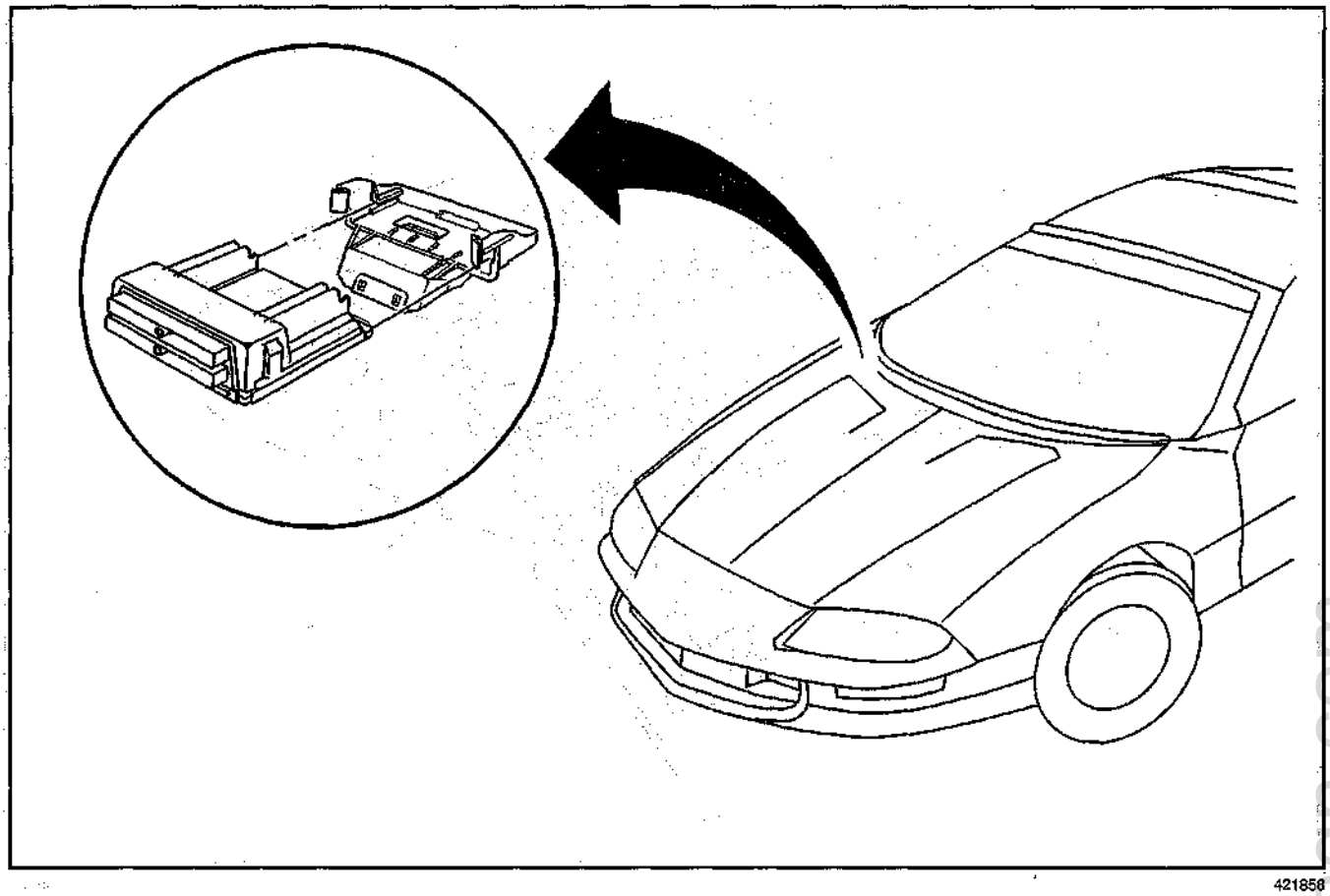


Legend

(1) HO2S Bank 2 Sensor 1
(2) HO2S Bank 2 Sensor 2
(3) HO2S Bank 1 Sensor 2
(4) HO2S Bank 1 Sensor 1

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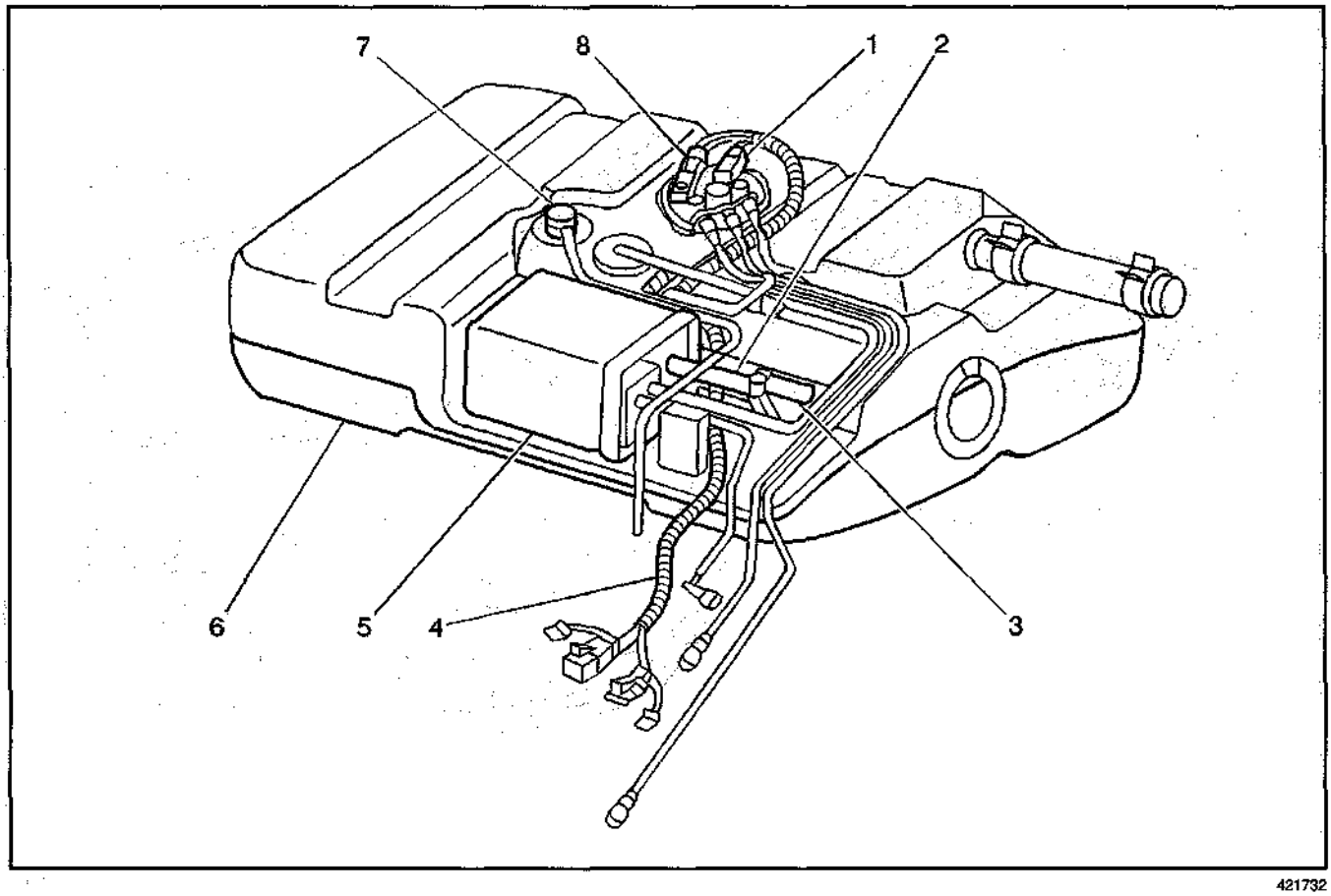
PCM Location



421858

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Fuel Tank Assembly with EVAP Canister



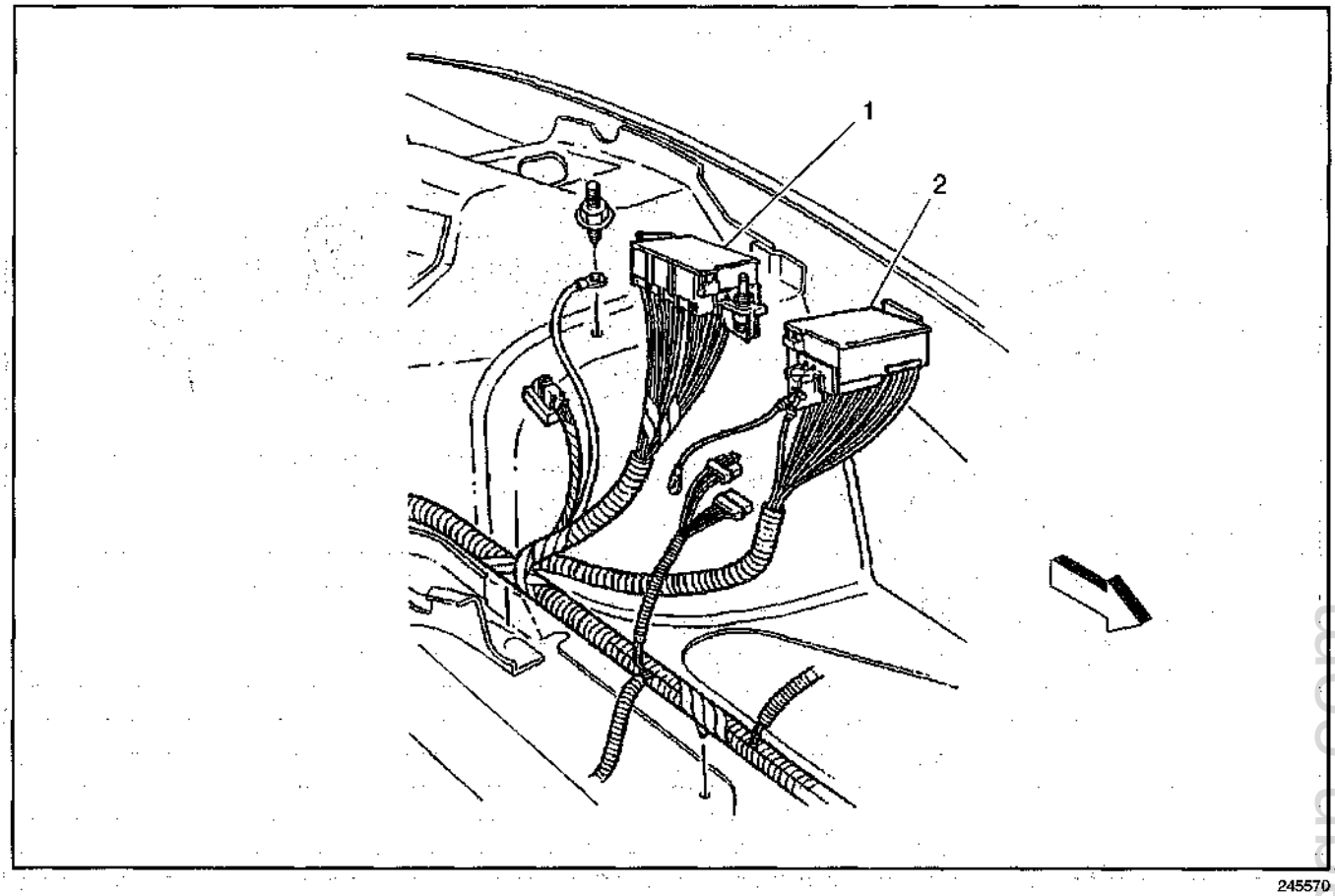
421732

Legend

(1) Fuel Sender Assembly
(2) Hose (EVAP Canister to Vent Solenoid)
(3) EVAP Vent Valve
(4) Fuel Tank Harness
(5) EVAP Canister
(6) Fuel Tank
(7) Overpressure Relief Valve
(8) Fuel Tank Pressure Sensor

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Fuse Blocks #1 and #2



Legend

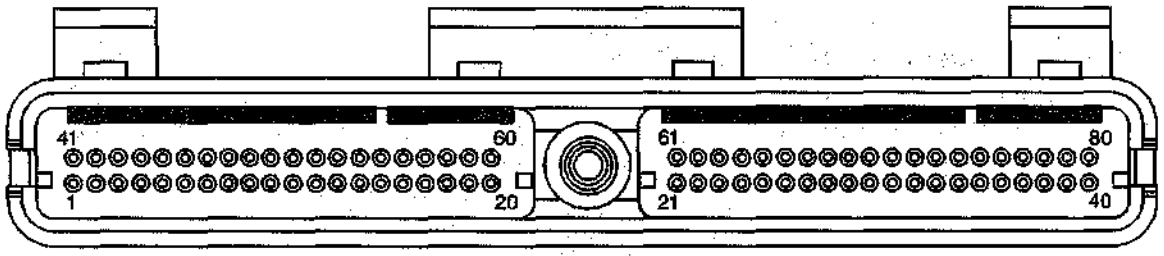
(1) Fuse Block #1

(2) Fuse Block #2

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PCM Connector End Views

PCM Connector C1 (BLU)

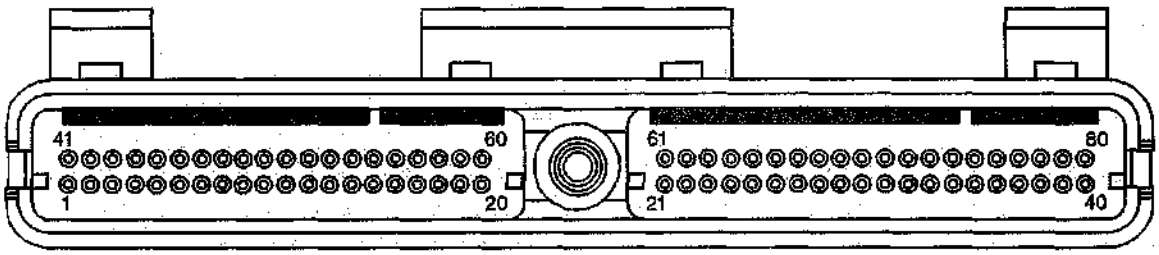


23346

Connector Part Information		• PCM Connector C1 Assembly 12191489 • TPA (BLU) 12176408 • Connector Cover 12191108	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	BLK	451	PCM Ground
2	LT GRN	1867	Crankshaft Position Sensor B+ Supply
3	PNK/BLK	1746	Injector 3 Control
4	LT GRN/BLK	1745	Injector 2 Control
5–7	—	—	Not Used
8	GRA	596	TP Sensor 5V Reference
9–10	—	—	Not Used
11	LT BLU	1876	Knock Sensor Signal Rear
12	DK BLU/WHT	1869	Crankshaft Position Sensor Signal
13–16	—	—	Not Used
17	DK BLU	1225	Transmission Range Signal B
18	RED	1226	Transmission Range Signal C
19	PNK	439	Ignition Positive Voltage
20	ORN	340	Battery Positive Voltage
21	YEL/BLK	1868	Crankshaft Position Sensor Reference Low
22	—	—	Not Used
23	GRA	720	Fuel Tank Pressure Sensor/Fuel Tank Sender Ground
24	—	—	Not Used
25	TAN	1671	HO2S Signal Low Bank 2 Sensor 2
26	TAN	1667	HO2S Signal Low Bank 2 Sensor 1
27	—	—	Not Used
28	TAN/WHT	1669	HO2S Signal Low Bank 1 Sensor 2
29	TAN/WHT	1653	HO2S Signal Low Bank 1 Sensor 1
30–31	—	—	Not Used
32	GRY	48	Clutch Pedal Position Switch Signal
33	PPL	420	TCC Brake Switch
34	ORN/BLK	434	PNP Switch Signal
35	—	—	Not Used
36	BLK	1744	Injector 1 Control
37	YEL/BLK	846	Injector 6 Control
38-39	—	—	Not Used
40	BLK	451	PCM Ground
41	BLK	407	EGR Pintle Position Sensor Ground
42	DK GRN	335	Engine Cooling Fan Relay 1 Control
43	RED/BLK	877	Injector 7 Control

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PCM Connector C1 (BLU) (cont'd)

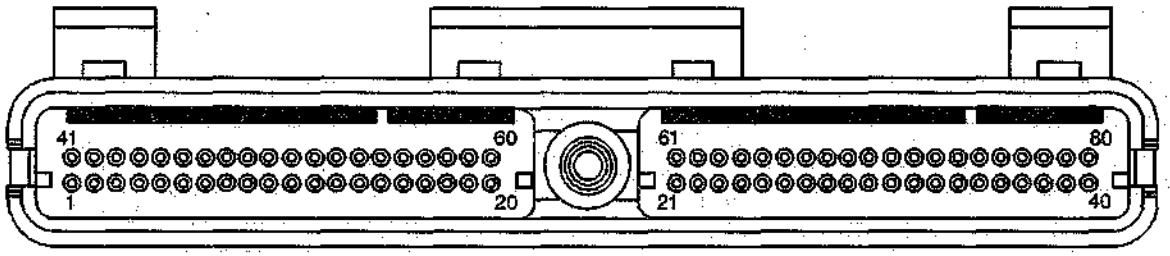


23346

Connector Part Information		• PCM Connector C1 Assembly 12191489 • TPA (BLU) 12176408 • Connector Cover 12191108	
Pin	**Wire Color**	**Circuit No.**	**Function**
44	LT BLU/BLK	844	Injector 4 Control
45	GRA	474	A/C Refrigerant Pressure Sensor 5V Reference
46	GRA	474	Fuel Tank Pressure Sensor 5V Reference
47	GRA	416	EGR Pintle Position Sensor 5V Reference
48	GRA	416	MAP Sensor 5V Reference
49-50	—	—	Not Used
51	DK BLU	496	Knock Sensor Signal Front
52	—	—	Not Used
53	BLK	407	Transmission Temperature Sensor Ground
54	ORN/BLK	407	MAP Sensor Ground
55	BRN	1456	EGR Pintle Position Sensor Signal
56	—	—	Not Used
57	ORN	340	Battery Positive Voltage
58	DK GRN	1049	Serial Data
59	—	—	Not Used
60	BLK	452	TP Sensor Ground
61	PNK/BLK	632	Camshaft Position Sensor Reference Low
62-64	—	—	Not Used
65	PPL	1670	HO2S Signal High Bank 2 Sensor 2
66	PPL	1666	HO2S Signal High Bank 2 Sensor 1
67	—	—	Not Used
68	PPL/WHT	1668	HO2S Signal High Bank 1 Sensor 2
69	PPL/WHT	1665	HO2S Signal High Bank 1 Sensor 1
70	BRN	1174	Low Oil Level Switch
71-72	—	—	Not Used
73	BRN/WHT	633	Camshaft Position (CMP) Sensor Signal
74	YEL	410	Engine Coolant Temperature (ECT) Sensor Signal
75	—	—	Not Used
76	BLK/WHT	845	Injector 5 Control
77	DK BLU/WHT	878	Injector 8 Control
78	—	—	Not Used
79	GRA or WHT	587 or 687	Skip Shift Solenoid Control (M/T) or 3-2 Shift Solenoid Control (A/T)
80	BLK	407	Engine Coolant Temperature (ECT) Sensor Ground

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PCM Connector C2 (RED)

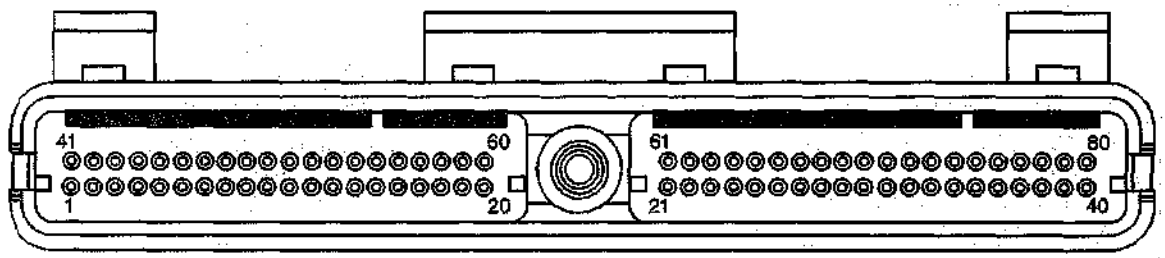


23346

Connector Part Information		• PCM Connector C2 Assembly 12191488 • TPA (RED) 12176410 • Connector Cover 12191108	
Pin	**Wire Color**	**Circuit No.**	**Function**
1	BLK	451	PCM Ground
2	BRN	418	TCC Control Solenoid
3	—	—	Not Used
4	PPL	421	AIR Solenoid Relay Control
5	—	—	Not Used
6	RED/BLK	1228	Transmission Fluid Pressure Control Solenoid High
7	RED	1676	EGR Control
8	LT BLU/WHT	1229	Transmission Fluid Pressure Control Solenoid Low
9	DK GRN/WHT	465	Fuel Pump Relay Control
10	WHT	121	Engine Speed (Tach) Output Signal
11–12	—	—	Not Used
13	WHT	85	Cruise Control Enable Signal
14	RED/BLK	380	A/C Refrigerant Pressure Sensor Signal
15	RED	225	Alternator L Terminal
16	—	—	Not Used
17	DK GRN/WHT	762	A/C Request Signal
18	DK GRN	59	A/C Status Signal
19	—	—	Not Used
20	LT GRN/BLK	822	Vehicle Speed Sensor (VSS) Reference Low
21	PPL/WHT	821	Vehicle Speed Sensor (VSS) Signal
22–23	—	—	Not Used
24	DK BLU	417	TP Sensor Signal
25	TAN	472	IAT Sensor Signal
26	PPL	2121	Ignition Control 1
27	RED	2127	Ignition Control 7
28	LT BLU/WHT	2126	Ignition Control 6
29	DK GRN/WHT	2124	Ignition Control 4
30	DK BLU	229	VTD Fuel Enable Signal
31	YEL	492	MAF Sensor Signal
32	LT GRN	432	MAP Sensor Signal
33	DK BLU	473	Engine Cooling Fan Relay 2 and 3 Control
34	DK GRN/WHT	428	EVAP Canister Purge Valve Control
35	—	—	Not Used
36	BRN	436	AIR Pump Relay Control
37	DK GRN	83	Cruise Control Inhibit
38	—	—	Not Used
39	RED	631	Camshaft Position Sensor B+ Supply

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PCM Connector C2 (RED) (cont'd)



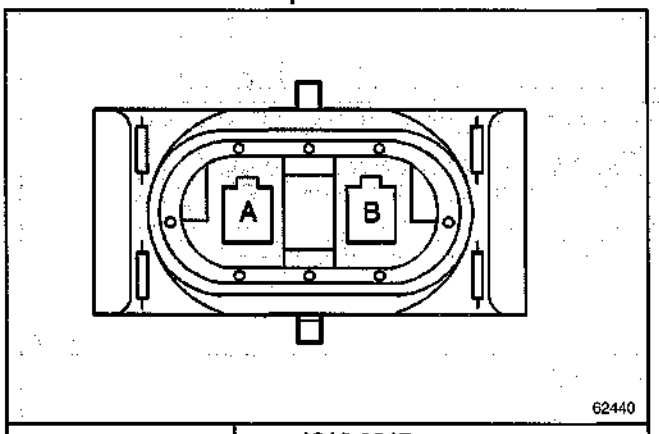
23346

Connector Part Information		• PCM Connector C2 Assembly 12191488 • TPA (RED) 12176410 • Connector Cover 12191108	
Pin	**Wire Color**	**Circuit No.**	**Function**
40	BLK	451	PCM Ground
41	GRA	435	EGR Position Sensor Ground
42	TAN/BLK	422	TCC Enable Circuit
43	DK GRN/WHT	459	A/C Clutch Relay Control
44	LT GRN	1652	Reverse Inhibit Solenoid Control
45	WHT	1310	EVAP Canister Vent Valve Control
46	BRN/WHT	419	Malfunction Indicator Lamp (MIL) Control
47	YEL/BLK	1223	Transmission Shift Solenoid B
48	LT GRN	1222	Transmission Shift Solenoid A
49	—	—	Not Used
50	DK GRN/WHT	817	Vehicle Speed Output Circuit
51	YEL/BLK	1227	Transmission Temperature Sensor Signal
52	—	—	Not Used
53	GRA/BLK	1687	Spark Retard Signal
54	PPL	1589	Fuel Level Sensor Signal
55-56	—	—	Not Used
57	PPL	719	IAT Sensor Ground
58-59	—	—	Not Used
60	BRN	2129	Ignition Control Reference Low Bank 1
61	BRN/WHT	2130	Ignition Control Reference Low Bank 2
62	—	—	Not Used
63	PNK	1224	Transmission Range Signal A
64	DK GRN	890	Fuel Tank Pressure Sensor Signal
65	—	—	Not Used
66	PPL/WHT	2128	Ignition Control 8
67	RED/WHT	2122	Ignition Control 2
68	DK GRN	2125	Ignition Control 5
69	LT BLU	2123	Ignition Control 3
70-75	—	—	Not Used
76	LT GRN/WHT	1749	IAC Coil B High
77	LT GRN/BLK	444	IAC Coil B Low
78	LT BLU/BLK	1748	IAC Coil A Low
79	LT BLU/WHT	1747	IAC Coil A High
80	—	—	Not Used

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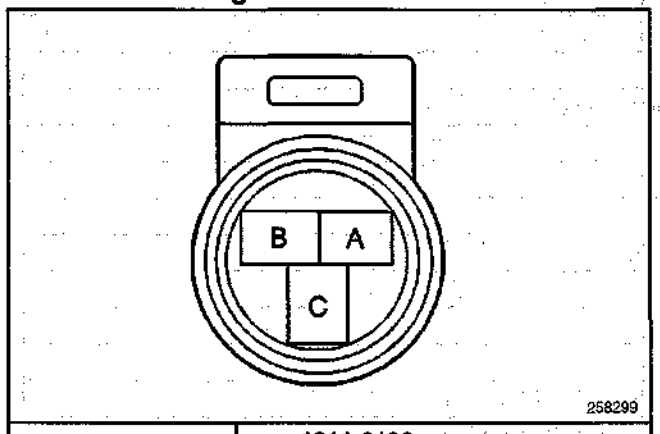
Engine Controls Connector End Views

A/C Compressor Clutch



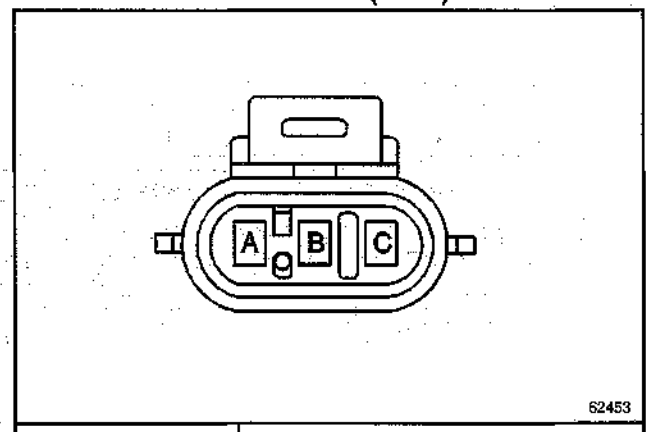
Connector Part Information	• 1216-2017 • 2 Way F Metri-Pack 150 Series (GRY)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	DK GRN	59	A/C Compressor Clutch Control
B	BLK	450	A/C Compressor Clutch Ground

A/C Refrigerant Pressure Sensor



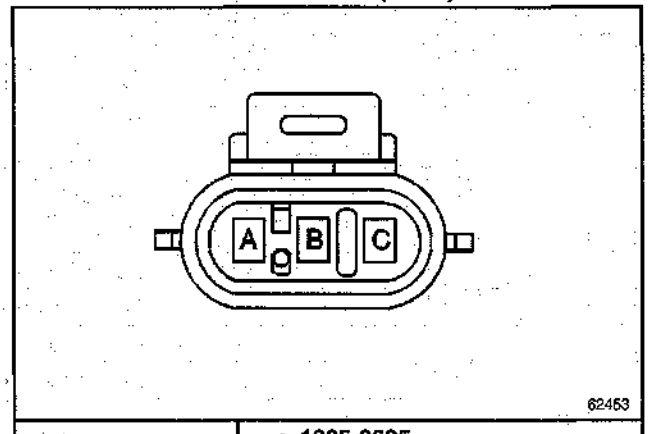
Connector Part Information	• 1211-0192 • 3 Way F Metri-Pack 150 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PPL	719	A/C Refrigerant Pressure Sensor Ground
B	GRY	474	A/C Refrigerant Pressure Sensor 5.0V Reference
C	RED/BLK	380	A/C Refrigerant Pressure Sensor Signal

Camshaft Position (CMP) Sensor



Connector Part Information	• 1205-9595 • 3 Way F Metri-Pack 150 Series (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BRN/WHT	633	Camshaft Position (CMP) Sensor Signal Input
B	PNK/BLK	632	Reference Low
C	RED	631	Ignition Feed

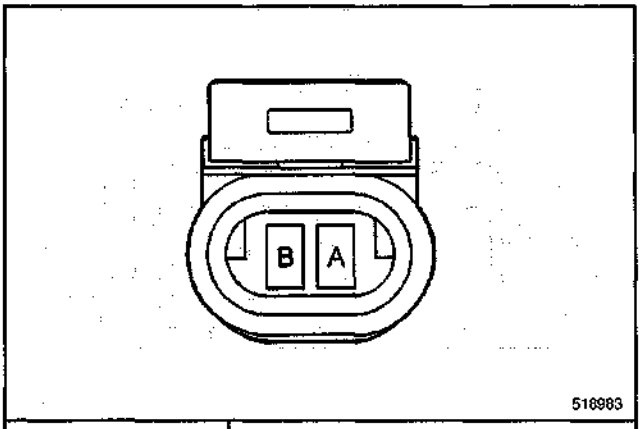
Crankshaft Position (CKP) Sensor



Connector Part Information	• 1205-9595 • 3 Way Metri-Pack 150 Series (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	DK BLU/ WHT	1869	Crankshaft Position (CKP) Sensor Signal Input
B	YEL/BLK	1868	Reference Low
C	LT GRN	1867	Ignition Feed

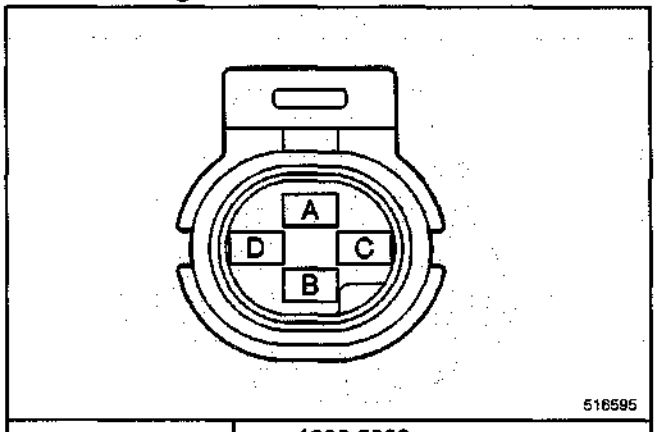
cardiagn.com

Engine Coolant Temperature Sensor



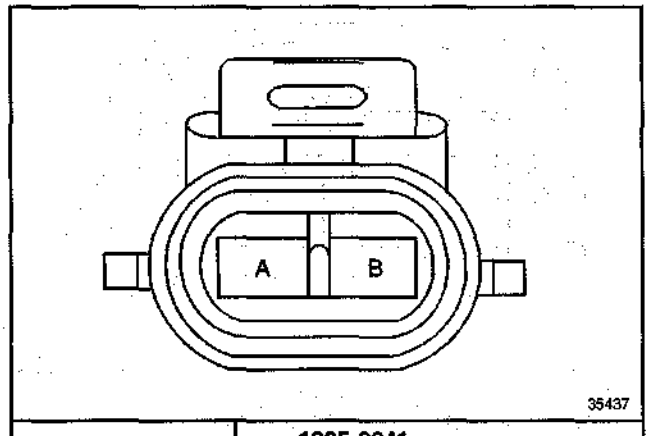
Connector Part Information	• 1216-2195 • 2 Way F Metri-Pack 150.2 Series Sealed P2S (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BLK	407	Sensor Ground
B	YEL	410	Engine Coolant Temperature Sensor (ECT) Signal

Engine Oil Pressure Sensor



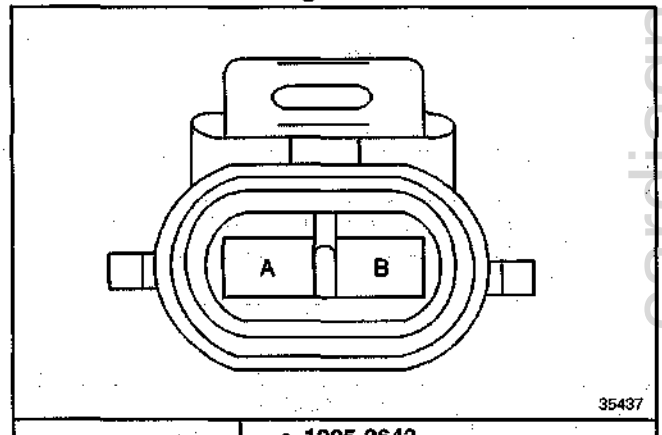
Connector Part Information	• 1206-5299 • 4 Way F Metri-Pack 150 Series Sealed (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	TAN	31	Oil Pressure Sensor Output
B	BLK/WHT	451	Ground
C-D	—	—	Not Used

Engine Oil Level Switch



Connector Part Information	• 1205-2641 • 2 Way F Metri-Pack 150 Series Sealed (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BRN	1174	Oil Level Switch Input
B	BLK/WHT	451	Ground

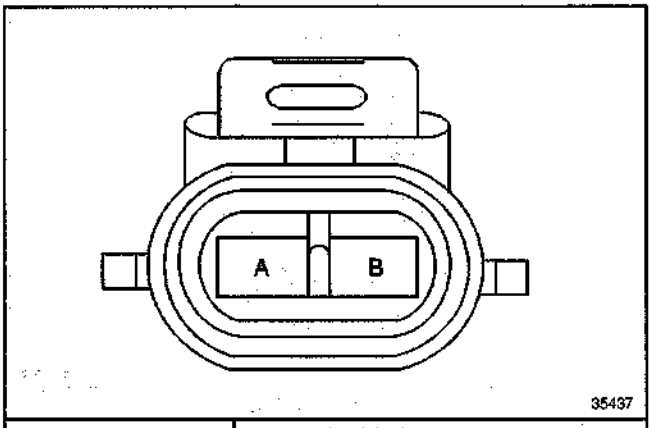
Evaporative Emission (EVAP) Canister Purge Valve



Connector Part Information	• 1205-2643 • 2 Way Metri-Pack 150 Series Sealed (RED)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	239	Fused Ignition Feed
B	DK GRN/WHT	428	EVAP Canister Purge Valve Control

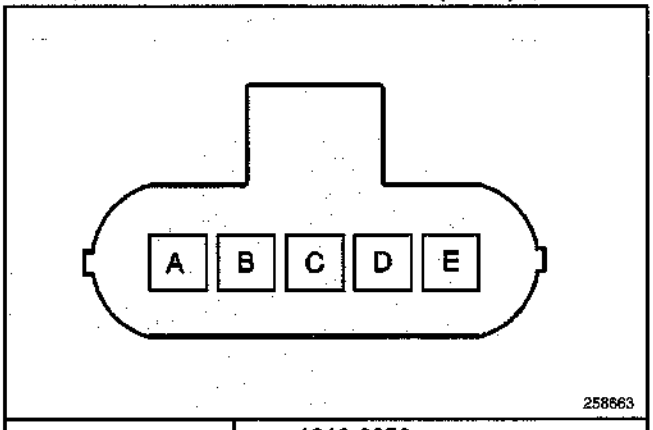
cardiagn.com

Evaporative Emission (EVAP) Canister Vent Valve



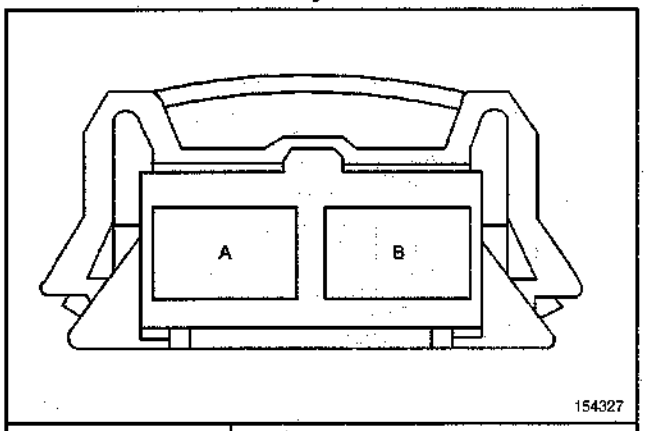
Connector Part Information	• 1205-2643 • 2 Way F Metri-Pack 150 Series Sealed (RED)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	239	Fused Ignition Feed
B	WHT	1310	EVAP Canister Vent Valve Control

Exhaust Gas Recirculation (EGR) Valve



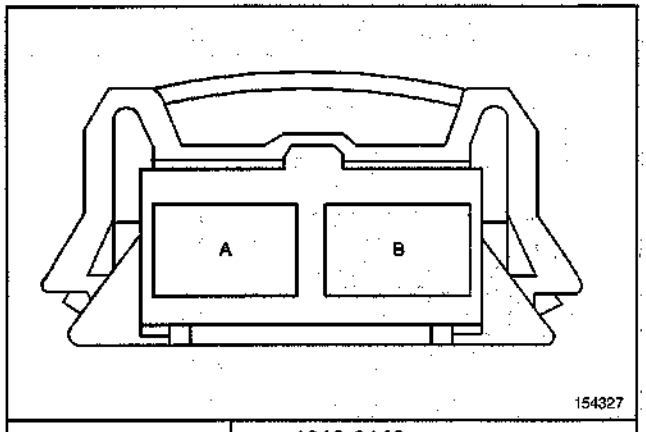
Connector Part Information	• 1218-6056 • 5 Way F Metri-Pack 150 Series Pull to Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	GRY	435	Exhaust Gas Recirculation (EGR) Valve Ground
B	BLK	407	Exhaust Gas Recirculation (EGR) Sensor Ground
C	BRN	1456	Exhaust Gas Recirculation (EGR) Pintle Position
D	GRY	416	Exhaust Gas Recirculation (EGR) 5V Reference
E	RED	1676	Exhaust Gas Recirculation (EGR) Valve Control

Fuel Injector #1



Connector Part Information	• 1212-9140 • 2 Way F Metri-Pack 280.1 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	639	Fused Ignition Feed
B	BLK	1744	Fuel Injector #1 Control

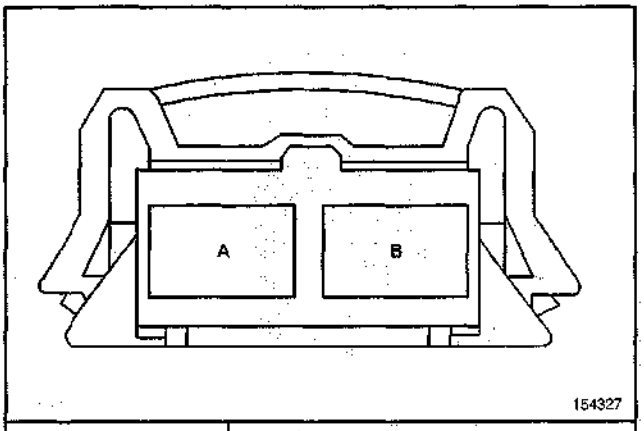
Fuel Injector #2



Connector Part Information	• 1212-9140 • 2 Way F Metri-Pack 280.1 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	839	Fused Ignition Feed
B	LT GRN/ BLK	1745	Fuel Injector #2 Control

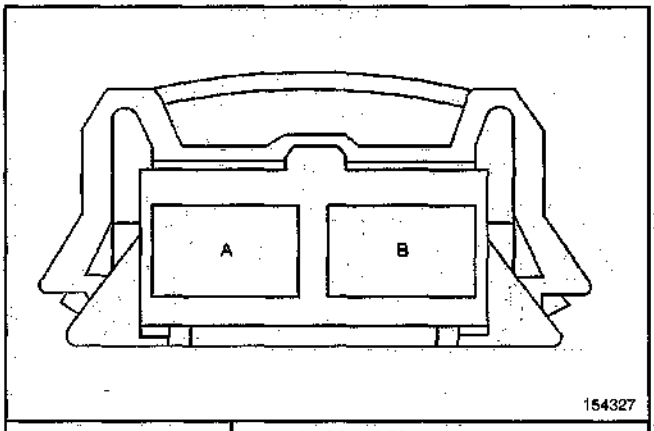
cardiagn.com

Fuel Injector #3



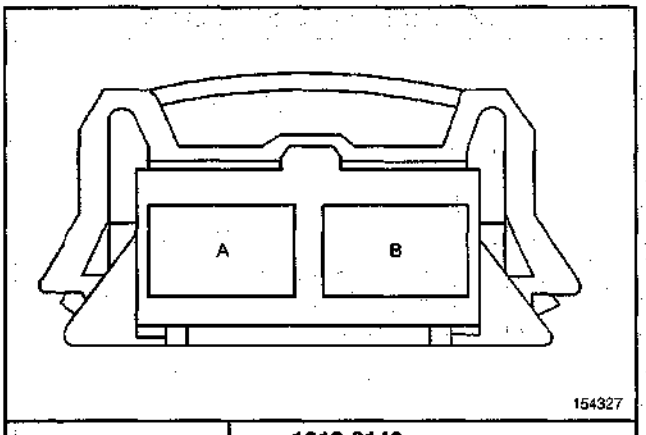
Connector Part Information	• 1212-9140 • 2 Way F Metri-Pack 280.1 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	639	Fused Ignition Feed
B	PNK/BLK	1746	Fuel Injector #3 Control

Fuel Injector #5



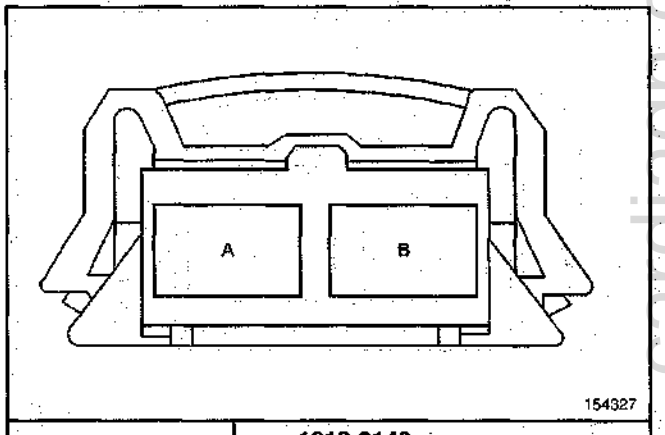
Connector Part Information	• 1212-9140 • 2 Way F Metri-Pack 280.1 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	639	Fused Ignition Feed
B	BLK/WHT	845	Fuel Injector #5 Control

Fuel Injector #4



Connector Part Information	• 1212-9140 • 2 Way F Metri-Pack 280.1 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	839	Fused Ignition Feed
B	LT BLU/ BLK	844	Fuel Injector #4 Control

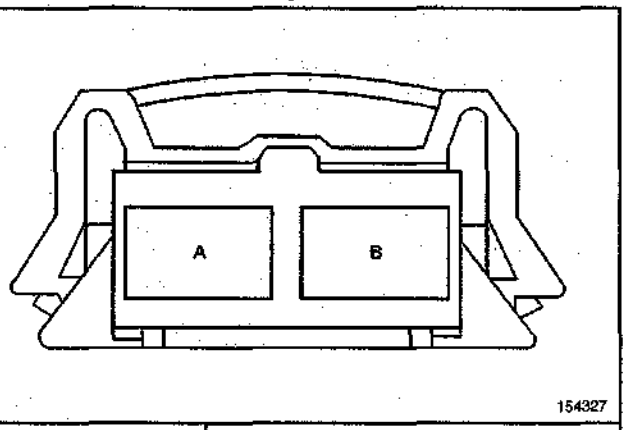
Fuel Injector #6



Connector Part Information	• 1212-9140 • 2 Way F Metri-Pack 280.1 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	839	Fused Ignition Feed
B	YEL/BLK	846	Fuel Injector #6 Control

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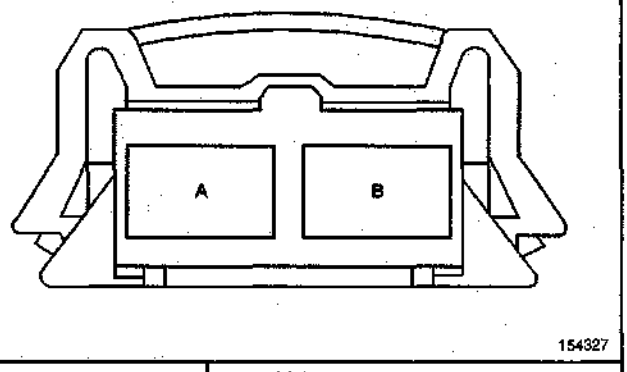
Fuel Injector #7



154327

Connector Part Information	• 1212-9140 • 2 Way F Metri-Pack 280.1 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	639	Fused Ignition Feed
B	RED/BLK	877	Fuel Injector #7 Control

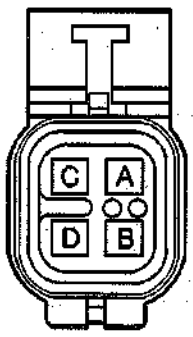
Fuel Injector #8



154327

Connector Part Information	• 1212-9140 • 2 Way F Metri-Pack 280.1 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK	839	Fused Ignition Feed
B	DK BLU/ WHT	878	Fuel Injector #8 Control

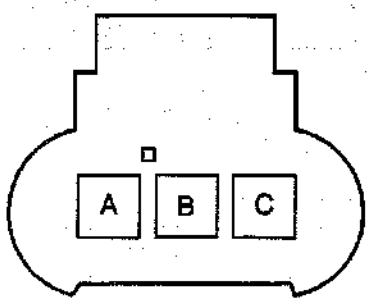
Fuel Level Sensor/Fuel Pump



518981

Connector Part Information	• 1216-0482 • 4 Way F Metri-Pack 150 Series Seald (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PPL	30	Fuel Level Input
B	GRY	120	Fuel Pump Control
C	BLK	150	Fuel Pump Ground
D	BLK/WHT	651	Fuel Level Sensor Ground

Fuel Tank Pressure Sensor

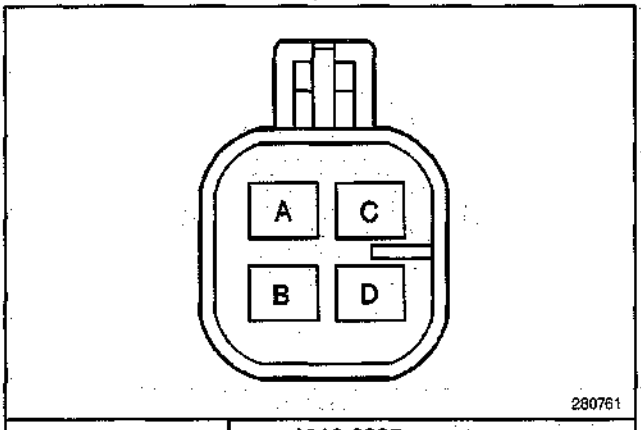


258675

Connector Part Information	• 1205-9595 • 3 Way F Metri-Pack 150 Series (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	ORN/BLK	469	Fuel Sensor Ground
B	DK GRN	890	Fuel Tank Pressure Signal
C	GRY/BLK	416	5V Sensor Feed

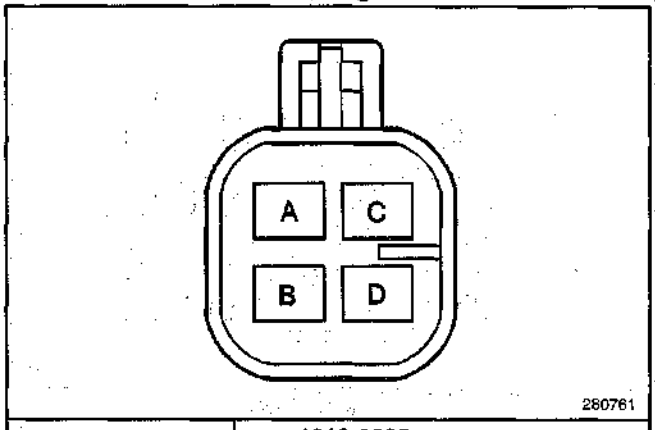
cardiagn.com

Heated Oxygen Sensor (HO2S), Bank 1, Sensor 2, Left Rear



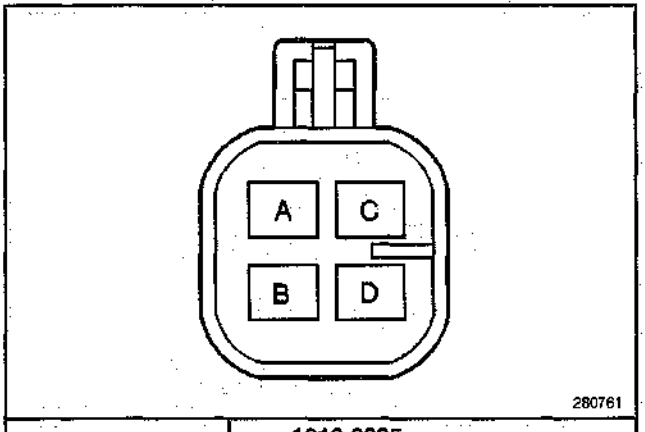
Connector Part Information	• 1216-0825 • 4 Way Metri-Pack 150 Series (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	TAN/WHT	1669	LR Heated Oxygen Sensor (HO2S) - Low
B	PPL/WHT	1668	LR Heated Oxygen Sensor (HO2S) - High
C	BLK	450	Ground
D	PNK	539	Fused Ignition Feed

Heated Oxygen Sensor (HO2S), Bank2, Sensor 2, Right Rear



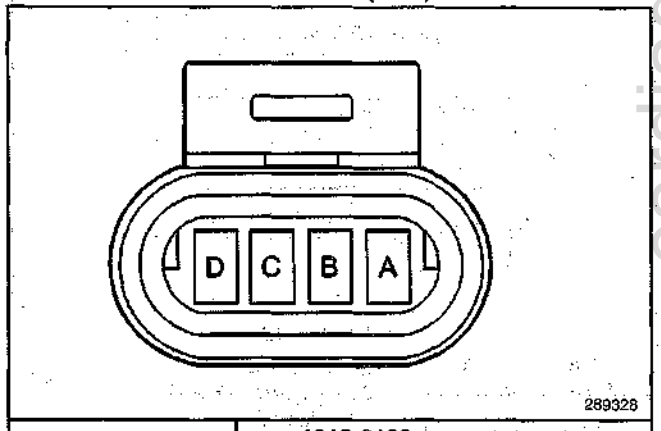
Connector Part Information	• 1216-0825 • 4 Way M Metri-Pack 150 Series Series (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	TAN	1671	RR Heated Oxygen Sensor (HO2S) - Low
B	PPL	1670	RR Heated Oxygen Sensor (HO2S) - High
C	BLK	450	Ground
D	PNK	539	Fused Ignition Feed

Heated Oxygen Sensor (HO2S), Bank 2, Sensor 1, Right Front



Connector Part Information	• 1216-0825 • 4 Way M Metri-Pack 150 Series Sealed (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	TAN	1667	RF Heated Oxygen Sensor (HO2S) - Low
B	PPL	1666	RF Heated Oxygen Sensor (HO2S) - High
C	BLK	450	Ground
D	PNK	539	Fused Ignition Feed

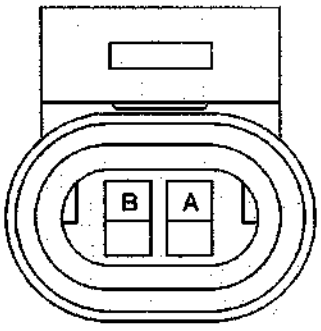
Idle Air Control (IAC) Valve



Connector Part Information	• 1216-2190 • 4 Way F Metri-Pack 150.2 Series Pull to Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN/ BLK	444	Idle Air Control (IAC) Valve Coil B Signal - Low
B	LT GRN/ WHT	1749	Idle Air Control (IAC) Valve Coil B Signal - High
C	LT BLU/ BLK	1748	Idle Air Control (IAC) Valve Coil A Signal - Low
D	LT BLU/ WHT	1747	Idle Air Control (IAC) Valve Coil A Signal - High

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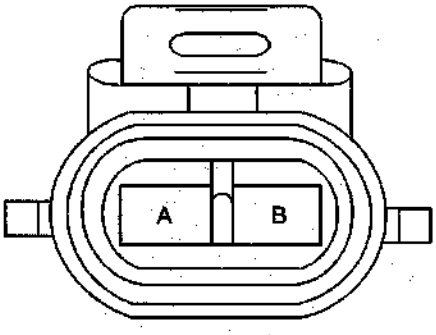
Intake Air Temperature (IAT) Sensor



68719

Connector Part Information	• 1216-2199 • 2 Way F Metri Pack 150.2 Series Pull to Seat (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

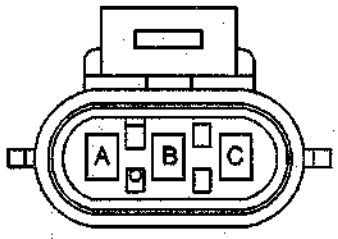
Knock Sensors (KS)



35437

Connector Part Information	• 1205-2641 • 2 Way F Metri-Pack 150 Series Sealed (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	DK BLU	496	Knock Sensor (KS) Signal - Front
B	LT BLU	1876	Knock Sensor (KS) Signal - Rear

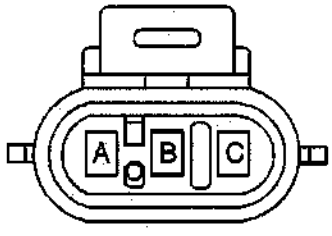
Manifold Absolute Pressure (MAP) Sensor



68740

Connector Part Information	• 1212-9946 • 3 Way F Metri Pack 150 Series (GRY)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	ORN/BLK	407	Manifold Absolute Pressure (MAP) Sensor Ground
B	LT GRN	432	Manifold Absolute Pressure (MAP) Sensor Signal
C	GRY	416	Manifold Absolute Pressure (MAP) Sensor 5.0V Reference

Mass Air Flow (MAF) Sensor

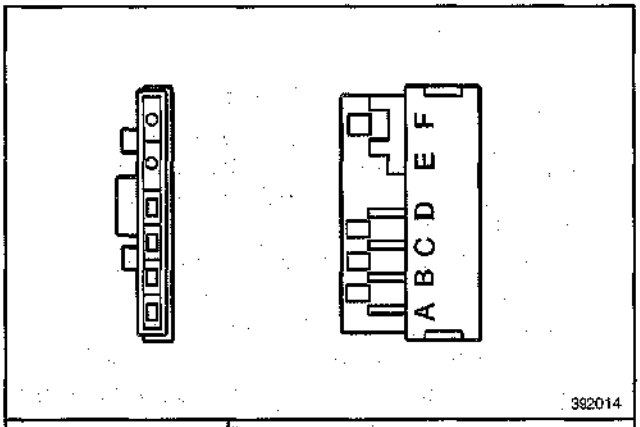


62453

Connector Part Information	• 1205-9595 • 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 Ignition Feed

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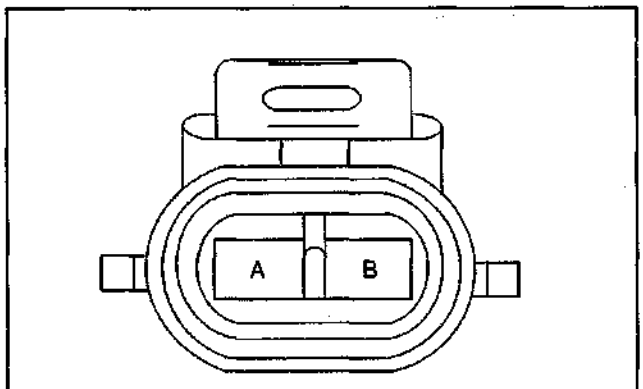
Park/Neutral Position Switch



392014

Connector Part Information	• 1201-5307 • 6 Way F Metri-Pack (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	BLK/WHT	451	Ground
B	ORN/BLK	434	PCM Park/Neutral Position Signal
C	BRN	141	Fused Ignition Feed
D	LT GRN	24	Back Up Lamps Feed
E	PPL/WHT	1035	Fused Ignition Feed
F	DK GRN	1433	Starter Enable

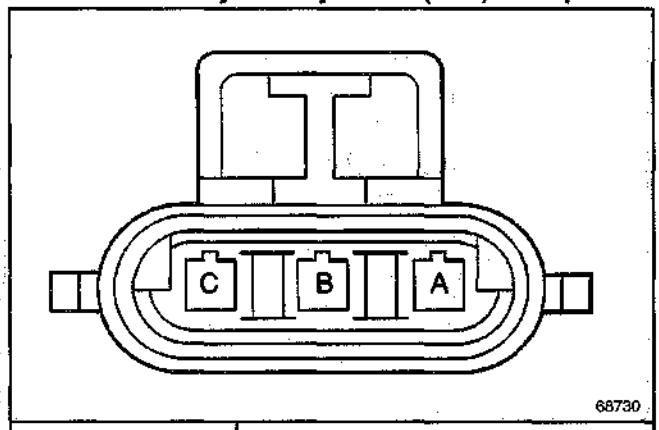
Secondary Air Injection (AIR) Bleed Valve Solenoid



35437

Connector Part Information	• 1205-2643 • 2 Way F Metri-Pack 150 Series Sealed (RED)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	PNK/BLK	429	Secondary Air Injection Bleed Valve Solenoid - Feed
B	BLK	150	Ground

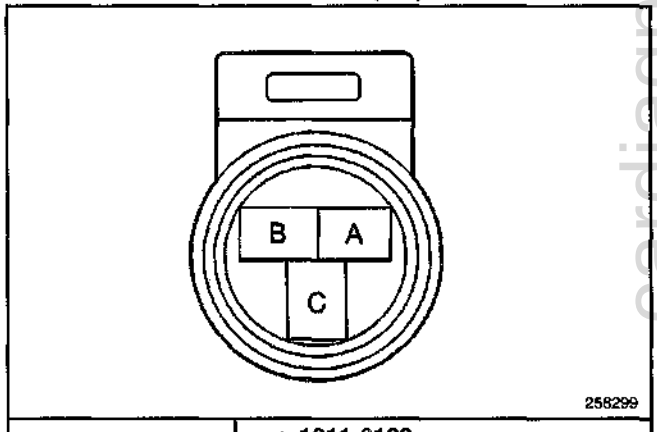
Secondary Air Injection (AIR) Pump



68730

Connector Part Information	• 1211-0293 • 3 Way F Metri-Pack 150 Series (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	RED	78	Secondary Air Injection Pump Motor - Feed
B	PNK/BLK	429	Secondary Air Injection Solenoid - Feed
C	BLK	150	Ground

Throttle Position (TP) Sensor

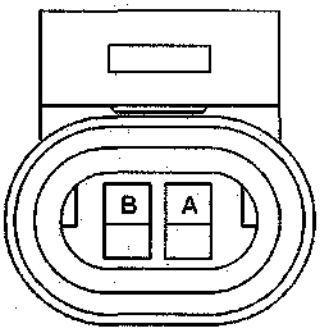


258299

Connector Part Information	• 1211-0192 • 3 Way F Metri-Pack 150 Series Pull To Seat (BLK)		
Pin	**Wire Color**	**Circuit No.**	**Function**
A	GRY	596	Throttle Position (TP) Sensor 5V Reference
B	BLK	452	Sensor Ground
C	DK BLU	417	Throttle Position (TP) Sensor Signal

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Vehicle Speed Sensor (VSS)



68719

Connector Part Information		• 1216-2195 • 2 Way F Metri-Pack 150.2 Series Pull to Seat (BLK)	
Pin	**Wire Color**	**Circuit No.**	**Function**
A	LT GRN/ BLK	822	Vehicle Speed Sensor (VSS) Signal - Low
B	PPL/WHT	821	Vehicle Speed Sensor (VSS) Signal - High

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

Description

The Powertrain OBD System Check is an organized approach to identifying a problem created by an electronic engine control system malfunction. The Powertrain OBD System Check is the starting point for any driveability concern diagnosis. The Powertrain OBD System Check directs the service technician to the next logical step in diagnosing a concern. Understanding and using the table correctly will reduce the diagnostic time and prevent the replacement of good parts.

Do not perform this check if no driveability concern exists. A driveability condition includes all PCM controlled systems and components.

For automatic transmission DTCs, refer to *Diagnostic Trouble Code (DTC) List/Type* in Automatic Transmission. The DTCs associated with the automatic transmission are:

- DTCs P0502 and P0503.
- Any 700 (except DTC P0704) and 1800 series DTCs (i.e. DTC P07XX and P18XX).

For Domestic and Export DTC Types, refer to *Diagnostic Trouble Code (DTC) List/Type*.

This vehicle is equipped with a Powertrain Control Module (PCM) utilizing an Electrically Erasable Programmable Read Only Memory (EEPROM). Program the new PCM when diagnostics call for replacement of the PCM. When the PCM is replaced, the following must be performed.

- The PCM must be programmed. Refer to *PCM Replacement/Programming*.
- The CKP System Variation Learn Procedure. Refer to *CKP System Variation Learn Procedure*.
- The Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.
- The Engine Oil Life Monitor reset procedure. Refer to *Engine Oil Life Monitor Reset Procedure*.

When the PCM power is interrupted or the PCM is reprogrammed, the *PCM Idle Learn Procedure* must be performed.

Diagnostic Aids

- If an intermittent condition exists, inspect the PCM wiring harnesses for improper installation of electrical components. Inspect for aftermarket theft deterrent devices, lights, and cellular phones. Ensure that no aftermarket equipment is connected to the Class 2 circuit. A cellular phone signal communication may cause an intermittent condition.
- The following may cause an intermittent:
  - Poor connections; Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
  - Corrosion.
  - Mis-routed harness.
  - Rubbed through wire insulation.
  - Broken wire inside the insulation.
- If multiple DTCs are set, inspect the IGN relay for proper operation. The following components are powered by the IGN relay:
  - Injectors/Ignition coils
  - A/C system
  - Transmission
  - EVAP solenoid and EVAP Vent Valve
  - MAF sensor
  - Heated Oxygen Sensors
- For an intermittent, refer to *Symptoms*.

Test Description

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

1. Use a properly functioning scan tool with the diagnostic tables in this section. DO NOT use the Clear Info function unless instructed by a diagnostic procedure.
3. An Ignition 1 voltage that is too low may cause the following conditions:
   - A no start
   - Stalling
   - High idle
   - An inoperative scan tool
5. This step determines if a DTC is set for the Vehicle Theft Deterrent (VTD) system. A VTD DTC set causes a no start condition.
6. If multiple DTCs are stored, diagnose in the following order of priority:
   1. PCM failure DTCs (P0601, P0602, P0604)
   2. System Voltage DTCs
   3. Component level DTCs (Sensors, Solenoids, Relays etc.). Multiple DTCs within this category should be diagnosed in numerical order starting with the lowest numbered DTC.
   4. System level DTCs (Misfire, Fuel Trim, etc.)

For Automatic Transmission DTCs, refer to *Diagnostic Trouble Code (DTC) List/Type* in Automatic Transmission.

It is beneficial to review the Freeze Frame Data and/or Fail Records. Use the odometer information and the fail counter in order to determine how frequently and how recently the DTC set. This information and the other operating conditions when the DTC set may help diagnose an intermittent condition. Capturing the stored info preserves data that the PCM will lose when instructed to Clear Info at the end of a diagnostic table, or if you disconnect the PCM or replace the PCM during a diagnostic procedure. The scan tool stores the data in the scan tool's memory. Review the captured info at the end of the diagnostic procedure in order to catch the next DTC in the event there are multiple DTCs stored. Follow the order of priority as listed above.

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7. Compare actual control system data with the values in the Engine Scan Tool Data List to determine if any parameter is not within limits. Keep in mind that a base engine condition (i.e. advanced cam timing) may substantially alter sensor values. If the actual data does not correspond with the values in the Engine Scan Tool Data List, refer to the appropriate system/component diagnostic aids or test descriptions.

A Powertrain On Board Diagnostic (OBD) System Check

Step	Action	Value(s)	Yes	No
1	**Important:** • Search for applicable service bulletins before proceeding with diagnosis. • Do not turn the ignition OFF when performing this diagnostic table. • Ensure the battery is fully charged before proceeding with this diagnostic. 1. Connect a scan tool to the Data Link Connector (DLC). 2. Turn ON the ignition leaving the engine OFF. Does the scan tool power-up?	—	*Go to Step 2*	Go to *Scan Tool Does Not Power Up* in Data Link Communications
2	**Important:** Save or capture the Freeze Frame and/or Failure Records information if the PCM displays data. Does the scan tool display PCM data?	—	*Go to Step 3*	Go to *Scan Tool Does Not Communicate w/Class 2 Data Line* in Data Link Communications
3	**Important:** If the starter does not engage, refer to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical. Monitor the Ignition 1 voltage using a scan tool while cranking the engine, or while the engine is operating. Is the Ignition 1 voltage near the specified voltage?	B+	*Go to Step 4*	Go to *DTC P0562 System Voltage Low*
4	Does the engine start and continue to run?	—	*Go to Step 6*	*Go to Step 5*
5	Is DTC P1626 stored?	—	Go to *DTC P1626 Theft Deterrent Fuel Enable Signal Lost*	Go to *Engine Cranks but Does Not Run*
6	Monitor the DTC information using a scan tool. Are any DTCs displayed?	—	Go to the applicable DTC table	*Go to Step 7*
7	Compare the scan tool data with the values shown in the *Scan Tool Data List*. Are the values normal or within typical ranges?	—	Go to *Symptoms*	Go to Diagnostic Aids and Test Descriptions

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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).
- 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:

All: The Parameter is in all data lists indicated below.
Eng 1: Engine Data 1 List
Eng 2: Engine Data 2 List
EE: Enhanced EVAP Data
FF/FR: Freeze Frame/Failure Records
FT: Fuel Trim Data List
MF: Misfire Data List

Scan Tool Data List

Scan Tool Parameter	Data List	Parameter Range/Units	Typical Data Values
Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed Loop/Accessories Off			
A/C High Side Pressure	Eng 2	0–5 Volts	Varies
A/C High Side Pressure	Eng 2	kPa/psi	Varies
A/C Relay Command	Eng 1, 2, EE, MF	On/Off	Off
A/C Request	Eng 1, 2, EE, MF	Yes/No	No
A/C Status	Eng 1, 2, EE, MF	On/Off	Off
Actual EGR Position	Eng 1	0–100%	0%
AIR Pump Relay	Eng 1, 2, FT	On/Off	Off
AIR Solenoid	Eng 1, 2, FT	On/Off	Off
Air Fuel Ratio	FF, FR	Ratio	14.7:1
BARO	Eng 1, FT, FF, FR	kPa/Volts	65–104 kPa/3.5–4.9 Volts (Varies w/Altitude)
CAM Signal Input High to Low	Eng 1	Counts	Varies
CAM Signal Input Low to High	Eng 1	Counts	Varies
Clutch Pedal Position Switch	Eng1, 2, MF	Depressed/Released	Varies
Cold Startup	Eng1, 2, EE	Yes/No	Varies
Commanded EGR	Eng 1	0–5 Volts	Less than 1.3 volts
Cruise Requested	Eng1, 2	Yes/No	No
Cruise Control Inhibit	Eng1, 2	Yes/No	Yes
Current Gear	Eng 2, FF, FR	Transmission Gear Position	1
Cycles of Misfire Data	MF	0–100 Counts	Varies
Cylinder Mode Misfire Index	MF	Counts	Varies
DTC Set This Ignition	Eng 1, 2, EE, FT	Yes/No	No
Desired IAC Airflow	Eng 1	0–64 g/s	Varies
Desired EGR Position	Eng 1	0–100%	0%
Desired Idle Speed	Eng 1, FF, FR	RPM	PCM Controlled
ECT	Eng 1, 2, EE, FT, MF, FF, FR	–39° to 140°C (–38° to 284°F)	85° to 113°C (185° to 235°F)
EGR Closed Pintle Position	Eng 1	0–5.0 Volts	Less than 1.3 volts
EGR Pintle Position	Eng 1	0–5.0 Volts	Less than 1.3 Volts

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Scan Tool Data List (cont'd)

Scan Tool Parameter	Data List	Parameter Range/Units	Typical Data Values
Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed Loop/Accessories Off			
Engine Load	MF, FF, FR	0–100%	1–4% @ Idle 5–9% @ 2500 RPM
Engine Run Time	Eng 1, 2, EE, FF, FR	Hrs, Min, Sec	Varies
Engine Speed	All	0–10,000 RPM	Varies
EVAP Canister Purge	Eng 1, 2, EE, FT, FR	0–100%	0–25%
EVAP Canister Vent Valve	Eng 1, 2, EE, FT	Not Venting/Venting	Venting
Fail Counter	FR	Counts	Varies
Failures Since First Fail	FR	Counts	Varies
FC Relay 1	Eng 1, 2, EE	On/Off	Depends on engine coolant temperature and A/C Pressure
FC Relay 2 and 3	Eng 1, 2, EE	On/Off	Depends on engine coolant temperature and A/C Pressure
FT Diag. Inhibit	FT	Enabled/Disabled	Varies
Fuel Gauge Control	Eng 2, EE	0–100%	Varies
Fuel Level Sensor	Eng 2, EE	5–0 Volts	0.7–2.5 Volts
Fuel Tank Level Remaining	Eng 2, EE, FT	0–16.6 gal./0–62.8 L	Varies
Fuel Tank Level Remaining	Eng 2, EE, FT	0–100%	Varies
Fuel Tank Pressure	Eng 1, 2, EE	–32.7 to 14.0 mm/Hg (–17.5 to 7.5 in/H2O)	Varies
Fuel Tank Pressure	Eng 2, EE	0–5.0 Volts	Varies
Fuel Tank Rated Capacity	Eng 2, EE, FT	16.6 gal./62.8 L	16.6 gal./62.8 L
Fuel Trim Cell	Eng 1, FT	0–23	16, 17, 20
Fuel Trim Learn	Eng 1, 2, EE, FT	Enabled/Disabled	Enabled (may Toggle)
Generator L Terminal	Eng 2,	Active/Inactive	Active
HO2S Bank 1 Sensor 1	Eng 1, FT	Millivolts	10–1,000 mV and Varying
HO2S Bank 1 Sensor 2	Eng 1, FT	Millivolts	10–1,000 mV and Varying
HO2S Bank 2 Sensor 1	Eng 1, FT	Millivolts	10–1,000 mV and Varying
HO2S Bank 2 Sensor 2	Eng 1, FT	Millivolts	10–1,000 mV and Varying
IAC Position	Eng 1	Counts	Varies
IAT	Eng 1, 2, EE, FT	–39° to 140°C (–38° to 284°F)	Varies
IC Circuit Cylinder 1–8	MF	Ok/Fault	Ok
Ignition 1	Eng 2, EE	0–25 Volts	11.5–14.5 Volts
Inj. PWM Average Bank 1	Eng 2, EE, FT, FF, FR	Milliseconds	1–4
Inj. PWM Average Bank 2	Eng 2, EE, FT, FF, FR	Milliseconds	1–4
Knock Retard	Eng 1, EE, FT	0.0°–16°	0°
Long Term FT 1 Average	FT	Percentage	Near 0%
Long Term FT 2 Average	FT	Percentage	Near 0%
Long Term FT Bank 1	Eng 1, 2, EE, FT, FF, FR	Percentage	Near 0%
Long Term FT Bank 2	Eng 1, 2, EE, FT, FF, FR	Percentage	Near 0%
Loop Status	Eng 1, 2, EE, FT MF, FF, FR	Open/Closed	Closed
Low Oil Lamp	Eng 2	On/Off	Off
Low Oil Level	Eng 2	Yes/No	No
MAF	Eng 1, 2, EE, FT, MF, FF, FR	Grams Per Seconds (g/s)	5–9 g/s@ Idle (depends on altitude) 20–26 g/s @ 2,500 RPM (depends on altitude)
MAF Frequency	Eng 2	0–31,999 Hz	Varies

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Scan Tool Data List (cont'd)

Scan Tool Parameter	Data List	Parameter Range/Units	Typical Data Values
Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed Loop/Accessories Off			
MAP	Eng 1, 2, EE, FT, FF, FR	kPa/Volts	20–48 kPa/1.0–2.0 Volts (varies w/altitude)
MIL	Eng 1, 2, EE	Off/On	Off
Mileage Since DTC Cleared	Eng 2	km/Miles	Varies
Mileage Since First Failure	FF, FR	km/Miles	Varies
Mileage Since Last Failure	FR	km/Miles	Varies
Mileage Since MIL Request	FF	km/Miles	Varies
Misfire Current #1–#8	MF	0–200 Counts	0
Misfire History #1–#8	MF	0–65,535 Counts	0
Misfiring Cylinder	MF	Prim. Cyl# 0–8 Sec. Cyl# 0–8	00000000 Prim. 00000000 Sec.
Misfire Revolution Status	MF	Reject/Accept	Varies
Not Run Counter	FR	Counts	Varies
PCM Reset	Eng 1, 2, MF	Yes/No	No
PNP (A/T only)	Eng 2	Park/Neutral R-D321	Park/Neutral
Pass Counter	FR	Counts	Varies
Reverse Inhibit (M/T only)	Eng 1, 2	Yes/No	No
Revolutions With Misfire	MF	Counts	0
SHRT FT Average 1	FT	Percentage	Near 0%
SHRT FT Average 2	FT	Percentage	Near 0%
Short Term FT Bank 1	Eng 1, 2, EE, FT, FF, FR	Percentage	Near 0%
Short Term FT Bank 2	Eng 1, 2, EE, FT, FF, FR	Percentage	Near 0%
Skip Shift Lamp (M/T only)	Eng 1, 2	On/Off	Off
Skip Shift Solenoid (M/T only)	Eng 1, 2	Enabled/Disabled	Disabled
Spark	Eng 1, 2, EE, FT, MF	Degrees	Varies
Start Up ECT	Eng 1, FF, FR, EE	C°/F°	Varies
TCC Brake Switch	Eng 1, 2, FF, FR	Applied/Released	Released
TCC Duty Cycle	Eng 1, 2, MF, FF, FR	Enabled/Disabled	Disabled
TCC Enable Sol.	Eng 1, 2, MF, FF, FR	Enabled/Disabled	Disabled
Total Misfire Current Count	MF	Counts	0
Total Misfire Failures Since First Fail	MF	0–65,535	0
Total Misfire Passes Since First Fail	MF	0–65,535	0
TP Sensor	Eng 2	0–5.0 Volts	.4–.9 Volts
TP Angle	Eng 1, 2, EE, FT, MF, FF, FR	0–100%	0%
Traction Control	Eng 1, 2, FF, FR	Active/Inactive	Inactive
Transmission OSS	FF, FR	RPM	Varies
Transmission Range	Eng 1, 2, FF, FR	0–4	1
Vehicle Speed	Eng 1, 2, EE, FT, FF, FR	km/h mph	0
VTD Fuel Disable	Eng 2, FF, FR	Active/Inactive	Inactive
Warm-Ups w/o Emission Faults	Eng 2	0–255 Counts	Varies
Warm-Ups w/o Non-Emission Faults	Eng 2	0–255 Counts	Varies

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Scan Tool Data Definitions

The Engine Scan Tool Data Definitions contains 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 may appear more than once or in more than one data list in order to group certain related parameters together.

A/C High Side Pressure: The scan tool displays 15–452 psi/103–3116 kPa/0–5.0 Volts. This parameter represents the A/C refrigerant pressure sensor signal. The amount of pressure indicates the amount of load that the A/C compressor places on the engine. The PCM uses this information in order to adjust idle and in order to control the cooling fans.

A/C Relay Command: The scan tool displays On or Off. The A/C Relay Command parameter represents the PCM commanded state of the A/C clutch relay control circuit. When the scan tool displays ON, the A/C clutch should be engaged.

A/C Request: The scan tool displays Yes or No. The A/C Request displays the state of the A/C request input circuit from the HVAC controls. The PCM uses the A/C request signal in order to determine whether the A/C compressor operation is being requested.

A/C Status: The scan tool displays On or Off. The scan tool displays ON when the PCM detects a voltage at the A/C status circuit.

Actual EGR Position: The scan tool displays percentage. This parameter indicates the position of the EGR pintle position in percentage. A fully closed EGR displays 0%. A fully open EGR displays 100%.

AIR System: The scan tool displays On or Off. The scan tool displays ON when the PCM enables the entire AIR system. The scan tool displays OFF when the PCM disables the entire AIR system.

AIR Pump Relay: The scan tool displays On or Off. The scan tool displays ON when the PCM grounds the AIR pump relay control circuit. The scan tool displays OFF when the PCM disables the ground circuit.

AIR Solenoid Valve: The scan tool displays On or Off. The scan tool displays ON when the PCM grounds the AIR solenoid valve control circuit. The scan tool displays OFF when the PCM disables the ground circuit.

Air Fuel Ratio: The scan tool display indicates the Air to Fuel Ratio. The Air Fuel ratio is determined from the Heated Oxygen sensor output. The PCM uses the fuel trim to adjust fueling to attempt to maintain an Air Fuel Ratio of 14.7:1.

BARO: The scan tool displays a range of 10–105 kPa/0.00–5.0 Volts. The Barometric Pressure reading is determined from the MAP sensor signal. The PCM monitors the MAP signal during key up and Wide-Open Throttle (WOT) conditions. The Barometric Pressure compensates for altitude differences.

CAM Signal Input High to Low: The scan tool displays 0–65,535 counts. The counts increment as the PCM detects the Camshaft sensor signal voltage going from high to low.

CAM Signal Input Low to High: The scan tool displays 0–65,535 counts. The counts increment as the PCM detects the Camshaft sensor signal voltage going from low to high.

Clutch Pedal Position Switch (M/T only): The scan tool displays depressed or released. This parameter displays the position of the clutch pedal.

Cold Start Up: The scan tool displays Yes or No. A cold start up is when the engine coolant temperature rises above a predetermined temperature during an ignition cycle. The next ignition cycle the engine coolant temperature should be below a predetermined temperature. Also the engine coolant temperature and the Intake Air temperature are less than 50 degrees C (122 degrees F) and are within 3 degrees C (5 degrees F) of each other at start up. When the above is true the scan tool displays Yes.

Commanded EGR: The scan tool displays 0–5.0 Volts. This parameter is the EGR pintle position commanded by the PCM.

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

Cycles of Misfire Data: The scan tool displays a range of 0–100. The PCM Counts the number of misfire tests during 200 revolutions.

Cylinder Mode Misfire Index: The scan tool displays a range of 0–65,535. This parameter displays the amount of crankshaft decelerations. When an engine is operating without a misfire, the scan tool displays less than 1,000 counts. When an engine misfire occurs, the counter displays more than 1,000 counts.

DTC Set This Ignition: The scan tool displays Yes or No. This parameter indicates if a Diagnostic Trouble Code (DTC) set during the current ignition cycle.

Desired IAC Airflow: The scan tool displays a range of 0–64 Grams Per Second (g/s). This parameter displays the calculated airflow in the IAC passage.

Desired EGR Position: The scan tool displays 0–5.0 Volts. This parameter displays the desired position of the EGR pintle as requested by the PCM. This parameter should be very close to Actual EGR position.

Desired Idle Speed: The scan tool displays a range of 0–3,187 RPM. The PCM commands the desired idle speed. The PCM compensates for various engine loads based on engine coolant temperature in order to keep the engine at the desired speed.

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ECT: The scan tool displays a range of –39°C to 140°C (–38°F to 284°F). The Engine Coolant Temperature (ECT) sensor is mounted in the cylinder head of the left bank. The PCM applies 5.0 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 the voltage 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 Pintle Position: The scan tool displays 0–5.0 Volts. This display represents the voltage that the PCM uses to determine whether or not the EGR valve is closed. The voltage displayed will be the closed position of the EGR pintle learned by the PCM.

EGR Pintle Position: The scan tool displays 0–5.0 Volts. This parameter displays the actual EGR pintle position in voltage.

Engine Load: The scan tool displays a range of 0%–100%. The PCM calculates the Engine load from engine speed and MAF sensor readings. The Engine Load increases with an increase in RPM or airflow.

Engine Run Time: The scan tool displays Hours, Minutes, Seconds. This displays the amount of engine run time for the current ignition cycle. When you cycle the ignition off, the timer will reset to zero.

Engine Speed: The scan tool displays a range of 0–10,000 RPM. The PCM computes Engine speed from the ignition reference pulses. The Engine speed should remain close to desired idle under various engine loads with the engine idling.

EVAP Canister Purge: The scan tool displays a range of 0%–100%. The PCM commands the PWM duty cycle of the EVAP Purge Solenoid valve. 0% displayed indicates no purge; 100% displayed indicates full purge.

EVAP Canister Vent Valve: The scan tool displays venting or not venting. The scan tool displays venting when the PCM commands the EVAP system to purge. The scan tool will show not venting when the valve is closed.

Fail Counter: This scan tool displays the amount of times a DTC fails. This parameter is located in the Failure Records list.

Failures Since First Fail: The scan tool displays the number of times a DTC failed since the first failure.

FC Relay 1: The scan tool displays On or Off. The scan tool displays ON when the PCM commands a coolant fan relay ON. Both fans are enabled on low speed when the PCM commands the fan one relay control ON.

FC Relay 2 and 3: The scan tool displays On or Off. The scan tool displays ON when the PCM commands a coolant fan relay ON. Both cooling fans are enabled on high speed when the PCM commands both fan control circuits ON.

FT Diag. Inhibit: The scan tool displays Enabled or Disabled. The scan tool displays Disabled when the PCM determines that certain parameters prohibit the Fuel Trim diagnostic from running. The scan tool displays Enabled when the PCM determines that the Fuel Trim diagnostic is allowed to run.

Fuel Gauge Control: The scan tool displays 0–100%. This parameter indicates the fuel level that the PCM is commanding the fuel gauge to. The scan tool displays in percentage the fuel level in the fuel tank.

Fuel Level Sensor: The scan tool displays 5.0–0 Volts. The PCM supplies a 5.0 Volt signal circuit to the fuel level sensor. The float inside the fuel tank controls a variable resistor which varies the resistance based on fuel level. The scan tool displays below 1.0 Volt for an empty tank, and close to 2.5 Volts for a full tank.

Fuel Tank Level Remaining: The scan tool displays 0–62.6 L (0–16.8 gal). The scan tool displays in Liters or Gallons the amount of fuel remaining in the fuel tank.

Fuel Tank Level Remaining: The scan tool displays 0–100%. The scan tool displays in percentage the amount of fuel remaining in the fuel tank.

Fuel Tank Pressure: The scan tool displays in –32.7 to 13.96 mm/Hg or –17.4 to 7.5 (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 Tank Pressure: The scan tool displays 0–5.0 Volts. The scan tool displays in voltage the pressure inside of the fuel tank.

Fuel Tank Rated Capacity: The scan tool displays 62.6 L (16.8 gal). The scan tool displays the capacity of the fuel tank in Liters or Gallons.

Fuel Trim Cell: The scan tool displays a range of 0 to 23. The PCM determines from the MAP and RPM inputs which fuel trim cell to operate the engine in. The fuel trim cell displayed on the scan tool is the cell that the engine is operating under.

Fuel Trim Learn: The scan tool displays Enabled or Disabled. When conditions are appropriate for enabling long term fuel trim corrections, the scan tool displays Enabled. This indicates that the long term fuel trim is responding to the short term fuel trim. If the scan tool displays Disabled, then long term fuel trim will not respond to changes in short term fuel trim.

HO2S Bank 1 and Bank 2 Sensor 1: The scan tool displays a range of 0–1,000 mV. The HO2S Bank 1 and Bank 2 Sensor 1 parameter represents the fuel control exhaust oxygen sensor output voltage. The voltage fluctuates constantly within a range between 10 mV (lean exhaust) and 1,000 mV (rich exhaust) while operating in Closed Loop.

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HO2S Bank 1 and Bank 2 Sensor 2: The scan tool displays a range of 0–1,000 mV. The HO2S Bn1 and Bn2 Sensor 2 parameter represents the exhaust oxygen sensor output voltage. The voltage fluctuates constantly within a range between 10 mV (lean exhaust) and 1,000 mV (rich exhaust) while operating in Closed Loop.

IAC Position: The scan tool displays counts from 0 to 1,024. The counts represent the commanded IAC position by the PCM. The scan tool displays 0 counts for a fully seated IAC pintle. The counts increase as the idle increases. The counts vary depending on the load placed on the engine at idle.

IAT: The scan tool displays a range of –39°C to 140°C (–38°F to 284°F). The PCM converts the resistance of the intake air temperature sensor to degrees. The PCM uses the Intake Air Temperature (IAT) in order to adjust fuel delivery and spark timing according to incoming air density.

IC Circuit Cylinder 1–8: The scan tool displays OK or Fault. If there is a problem with an ignition control circuit, the scan tool displays Fault. The scan tool displays OK under the normal operating conditions.

Ignition 1: The scan tool displays 0–25.5 Volts. The Ignition 1 represents the system voltage measured by the PCM at the ignition feed circuit.

Inj. PWM Average Bank 1 and Bank 2: The scan tool displays a range of 0–1,000 m/sec. The Injector average indicates the amount of time the PCM commands each injector ON during each engine cycle. A longer injector pulse width causes more fuel to be delivered. The Injector Pulse Width increases with an increased engine load.

Knock Retard: The scan tool displays a range of 0.0 degrees–16 degrees. Knock Retard indicates the amount of spark the PCM removes from the IC spark advance in response to the signal from the knock sensors.

Long Term FT Average Bank 1 and Bank 2: The scan tool displays Percentage. This parameter indicates the average of all long term fuel trim cells. The short term fuel trim cells are rated (Weighted) for the amount of which they are used. For example, an idle cell is rated higher than a wide open cell. If a fueling malfunction occurs in the idle cell and the wide open cell, the average would be more affected by the idle cell than the wide open cell. 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 more than 0 percent indicates that a lean condition exists and the PCM compensates by adding fuel (increased injector pulse width). When the average of the cells reach a predetermined high or low, a fuel trim DTC sets.

Long Term FT Bank 1 and Bank 2: The scan tool displays Percentage. The PCM derives the Long Term Fuel Trim from the Short Term Fuel Trim value. The Long Term Fuel Trim represents a long–term correction of fuel delivery. A value of 0 percent indicates that fuel delivery requires no compensation in order to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0 percent indicates that the fuel system is rich and the PCM is reducing the fuel delivery (decreased injector pulse width). A positive value significantly greater than 0 Percent indicates that a lean condition exists and the PCM compensates by adding fuel (increased injector pulse width). Fuel trim values at maximum authority indicates an excessively rich or lean system.

Loop Status: The 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.

Low Oil Lamp: The scan tool displays On or Off. The scan tool displays On when the PCM detects that there is a low oil level condition. The Low Oil Lamp is then commanded on by the PCM.

Low Oil Level: The scan tool displays Yes or No. This parameter indicates when the engine oil level is low. The scan tool displays YES when the PCM detects the engine oil level is low.

MAF: The scan tool displays a range of 0.0–655 g/s. The MAF (Mass Air Flow) is the MAF Input Frequency converted to grams of air per second. This indicates the amount of air entering the engine.

MAF Frequency: The scan tool displays a range of 0–31,999 Hz. The PCM converts current draw needed by the MAF (to keep the hot wires at a constant temperature) into a frequency signal. The scan tool displays this frequency in Hertz signal.

MAP: The scan tool displays a range of 10–105 kPa/0.00–5.0 Volts. The Manifold Absolute Pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, and speed changes. As the intake manifold pressure increases, the intake vacuum decreases resulting in a higher MAP sensor voltage and kPa reading. The PCM uses the MAP sensor signal for the following: (1) Updating the BARO reading; (2) Enabling factor for several of the diagnostics.

MIL: The scan tool displays On or Off. The scan tool indicates if the PCM has commanded the Malfunction Indicator Light (MIL) On.

Mileage Since DTC Cleared: The scan tool displays Kilometers or Miles. This parameter indicates the mileage accumulated since an emission Diagnostic Trouble Code cleared. The PCM stores this mileage in the Freeze Frame and Failure records buffers.

Mileage Since First Failure: The scan tool displays Kilometers or Miles. This parameter indicates the mileage accumulated since an emission Diagnostic Trouble Code first failed. The PCM stores this mileage in the Freeze Frame and Failure records buffers.

Mileage Since Last Failure: The scan tool displays Kilometers or Miles. This parameter indicates the mileage accumulated since an emission Diagnostic Trouble Code last failed. The PCM stores this mileage in the Freeze Frame and Failure records buffers.

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Mileage Since MIL Request: The scan tool displays Kilometers or Miles. This parameter indicates the mileage accumulated since the PCM requested the MIL to illuminate. The PCM stores this mileage in the Freeze Frame and Failure records buffers.

Misfire Current #1 – #8: The scan tool displays a range of 0–200 Counts. The Misfire Current counters increment at a rate according to the number of possible misfires the PCM detects on each cylinder during the last 200 cylinder firing events.

Misfire History #1 – #8: The scan tool displays a range of 0–65,535 Counts. The Misfire History counters display the total level of misfire that has been detected on each cylinder. The Misfire History counters will not update or show any activity until a misfire DTC (P0300) has become active. The Misfire History counters will update every 200 cylinder firing events.

Misfiring Cylinder: The scan tool displays Prim. Cyl # 0–8 and Sec. Cyl # 0–8. When a multiple misfire occurs, the scan tool displays the cylinder with the most significant misfire under Prim. Cyl. The scan tool displays the least significant misfire under Sec. Cyl.

Misfire Revolution Status: The scan tool displays Reject/Accept. This parameter indicates the misfire diagnostic is inhibited. The scan tool displays Reject when the conditions for running the DTC are not in range.

Not Run Counter: The scan tool displays counts from 0 to 65,535. The scan tool displays the number of times a DTC diagnostic has not reached it's predetermined criteria in order to run since it's first failure.

PCM Reset: The scan tool displays Yes or No. This parameter indicates when the internal PCM resets. The scan tool displays YES when an internal PCM reset occurred. The scan tool displays NO under the normal operating conditions.

PNP: The scan tool displays PARK/NEUTRAL or R-D321. When the transmission is in park or neutral the scan tool displays PARK/NEUTRAL. When you place the gear selector into reverse or any forward gear position, the scan tool displays R-D321.

Pass Counter: The scan tool displays the number of times a DTC has passed.

Reverse Inhibit (M/T only): The scan tool displays Yes or No. The PCM grounds the control circuit when the conditions are met for enabling the Reverse Inhibit solenoid. The scan tool displays Yes when the PCM grounds the control circuit.

Revolutions with Misfire: The scan tool displays the number of engine revolutions the engine is misfiring.

SHRT FT Average 1 and 2: The scan tool displays Percentage. This parameter indicates the average of the short term fuel trim cells. The short term fuel trim cells are rated (Weighted) for the amount of which they are used. For example, the PCM rates an idle cell higher than a wide open cell. If a fueling malfunction is occurs in the idle cell and the wide open cell, the idle cell would affect more than then the wide open cell. A negative value significantly below 0 percent indicates that the fuel system is rich and the PCM is reducing the fuel delivery (decreased injector pulse width). A positive value significantly more than 0 percent indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width). When the average of the cells reach a predetermined high or low, a fuel trim DTC sets.

Short Term FT Bank 1 and Bank 2: The scan tool displays Percentage. The 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 mainly remains less than 450 mV, indicating a lean air/fuel mixture, short term fuel trim increases into the positive range above 0 percent. The PCM adds fuel. If the oxygen sensor voltage stays mainly above the threshold, the short term fuel trim decreases below 0 percent into the negative range. The PCM reduces the fuel delivery in order to compensate for the indicated rich condition. Under certain conditions such as an extended idle and a high ambient temperature, the canister purge may cause the Short Term Fuel Trim to read in the negative range during normal operation. The Fuel trim values at maximum authority may indicate an excessively rich or lean system.

Skip Shift Lamp (M/T only): The scan tool displays On or Off. The PCM sends a message to the IPC (via class 2) to enable the Skip Shift Lamp when the Skip Shift Solenoid is enabled. The scan tool displays On when the Skip Shift Lamp is On.

Skip Shift Solenoid (M/T): The scan tool displays Enabled or Disabled. The PCM grounds the control circuit when the conditions are met for enabling the Skip Shift solenoid. The scan tool displays Enabled when the PCM grounds the control circuit.

Spark: The scan tool displays a range of –64 degrees to 64 degrees. The scan tool displays the amount of degrees the PCM commands the spark advance on the IC circuit. The PCM computes the desired spark advance using the following: (1) Engine coolant temperature; (2) Engine speed (RPM); (3) Load; (4) Vehicle speed. The PCM adjusts the timing.

Start Up ECT: The scan tool displays a range of –39°C to 140°C (–38°F to 284°F). The scan tool displays the Engine Coolant Temperature at the time the engine was started. The PCM uses Start Up ECT for certain DTCs.

TCC Brake Switch: The scan tool displays Applied or Released. This parameter indicates the state of the TCC brake switch circuit input. The scan tool displays Applied when you apply the vehicle brakes. The torque converter clutch disengages. The scan tool displays Released when you release the vehicle brakes. This allows the torque converter clutch to engage.

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TCC Duty Cycle: The scan tool displays Disabled or Enabled. This parameter is the commanded state of the TCC PWM solenoid. The scan tool displays Enabled when the commanded state of the solenoid is ON. The scan tool displays Disabled when the solenoid is not on.

TCC Enable Sol.: The scan tool displays Enabled or Disabled. The scan tool displays Enabled when the electrical system supplies a voltage to the TCC Enable solenoid.

Total Misfire Current Count: The scan tool displays a range of 0–200. The Total Misfire Current Count displays the total number of cylinder firing events that the PCM detected as being misfires during the last 200 crankshaft revolution sample period.

Total Misfire Failures Since First Fail: The scan tool displays a range of 0–65,535. The Total Misfire Failures Since First Fail displays the total number of cylinder firing events that the PCM detected as being misfires since the first failure.

Total Misfire Passes Since First Fail: The scan tool displays a range of 0–65,535. The Total Misfire Passes Since First Fail displays the total number of cylinder firing events that the PCM detected as being good since the first fail.

TP Angle: The scan tool displays 0–100 percent. The scan tool displays the amount of throttle opening in percentage. The scan tool displays about 0 percent at closed throttle. The scan tool displays about 100 percent at wide open throttle.

TP Sensor: The scan tool displays 0–5 Volts. The scan tool displays the amount of throttle opening in voltage. When the throttle is at a closed throttle the voltage is between 0.4–0.9 Volts. When the throttle is at wide open throttle the voltage is above 4.0 Volts.

Traction Control: The scan tool displays Active or Inactive (If so equipped). The scan tool displays active if the PCM receives a signal from the Electronic Brake and Traction Control Module (EBTCM) requesting torque reduction during a traction control maneuver. The scan tool displays Inactive under normal operating conditions.

Transmission OSS: The scan tool displays transmission output speed. This parameter indicates the rotational speed of the transmission output shaft expressed as revolutions per minute.

Transmission Range: The scan tool displays the transmission gear position.

Vehicle Speed: The scan tool displays km/h and mph. The vehicle speed sensor signal is converted into km/h and mph for display on the scan tool.

VTD Fuel Disabled: The scan tool displays Active/Inactive. The PCM receives a 40–60 Hertz signal from the Body Control Module (BCM) when the proper starting procedure occurs. When the PCM receives this 40–60 Hertz signal the fuel system is enabled and the engine starts. The scan tool displays Active once the hertz signal is received by the PCM. If an improper starting procedure occurs, the BCM will not send the 40–60 Hertz signal to the PCM and the PCM disables the fuel system. The scan tool displays Inactive.

Warm-Ups w/o Emission Faults: The scan tool displays a range of 0–255. This parameter counts the number of warm up cycles without an emission fault present. The counter increments to 255 and roll back to 0 unless a fault occurs. If a fault occurs, the counter reverts back to 0 until the fault is corrected. Clearing the information with a scan tool or a loss of power to the PCM also resets the counter to 0.

Warm-Ups w/o Non-Emission Faults: The scan tool displays a range of 0–255. This parameter counts the number of warm up cycles without a non-emission fault present. The counter increments to 255 and roll back to 0 unless a fault occurs. If a fault occurs, the counter reverts back to 0 until the fault is corrected. Clearing information with a scan tool or a loss of power to the PCM also resets the counter to 0.

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

The service information contained in this manual refers to the Federal calibration package. The export change is NOT reflected in the service information on the DTC's diagnostic support information page or in the Repair Instructions. The DTC Type table information refers to domestic and Export calibration packages. Export vehicles may have differences in DTC types that will affect Malfunction Indicator Lamp (MIL) operation. Certain DTCs have been changed from type A to type C or, in some cases, type X. When a type A diagnostic fails, a DTC is set immediately and the Malfunction Indicator Lamp (MIL) is illuminated. When a type B DTC diagnostic fails, the Malfunction Indicator Lamp (MIL) will illuminate if the fault is present after two consecutive ignition cycles. A type C DTC will set after one failure and be stored in history but will not illuminate the Malfunction Indicator Lamp (MIL). Type X DTCs have been turned off (the diagnostic does not run, no codes are stored, and the Malfunction Indicator Lamp (MIL) will not illuminate.

If a system is malfunctioning and the associated DTC has been disabled (Type X), it may be beneficial to use the diagnostic table as a guide to aid in diagnosis. Many of the DTC tables include a functional check of the system that may pinpoint a problem. However, it is important to remember that the DTC tables are specifically designed for use only when a DTC is set. Therefore, a thorough understanding of the normal operation of the system being diagnosed is necessary and use of the tables for this purpose is at the discretion of the technician.

Important: An export vehicle may have unrequired emissions components removed.

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Diagnostic Trouble Code (DTC) Type Table

DTC Description	Domestic	Export Unleaded Fuel RPO K29, and VE1	Export Leaded Fuel RPO NM8
DTC P0101 Mass Air Flow (MAF) Sensor Performance	B	C	C
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 P0121 TP Sensor Circuit Insufficient Activity	B	C	C
DTC P0122 Throttle Position (TP) Sensor Circuit Low Voltage	B	B	B
DTC P0123 Throttle Position (TP) Sensor Circuit High Voltage	B	B	B
DTC P0125 Engine Coolant Temperature (ECT) Excessive Time to Closed Loop Fuel Control	B	C	X
DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1	B	B	X
DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1	B	B	X
DTC P0133 HO2S Slow Response Bank 1 Sensor 1	B	C	X
DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1	B	B	X
DTC P0135 HO2S Heater Performance Bank 1 Sensor 1	B	C	X
DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2	B	B	X
DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2	B	B	X
DTC P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2	B	B	X
DTC P0141 HO2S Heater Performance Bank 1 Sensor 2	B	C	X
DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1	B	B	X
DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1	B	B	X
DTC P0153 HO2S Slow Response Bank 2 Sensor 1	B	C	X
DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1	B	B	X
DTC P0155 HO2S Heater Performance Bank 2 Sensor 1	B	C	X
DTC P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2	B	B	X
DTC P0158 HO2S Circuit High Voltage Bank 2 Sensor 2	B	B	X
DTC P0160 HO2S Circuit Insufficient Activity Bank 2 Sensor 2	B	B	X
DTC P0161 HO2S Heater Performance Bank 2 Sensor 2	B	C	X
DTC P0171 Fuel Trim System Lean Bank 1	B	B	X
DTC P0172 Fuel Trim System Rich Bank 1	B	B	X
DTC P0174 Fuel Trim System Lean Bank 2	B	B	X
DTC P0175 Fuel Trim System Rich Bank 2	B	B	X
DTC P0200 Injector Control Circuit	B	C	C
DTC P0218 Transmission Fluid Overtemperature (5.7L)	C	C	C
DTC P0230 Fuel Pump Relay Control Circuit	B	B	B
DTC P0300 Engine Misfire Detected	B	B (No MIL)	B (No MIL)
DTC P0325 Knock Sensor Module Performance	B	C	C

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Diagnostic Trouble Code (DTC) Type Table (cont'd)

DTC Description	Domestic	Export Unleaded Fuel RPO K29, and VE1	Export Leaded Fuel RPO NM8
DTC P0327 Knock Sensor (KS) 1 Circuit	B	C	C
DTC P0332 Knock Sensor (KS) 2 Circuit	B	C	C
DTC P0335 Crankshaft Position (CKP) Sensor Circuit	B	B	B
DTC P0336 Crankshaft Position (CKP) Sensor Performance	B	B	B
DTC P0341 Camshaft Position (CMP) Sensor Performance	B	B	B
DTC P0342 Camshaft Position (CMP) Sensor Circuit Low Voltage	B	B	B
DTC P0343 Camshaft Position (CMP) Sensor Circuit High Voltage	B	B	B
DTC P0351 Ignition Coil 1 Control Circuit	B	B	B
DTC P0352 Ignition Coil 2 Control Circuit	B	B	B
DTC P0353 Ignition Coil 3 Control Circuit	B	B	B
DTC P0354 Ignition Coil 4 Control Circuit	B	B	B
DTC P0355 Ignition Coil 5 Control Circuit	B	B	B
DTC P0356 Ignition Coil 6 Control Circuit	B	B	B
DTC P0357 Ignition Coil 7 Control Circuit	B	B	B
DTC P0358 Ignition Coil 8 Control Circuit	B	B	B
DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient	A	C	X
DTC P0404 Exhaust Gas Recirculation (EGR) Open Position Performance	B	B	X
DTC P0405 Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage	B	B	X
DTC P0410 Secondary Air Injection (AIR) System	B	C	X
DTC P0412 Secondary Air Injection (AIR) Solenoid Control Circuit	B	C	X
DTC P0418 Secondary Air Injection (AIR) Pump Relay Control Circuit	B	C	X
DTC P0420 Catalyst System Low Efficiency Bank 1	A	C	X
DTC P0430 Catalyst System Low Efficiency Bank 2	A	C	X
DTC P0440 Evaporative Emission (EVAP) System	A	C	X
DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected	A	C	X
DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit	B	C	C
DTC P0446 Evaporative Emission (EVAP) Vent System Performance	A	C	X
DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit	B	C	X
DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage	B	C	X
DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage	B	C	X
DTC P0461 Fuel Level Sensor Performance	C	C	C
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	C	C
DTC P0481 Cooling Fan Relay 2 and 3 Control Circuit	B	C	C
DTC P0500 Vehicle Speed Sensor (VSS) Circuit (Manual Transmission)	B	B	X
DTC P0502 Vehicle Speed Sensor (VSS) Circuit Low Input (5.7L) (Automatic Transmission)	B	B	C

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Diagnostic Trouble Code (DTC) Type Table (cont'd)

DTC Description	Domestic	Export Unleaded Fuel RPO K29, and VE1	Export Leaded Fuel RPO NM8
DTC P0503 Vehicle Speed Sensor (VSS) Circuit Intermittent (5.7L) (Automatic Transmission)	B	B	C
DTC P0506 Idle Speed Low	B	B	B
DTC P0507 Idle Speed High	B	B	B
DTC P0530 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit	C	C	C
DTC P0562 System Voltage Low	C	C	C
DTC P0563 System Voltage High	C	C	C
DTC P0601Control Module Read Only Memory (ROM)	A	A	A
DTC P0602 Control Module Not Programmed	A	A	A
DTC P0604 Control Module Random Access Memory (RAM)	A	A	A
DTC P0608 Vehicle Speed Output Circuit	C	C	C
DTC P0645 Air Conditioning (A/C) Clutch Relay Control Circuit	C	C	C
DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit	B (No MIL)	B (No MIL)	B (No MIL)
DTC P0704 Clutch Switch Circuit (Manual Transmission)	C	C	X
DTC P0711 TFT Sensor Circuit Range/Performance (5.7L)	C	C	C
DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input (5.7L)	C	C	C
DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input (5.7L)	C	C	C
DTC P0719 Brake Switch Circuit Low Input (5.7L)	C	C	C
DTC P0724 Brake Switch Circuit High Input (5.7L)	C	C	C
DTC P0740 TCC Enable Solenoid Circuit Electrical (5.7L)	B	B	C
DTC P0742 TCC System Stuck On (5.7L)	B	B	C
DTC P0748 Pressure Control Solenoid Circuit Electrical (5.7L)	C	C	C
DTC P0751 1-2 Shift Solenoid Valve Performance (5.7L)	A	A	C
DTC P0753 1-2 Shift Solenoid Circuit Electrical (5.7L)	B	B	C
DTC P0756 2-3 Shift Solenoid Valve Performance (5.7L)	A	A	C
DTC P0758 2-3 Shift Solenoid Circuit Electrical (5.7L)	A	A	C
DTC P0785 3-2 Shift Solenoid Circuit Electrical (5.7L)	A	A	C
DTC P0801 Reverse Inhibit Solenoid Control Circuit (Manual Transmission)	C	C	X
DTC P0803 Skip Shift Solenoid Control Circuit (Manual Transmission)	B	X	X
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 P1121 Throttle Position (TP) Sensor Circuit Intermittent High Voltage	C	C	C
DTC P1122 Throttle Position (TP) Sensor Circuit Intermittent Low Voltage	C	C	C
DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1	B	C	X

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Diagnostic Trouble Code (DTC) Type Table (cont'd)

DTC Description	Domestic	Export Unleaded Fuel RPO K29, and VE1	Export Leaded Fuel RPO NM8
DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1	B	C	X
DTC P1153 HO2S Insufficient Switching Bank 2 Sensor 1	B	C	X
DTC P1154 HO2S Transition Time Ratio Bank 2 Sensor 1	B	C	X
DTC P1258 Engine Coolant Overtemperature - Protection Mode Active	A	A	A
DTC P1336 Crankshaft Position (CKP) System Variation Not Learned	A	A	A
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	X
DTC P1415 Secondary Air Injection (AIR) System Bank 1	B	C	X
DTC P1416 Secondary Air Injection (AIR) System Bank 2	B	C	X
DTC P1441 Evaporative Emission (EVAP) System Flow During Non-Purge	B	C	X
DTC P1539 Air Conditioning (A/C) Clutch Feedback Circuit High Voltage	C	C	C
DTC P1546 Air Conditioning (A/C) Clutch Feedback Circuit Low Voltage	C	C	C
DTC P1626 Theft Deterrent Fuel Enable Signal Lost	C	C	C
DTC P1635 5 Volt Reference 1 Circuit	B	B	B
DTC P1637 Generator L-Terminal Circuit	C	C	C
DTC P1639 5 Volt Reference 2 Circuit	B	B	B
DTC P1810 TFP Valve Position Switch Circuit (5.7L)	B	B	C
DTC P1860 TCC PWM Solenoid Circuit Electrical (5.7L)	B	B	C
DTC P1870 Transmission Component Slipping (5.7L)	B	B	C

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Engine Cranks but Does Not Run

Description

The Engine Cranks but Does Not Run diagnostic table assumes that battery condition and engine cranking speed are OK. If the battery condition and the cranking speed are not OK, refer to *Engine Cranks/Cranks Slowly, but Does Not Start* in Engine Electrical for diagnosis. Make sure that there is adequate fuel in the tank.

Diagnostic Aids

- The following may cause an intermittent:
  - Poor connections—refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
  - Corrosion
  - Mis-routed harness
  - Rubbed through wire insulation
  - Broken wire inside the insulation
- Check the duct work between the Mass Air Flow (MAF) sensor and the throttle body for air leaks.
- A malfunctioning MAF sensor may cause a no start or a stall after start. If you suspect this, disconnect the MAF sensor. The PCM will default to the speed density (MAP, IAT, RPM) in order to calculate the load and the air flow. If this corrects the condition and the connections are OK, replace the MAF sensor. Refer to *MAF Sensor Replacement* for procedures.
- If certain components are disconnected at the same time, the engine may not start and NO DTCs set.
- For an intermittent, refer to *Symptoms*.

Test Description

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

2. Certain DTCs only set while cranking the engine. This step verifies if a component is causing the no start condition.
4. This step is testing for a grounded ignition feed circuit for the crankshaft position sensor and the camshaft position sensor. When the ignition feed circuit is shorted, a no start occurs and no DTCs are set. The ignition feed circuits are connected internally within the PCM. The PCM cannot detect that the engine is cranking with a grounded ignition feed circuit. If no engine speed is displayed on the scan tool, inspect the ignition feed circuit for a short to ground.

   The scan tool may reset if the battery is at a low state of charge. The battery may need to be charged to perform this step.
5. This step verifies the IGN relay for proper operation. The IGN relay supplies voltage to the injectors and the ignition coils. When the IGN relay is not operating properly, a no start condition occurs. If the test lamp does not illuminate, this indicates the IGN relay is not suppling a voltage to the fuses.
6. The Crankshaft Position sensor is located near the starter.
7. The Camshaft Position sensor is located at the rear of the engine behind the intake manifold.
8. The ignition feed circuit for the Camshaft and Crankshaft Position sensors is internally connected within the PCM. A short to ground on either circuit causes a no start condition.
10. The fuel cap may need to be removed to hear if the fuel pump is operating.

Engine Cranks but Does Not Run

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	**Important:** Refer to applicable DTC table if any of the following DTCs are set: P0230, P0335, P0336, P0601, P0602, P0604. Crank the engine for the specified amount of time. Does the scan tool display any DTCs that failed this ignition?	15 seconds	Go to the applicable DTC table	*Go to Step 3*
3	Monitor the VTD Fuel Enabled status using a scan tool. Does the scan tool display Active?	—	Go to *DTC P1626 Theft Deterrent Fuel Enable Signal Lost*	*Go to Step 4*
4	Monitor the engine speed while cranking the engine. Is engine RPM indicated on the scan tool?	—	*Go to Step 5*	*Go to Step 6*

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Engine Cranks but Does Not Run (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn ON the ignition leaving the engine OFF. 2. Probe both sides of the fuses (located in the Underhood Electrical Center 2) listed below using the *J 34142-B* test lamp connected to ground. • INJR1 • INJR2 • ENG CTRL • ENG SEN • A/C CRUISE Does the test lamp illuminate on both sides of all the fuses?	—	*Go to Step 9*	Go to *Ignition Relay Diagnosis*
6	1. Disconnect the Crankshaft Position (CKP) sensor electrical connector. Refer to *Crankshaft Position (CKP) Sensor Replacement.* 2. Measure the voltage at the ignition feed circuit at the CKP electrical connector using the DMM. Does the DMM display near the specified value?	B+	*Go to Step 13*	*Go to Step 7*
7	1. Disconnect the Camshaft Position (CMP) sensor electrical connector. Refer to *Camshaft Position (CMP) Sensor Replacement.* 2. Measure the voltage at the ignition feed circuit at the CMP electrical connector using the DMM. Does the DMM display near the specified value?	B+	*Go to Step 14*	*Go to Step 8*
8	1. Test the Camshaft and Crankshaft Position sensor ignition feed circuits for a short to ground. Refer to *Testing for Short to Ground* in Wiring Systems. 2. If you find a grounded circuit repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 16*	*Go to Step 15*
9	Monitor the engine coolant temperature using the scan tool. Is the engine coolant temperature on the scan tool close to the actual engine temperature?	—	*Go to Step 10*	Go to *DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage*
10	Enable the fuel pump using the scan tool. Does the fuel pump operate?	—	*Go to Step 11*	Go to *Fuel Pump Electrical Circuit Diagnosis*
11	1. Turn OFF the ignition. 2. Install a fuel pressure gauge. Refer to *Fuel System Diagnosis.* 3. Turn ON the ignition leaving the engine OFF. 4. Observe the fuel pressure. Is the fuel pressure within the specified range when the fuel pump is operating?	380–420 kPa (55–61 psi)	*Go to Step 12*	Go to *Fuel System Diagnosis*

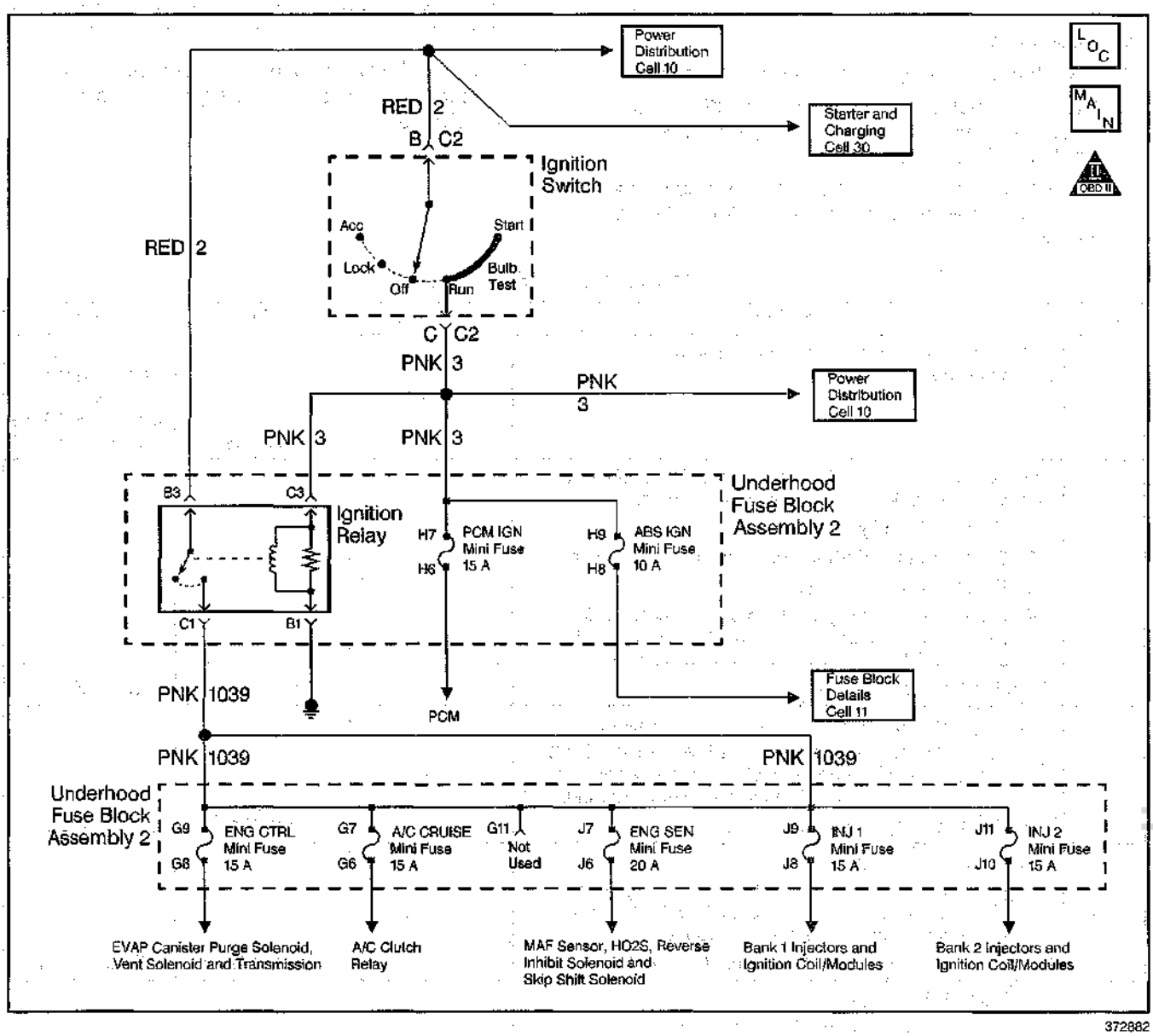
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Engine Cranks but Does Not Run (cont'd)

Step	Action	Value(s)	Yes	No
12	Perform the following additional inspections: • Inspect the duct work between the Mass Air Flow (MAF) sensor and the throttle body for air leaks. • Inspect that the throttle angle is at 0% at a closed throttle. If the throttle angle is not at 0%, refer to *DTC P0122 Throttle Position (TP) Sensor Circuit Low Voltage* and *DTC P0123 Throttle Position (TP) Sensor Circuit High Voltage.* • A malfunctioning MAF sensor may cause a no start or a stall after a start. If you suspect this, disconnect the MAF sensor. The PCM will default to the speed density (MAP, IAT, RPM) in order to calculate the engine load and the intake air flow. If disconnecting the MAF sensor corrects the condition and the connections are OK, replace the MAF sensor. Refer to *MAF Sensor Replacement.* • Inspect the spark plugs for being gas fouled. Refer to *Spark Plug Visual Diagnosis* in Engine Electrical. If the spark plugs are gas fouled, determine what caused the rich condition. • Inspect for an engine mechanical failure that causes an engine not to start (i.e. timing chain, low compression). • Compare MAP/BARO parameters to another vehicle. The parameter values should be close to each other. Did you find and correct the condition?	—	*Go to Step 16*	Go to *Hard Start* for diagnosis
13	Replace the CKP sensor. Refer to *Crankshaft Position (CKP) Sensor Replacement.* Is the action complete?	—	*Go to Step 16*	—
14	Replace the CMP sensor. Refer to *Camshaft Position (CMP) Sensor Replacement.* Is the action complete?	—	*Go to Step 16*	—
15	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 16*	—
16	1. Select the Diagnostic Trouble Codes (DTC) option and the Clear DTC Information option using the scan tool. 2. Attempt to start the engine. Does the engine start and continue to run?	—	*Go to Step 17*	*Go to Step 2*
17	1. Idle the engine at the normal operating temperature. 2. Monitor the Diagnostic Trouble Code (DTC) option using the scan tool. Are any DTCs displayed?	—	Go to the applicable DTC table	*Go to Step 18*
18	Select the Capture Info option and the Review Info option using the scan tool. Are any DTCs displayed that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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Ignition Relay Diagnosis



Circuit Description

The IGN relay powers the following components:

- Injectors/Ignition coils
- Transmission
- A/C system
- EVAP solenoid and EVAP Vent Valve
- MAF sensor
- Heated Oxygen Sensors

Diagnostic Aids

- The following may cause an intermittent:
  - Poor connections; Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
  - Corrosion
  - Mis-routed harness.
  - Rubbed through wire insulation.
  - Broken wire inside the insulation.
- For an intermittent, refer to *Symptoms*.

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Test Description

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

4. This step tests the ignition relay ground circuit.
5. This step isolates the circuit from the IGN relay. All of the circuits at the relay are good if the test lamp illuminates.
8. Inspect the fuses for the IGN relay for being open. If a fuse is open inspect the circuits for a short to ground.
9. Inspect the fuses for the IGN relay for being open. If a fuse is open, inspect the circuits for a short to ground.
11. Remove the underhood electrical center and inspect the circuits that are supplied a voltage by the IGN relay.

Ignition Relay Diagnosis

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	**Important:** For terminal identification, refer to *Electrical Center Identification Views* in Wiring Systems. 1. Turn OFF the ignition. 2. Remove the underhood electrical center 2 cover. 3. Remove the IGN relay. 4. Probe the IGN relay B+ feed circuit (switch side of relay) at the underhood electrical center 2 with the *J 34142-B* test lamp connected to battery ground. Does the test lamp illuminate?	—	*Go to Step 3*	*Go to Step 8*
3	1. Turn ON the ignition leaving the engine OFF. 2. Probe the IGN relay ignition feed circuit (coil side of relay) at the underhood electrical center 2 with the *J 34142-B* test lamp connected to battery ground. Does the test lamp illuminate?	—	*Go to Step 4*	*Go to Step 9*
4	1. Turn OFF the ignition. 2. Measure the resistance of the IGN relay ground circuit at the underhood electrical center 2 using the DMM connected to the battery ground. Is the resistance less than the specified value?	0–2Ω	*Go to Step 5*	*Go to Step 10*
5	1. Turn OFF the ignition. 2. Jumper the IGN relay B+ feed circuit and the IGN relay load circuit together at the underhood electrical center 2 using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. 3. Probe the fuses for the following components with the *J 34142-B* test lamp connected to a ground. • ENG CTRL • A/C CRUISE • INJR1 • INJR2 • ENG SEN Does the test lamp illuminate?	—	*Go to Step 6*	*Go to Step 11*
6	1. Inspect the IGN relay for poor connections at the underhood electrical center. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 7*

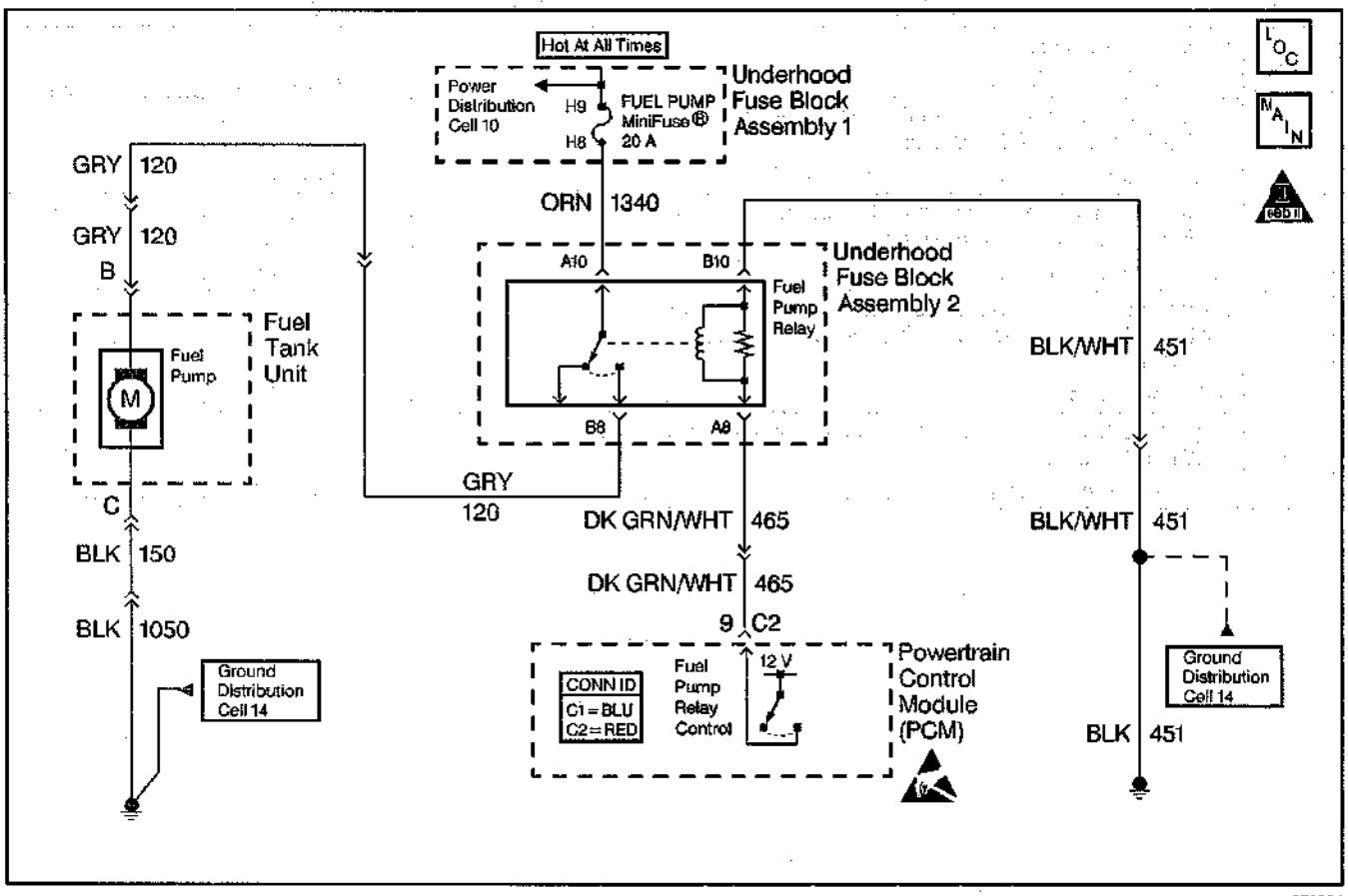
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Ignition Relay Diagnosis (cont'd)

Step	Action	Value(s)	Yes	No
7	Replace the IGN relay. Is the action complete?	—	System OK	—
8	Repair the open B+ supply to the IGN relay. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
9	Repair the ignition feed circuit to the IGN relay. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
10	Repair the open or the high resistance in the ground circuit for the IGN relay. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
11	Repair the IGN relay load circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—

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Fuel Pump Electrical Circuit Diagnosis



372984

Circuit Description

When the ignition switch is ON, the PCM activates the in-tank fuel pump. The fuel pump remains ON as long as the PCM receives reference pulses from the ignition system. If there are no reference pulses, the PCM turns the fuel pump OFF after about 2–3 seconds. The pump delivers fuel to the fuel rail and injectors. The fuel pressure regulator, located in the fuel tank, maintains the system pressure at 380–410 kPa (55–60 psi). Excess fuel returns to the fuel tank. When the engine is stopped, a scan tool in the output controls function can turn ON the fuel pump.

Improper fuel system pressure results in one or many of the following symptoms:

- Cranks but will not run
- Cuts out, may feel like an ignition problem
- Poor fuel economy
- Loss of power
- Hesitation
- DTCs

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent, refer to *Intermittent Conditions*.

Test Description

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

2. Command both the ON and OFF states. Repeat the commands as necessary.
3. This step determines if the condition is located on the coil side or the switch side of the circuit.
4. Verifies that the powertrain control module is providing voltage to the fuel pump relay.
5. Tests for an open in the ground circuit to the fuel pump relay.

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6. This step determines if a voltage is constantly being applied to the fuel pump relay.
12. This step determines if the condition is between the fuel pump relay and the body pass through connector.
15. This step tests if the relay is causing the condition. Use a fused jumper wire with a 20 Amp fuse.
16. This step determines if the condition is between the fuel pump relay and the body pass through connector.
17. This step verifies if the fuel pump ground circuit is causing the condition. Inspect all connections for corrosion or poor connections.
18. A condition with the fuel pump jumper harness may cause the pump to be inoperative. Inspect the fuel pump jumper harness carefully.
20. This step determines if the condition with the circuit is intermittent. If the fuse does not open, inspect the supply voltage circuit between the fuse and the fuel pump for an intermittent condition.

Fuel Pump Electrical Circuit Diagnosis

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to *Step 2*	Go to *A Powertrain On Board Diagnostic (OBD) System Check*
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, command the fuel pump relay ON and OFF. Does the fuel pump turn ON and OFF?	Go to *Intermittent Conditions*	Go to *Step 3*
3	With a scan tool, command the fuel pump relay ON and OFF. Do you hear a click when you command the fuel pump relay ON and OFF?	Go to *Step 9*	Go to *Step 4*
4	1. Turn OFF the ignition. 2. Disconnect the fuel pump relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the control circuit of the fuel pump relay with a test lamp that is connected to a good ground. 5. With a scan tool, command the fuel pump relay ON and OFF. Does the test lamp turn ON and OFF?	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test lamp between the control circuit of the fuel pump relay and the ground circuit of the fuel pump relay. 2. With a scan tool, command the fuel pump relay ON and OFF. Does the test lamp turn ON and OFF?	Go to *Step 21*	Go to *Step 24*
6	Does the test lamp remain illuminated with each command?	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the PCM. Refer to *PCM Replacement/Programming*. 2. Test the control circuit of the fuel pump relay for a short to voltage. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 28*
8	1. Disconnect the PCM. Refer to *PCM Replacement/Programming*. 2. Test the control circuit of the fuel pump relay for a short to ground or an open. Refer to *Circuit Testing* and *Circuit Testing* in Wiring Systems. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 22*
9	Turn ON the ignition, with the engine OFF. Does the fuel pump operate continuously?	Go to *Step 10*	Go to *Step 11*
10	1. Turn OFF the ignition. 2. Disconnect the fuel pump relay. 3. Turn ON the ignition, with the engine OFF. Does the fuel pump operate continuously?	Go to *Step 23*	Go to *Step 27*
11	Is the fuel pump fuse open?	Go to *Step 12*	Go to *Step 14*

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Fuel Pump Electrical Circuit Diagnosis (cont'd)

Step	Action	Yes	No
12	• Disconnect the fuel pump jumper harness from the body pass through connector. Refer to *Outside Left Rear of the Floor Pan, Forward of the Rear Axle* in Wiring Systems. • Test the supply voltage circuit of the fuel pump for a grounded circuit between the fuel pump relay and the body pass through connector. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems. • Replace the fuel pump fuse if necessary. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 13*
13	1. Lower the fuel tank. Refer to *Fuel Tank Replacement.* 2. Test or inspect the fuel pump jumper harness for the following: • Damage to the harness. • A grounded circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems. 3. Replace the fuse if necessary. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 20*
14	1. Turn OFF the ignition. 2. Disconnect the fuel pump relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the battery voltage circuit of the fuel pump relay switch with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to *Step 15*	Go to *Step 25*
15	Connect a 20 amp fused jumper wire between the battery voltage circuit of the fuel pump relay switch and the supply voltage circuit of the fuel pump. Does the fuel pump operate?	Go to *Step 21*	Go to *Step 16*
16	1. Disconnect the fuel pump jumper harness from the body pass through connector. Refer to *Outside Left Rear of the Floor Pan, Forward of the Rear Axle* in Wiring Systems. 2. Test the supply voltage circuit of the fuel pump for an open or high resistance between the fuel pump relay and the body pass through connector. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 17*
17	**Important:** Visually/physically inspect the ground circuit for being tight, corrosion on terminals, or damage to the wiring harness. Test the ground circuit of the fuel pump for an open or high resistance between the body pass through connector and ground. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 18*
18	Inspect for poor connections at the fuel pump jumper harness to the body pass through connector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 19*
19	1. Lower the fuel tank. Refer to *Fuel Tank Replacement.* 2. Test or inspect the fuel pump jumper harness for the following: • Damage to the harness. • A open circuit. Refer to *Circuit Testing* and *Wiring Repairs* in Wiring Systems. • Poor connection at the fuel pump connector. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 26*

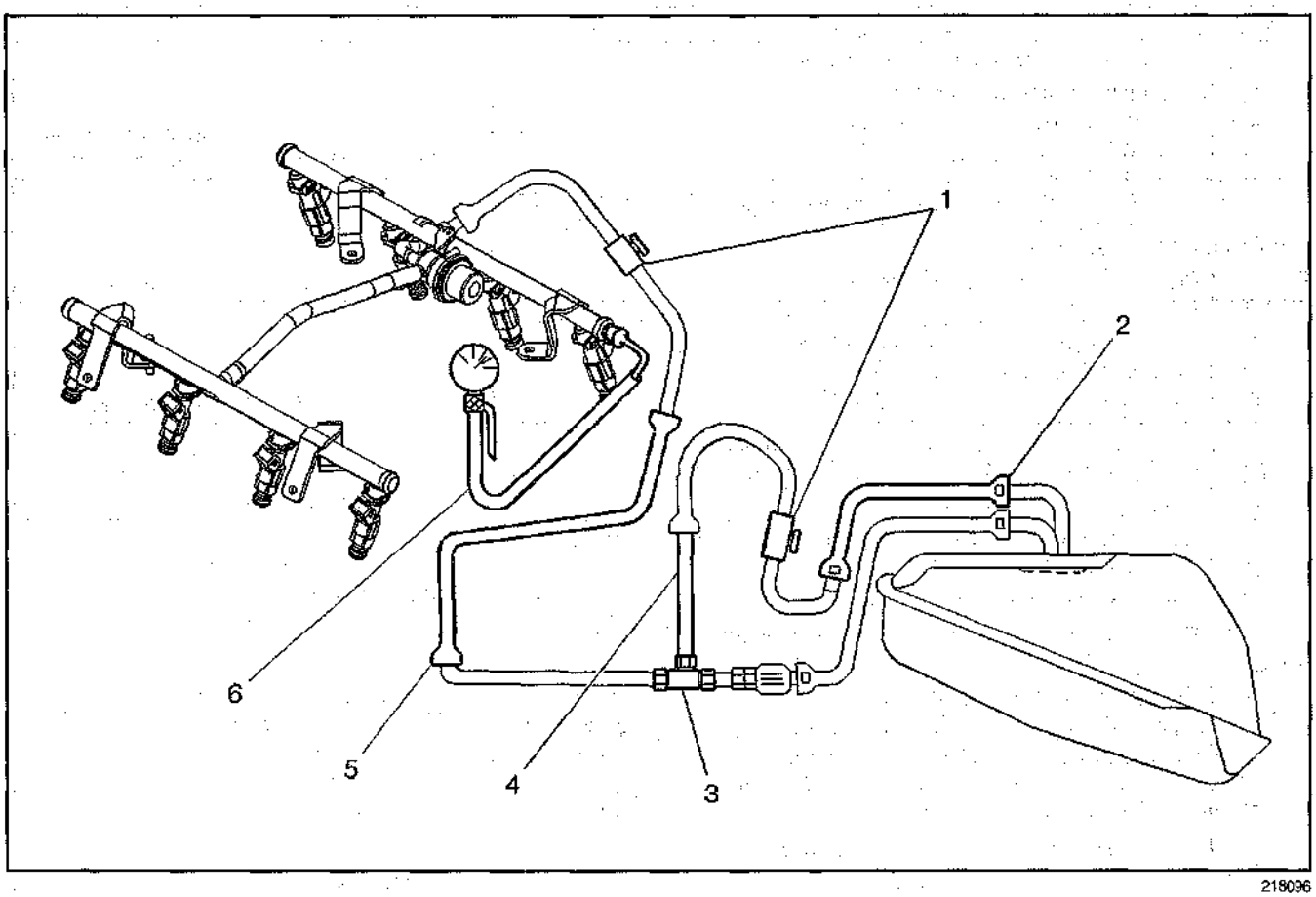
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Fuel Pump Electrical Circuit Diagnosis (cont'd)

Step	Action	Yes	No
20	1. Install all disconnected components. 2. Install a new fuel pump fuse. 3. With a scan tool, turn ON the fuel pump. Is the fuel pump fuse open?	Go to *Step 26*	Go to *Intermittent Conditions*
21	Inspect for poor connections at the fuel pump relay. Refer to *Testing for Intermittent and Poor Connections* and *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 27*
22	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. Did you find and correct the condition?	Go to *Step 29*	Go to *Step 28*
23	Repair the supply voltage circuit of the fuel pump for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Did you complete the repair?	Go to *Step 29*	—
24	Repair the open fuel pump relay ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Did you complete the repair?	Go to *Step 29*	—
25	Repair the battery voltage circuit of the fuel pump relay switch. Refer to *Wiring Repairs* in Wiring Systems. Did you complete the repair?	Go to *Step 29*	—
26	**Important:** Inspect for poor connections at the fuel pump, within the fuel tank, before replacing the fuel pump. 1. Replace the fuel pump. Refer to *Fuel Tank Pump Module Replacement.* 2. Replace the fuel pump fuse if necessary. Did you complete the replacement?	Go to *Step 29*	—
27	Replace the fuel pump relay. Did you complete the replacement?	Go to *Step 29*	—
28	Replace the PCM. Refer to *PCM Replacement/Programming.* Did you complete the replacement?	Go to *Step 29*	—
29	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to *Step 2*

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Fuel System Diagnosis



218096

Legend

(1) J 37287 Fuel Line Shut-off Adapters
(2) Rear Fuel Return Pipe
(3) T-connector
(4) Fuel Return Pipe
(5) Fuel Feed Pipe
(6) J 34730-1A Fuel Pressure Gauge

Circuit Description

When you turn ON the ignition switch, the Powertrain Control Module (PCM) turns ON the in-tank fuel pump. The in-tank fuel pump remains ON as long as the engine is cranking or running and the PCM receives reference pulses. If there are no reference pulses, the PCM turns the in-tank fuel pump OFF 2 seconds after the ignition switch is turned ON or 2 seconds after the engine stops running.

The electric fuel pump attaches to the fuel sender assembly inside the fuel tank. The in-tank fuel pump supplies fuel through an in-pipe fuel filter to the fuel rail assembly. The fuel pump provides fuel at a pressure above the pressure needed by the fuel injectors. The fuel pressure regulator keeps the fuel available to the fuel injectors at a regulated pressure. The fuel pressure regulator attaches to the fuel sender assembly return pipe. Unused fuel returns to the fuel tank by a separate fuel return pipe. The fuel return pipe attaches to a T-connector in the fuel feed pipe on the outlet side of the fuel filter.

Test Description

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

2. When the ignition switch is ON and the fuel pump is running, the fuel pressure indicated by the fuel pressure gauge should read 380–410 kPa (55–60 psi). The spring pressure inside the fuel pressure regulator controls the fuel pressure.
3. A fuel system that drops more than 34 kPa (5 psi) in 10 minutes has a leak in one or more of the following areas:
   - The fuel pipes.
   - The fuel pump check valve.
   - The fuel pump flex pipe.
   - The valve or valve seat within the fuel pressure regulator.
   - The fuel injector(s).
4. A fuel system that drops more than 14 kPa (2 psi) in 10 minutes after being relieved to 69 kPa (10 psi) indicates a leaking fuel pump check valve.

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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. You can diagnose a lean condition using a scan tool. If an extremely lean condition occurs, the heated oxygen sensors(s) will stop toggling. The heated oxygen sensor output voltage(s) will drop below 300 mV. The fuel injector pulse width will increase.

Important: Make sure the fuel system is not operating in the Fuel Cut-Off Mode. This can cause false indications by the scan tool.

10. A rich condition may result from the fuel pressure being above 410 kPa (60 psi). A rich condition may cause DTC P0132, DTC P0152, DTC P0172 or DTC P0175 to set. Driveability conditions associated with rich conditions can include hard starting followed by black smoke and a strong sulfur smell in the exhaust.
11. 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.
12. A lean condition may result from the fuel pressure being below 380 kPa (55 psi). A lean condition may cause DTC P0131, DTC P0151, DTC P0171 or DTC P0174 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.

Notice: Do not allow the fuel pressure to exceed 500 kPa (72 psi). Fuel pressure in excess of 500 kPa (72 psi) may damage the fuel pressure regulator.

13. Restricting the fuel return pipe with the *J 37287* fuel pipe shut-off adapter causes the fuel pressure to rise above the regulated fuel pressure. Using a scan tool to pressurize the fuel system, the fuel pressure should rise above 410 kPa (60 psi) as the valve on the fuel pipe shut-off adapter connected to the fuel return pipe becomes partially closed.
18. 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:
    1. Remove the fuel rail, but leave the fuel pipe connected to the fuel rail. Refer to *Fuel Rail Assembly Replacement*.
    2. Lift the fuel rail just enough to leave the fuel injector nozzles in the fuel injector ports.

Caution: In order to reduce the risk of fire and personal injury that may result from fuel spraying on the engine, verify that the fuel rail is positioned over the fuel injector ports. Also verify that the fuel injector retaining clips are intact.

    3. Pressurize the fuel system by using the scan tool fuel pump enable.
    4. Visually and physically inspect the fuel injector nozzles for leaks.

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Fuel System Diagnosis

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	1. Turn the ignition OFF. 2. Turn the air conditioning system OFF. ***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. Install the *J 34730-1A* fuel pressure gauge (6). 4. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 5. Turn the ignition ON. 6. Bleed the air out of the fuel pressure gauge. 7. Turn the ignition OFF for 10 seconds. 8. Turn the ignition ON. **Important:** The fuel pump will run for approximately 2 seconds. Cycle the ignition as necessary in order to achieve the highest possible fuel pressure. 9. Observe the fuel pressure with the fuel pump running. Is the fuel pressure within the specified limits?	380–410 kPa (55–60 psi)	*Go to Step 3*	*Go to Step 10*
3	**Important:** The fuel pressure may vary slightly when the fuel pump stops running. After the fuel pump stops running the fuel pressure should stabilize and remain constant. Does the fuel pressure drop more than the specified value in 10 minutes?	34 kPa (5 psi)	*Go to Step 8*	*Go to Step 4*
4	Relieve the fuel pressure to the first specified value. Does the fuel pressure drop more than the second specified value in 10 minutes?	69 kPa (10 psi) 14 kPa (2 psi)	*Go to Step 17*	*Go to Step 5*
5	Do you suspect the fuel pressure of dropping-off during acceleration, cruise, or hard cornering?	—	*Go to Step 6*	Go to *Symptoms*
6	Visually and physically inspect the following items for a restriction: • The fuel filter. • The fuel feed pipe (5). Did you find a restriction?	—	*Go to Step 21*	*Go to Step 7*
7	1. Remove the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*. 2. Visually and physically inspect the following items: • The fuel pump strainer for a restriction • The fuel pump flex pipe for leaks • The fuel pressure regulator for leaks • The fuel pressure regulator fuel return pipe for leaks • Verify the fuel pump is the correct fuel pump for this vehicle Did you find a problem in any of these areas?	—	*Go to Step 21*	*Go to Step 17*

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Fuel System Diagnosis (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief Procedure.* 2. Disconnect the fuel feed pipe (5) from the fuel rail. 3. Install the *J 37287* fuel pipe shut-off adapter (1) between the fuel feed pipe and the fuel rail. 4. Open the valve on the fuel feed pipe shut-off adapter. 5. Pressurize the fuel system using a scan tool. 6. Place the bleed hose of the fuel pressure gauge (6) into an approved gasoline container. 7. Bleed the air out of the fuel pressure gauge. 8. Wait for the fuel pressure to build. 9. Close the valve in the fuel feed pipe shut-off adapter. Does the fuel pressure remain constant?	—	*Go to Step 9*	*Go to Step 18*
9	**Important:** This step requires the aid of an assistant. 1. Open the valve in the fuel feed pipe shut-off adapter (1). 2. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief Procedure.* 3. Raise the vehicle. 4. Disconnect the steel fuel return pipe (4) at the nylon rear return pipe (2). 5. Drain any remaining fuel from the pipes into an approved gasoline container. 6. Install the *J 37287* fuel pipe shut-off adapter (1) between the steel fuel return pipe and the rear nylon return pipe. 7. Pressurize the fuel system using a scan tool. 8. Wait for the fuel pressure to build. 9. Close the valve in the fuel pipe shut-off adapter that is connected to the fuel return pipe (4). Does the fuel pressure remain constant?	—	*Go to Step 16*	*Go to Step 17*
10	Is the fuel pressure above the specified limit?	410 kPa (60 psi)	*Go to Step 11*	*Go to Step 12*
11	1. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief Procedure.* 2. Disconnect the steel fuel return pipe (4) at the nylon rear return pipe (2). 3. Drain any remaining fuel from the fuel pipes into an approved gasoline container. 4. Attach a length of flexible fuel hose to the steel fuel return pipe attached to the T-connector (3). 5. Place the open end of the flexible fuel hose into an approved gasoline container. 6. Turn ON the fuel pump using a scan tool. 7. Observe the fuel flow with the fuel pump running. Is there fuel flow?	—	*Go to Step 20*	*Go to step 19*
12	Is the fuel pressure above the specified value?	0 kPa (0 psi)	*Go to Step 13*	*Go to Step 14*

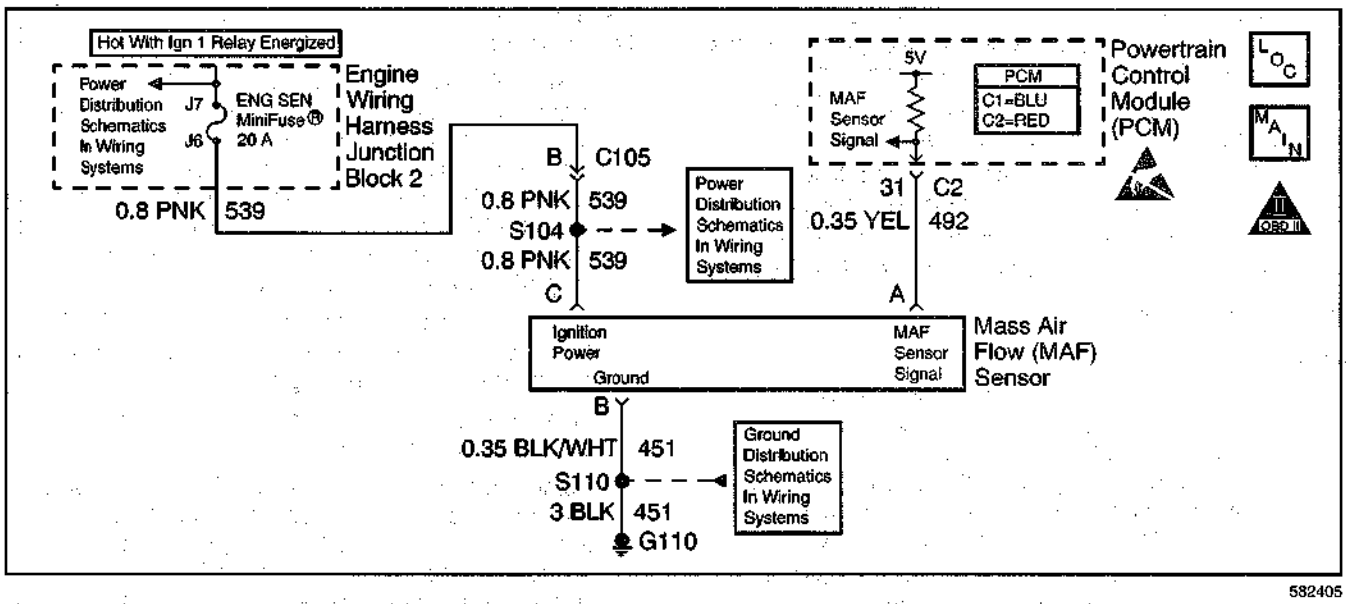
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Fuel System Diagnosis (cont'd)

Step	Action	Value(s)	Yes	No
13	**Important:** This step requires the aid of an assistant. 1. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief Procedure.* 2. Raise the vehicle. 3. Disconnect the steel fuel return pipe (4) from the nylon rear return pipe (2). 4. Drain any remaining fuel from the fuel pipes into an approved gasoline container. 5. Install the *J 37287* fuel pipe shut-off adapter (1) between the steel fuel return pipe and the nylon rear fuel return pipe. 6. Open the valve on the fuel pipe shut-off adapter. 7. Pressurize the fuel system using a scan tool. 8. Place the bleed hose of the fuel pressure gauge (6) into an approved gasoline container. 9. Bleed the air out of the fuel pressure gauge. ***Notice:*** Do not allow the fuel pressure to exceed 500 kPa (72 psi). Fuel pressure in excess of 500 kPa (72 psi) may damage the fuel pressure regulator. 10. Slowly close the valve in the fuel pipe shut-off adapter that is connected to the fuel return pipe. Does the fuel pressure rise above the specified value?	410 kPa (60 psi)	*Go to Step 16*	*Go to Step 7*
14	Turn ON the fuel pump using a scan tool. Does the fuel pump run?	—	*Go to Step 15*	Go to *Fuel Pump Electrical Circuit Diagnosis*
15	Visually and physically inspect the following items: • The fuel filter for obstructions. • The fuel feed pipe (5) for a restriction. • The fuel pump strainer for obstructions. • The fuel pump flex pipe for leaks. Did you find a problem in any of these areas?	—	*Go to Step 21*	*Go to Step 17*
16	Replace the fuel pressure regulator. Refer to *Fuel Pressure Regulator Replacement.* Is the action complete?	—	System OK	—
17	Replace the fuel pump. Refer to *Fuel Tank Pump Module Replacement.* Is the action complete?	—	System OK	—
18	Locate and replace any leaking fuel injector(s). Is the action complete?	—	System OK	—
19	Locate and correct the restriction in the steel fuel return pipe (4) or the T-connector (3). Is the action complete?	—	System OK	—
20	Visually and physically inspect the nylon rear fuel return pipe (2) for a restriction. Did you find a restriction?	—	*Go to Step 21*	*Go to Step 16*
21	Repair the problem as necessary. Is the action complete?	—	System OK	—

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DTC P0101 Mass Air Flow (MAF) Sensor Performance



582405

Circuit Description

The Mass Air Flow (MAF) sensor measures the amount of air ingested by the engine. The direct measurement of the air entering the engine is more accurate than calculating the airflow from the MAP, the IAT and the engine speed (speed/density). The MAF sensor has a battery feed, ground, and a signal circuit.

The MAF sensor used on this engine is a hot wire type. This engine uses the MAF sensor to measure air flow rate. The MAF output frequency is a function of the power required to keep the air flow sensing elements (hot wires) at a fixed temperature above the ambient temperature. Air flowing through the sensor cools the sensing elements. The amount of cooling is proportional to the amount of air flow. The MAF sensor requires a greater amount of current in order to maintain the hot wires at a constant temperature as the air flow increases. The MAF sensor converts the changes in current draw to a frequency signal read by the PCM. The PCM calculates the air flow (grams per second) based on this signal.

The PCM monitors the MAF sensor frequency. The PCM can determine if the sensor is stuck low, stuck high, not providing the airflow value expected for a given operating condition, or that the signal appears to be stuck based on a lack of signal variation expected during the normal operation. This diagnostic tests the range/performance of the MAF sensor. The MAF system performance or rationality diagnostic uses the MAP, the IAT, and the engine speed to calculate an expected airflow rate. The PCM then compares the rate to the actual measured airflow from the MAF sensor. The PCM only compares the actual MAF value and the calculated value during conditions where the values are likely to match. This DTC sets if the actual MAF reading is not within a predetermined range of the calculated reading.

Conditions for Running the DTC

- DTCs P0102, P0103, P0107, P0108, P0121, P0122, P0123 not set.
- The engine is running.
- The TP sensor angle is less than 50 percent and the engine vacuum (BARO-MAP) is greater than 65 kPa.
- The system voltage is more than 11 volts but less than 18 volts.
- The EGR pintle position is less than 90 percent.
- The change in TP sensor is less than 3 percent.
- All above conditions stable for 2.0 seconds.

Conditions for Setting the DTC

- The MAF frequency is 50 percent different from the speed density calculation.
- All conditions met for 5.0 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems for procedures.
- Any un-metered air may cause this DTC to set. Inspect for the following:
  - An engine vacuum leak
  - The PCV system for vacuum leaks
  - An incorrect PCV valve
  - The engine oil dip stick not fully seated
- For an intermittent, refer to *Symptoms*.

Test Description

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

2. The MAF system performance or rationality diagnostic uses the MAP sensor signal along with other inputs in order to calculate an expected airflow rate. The PCM then compares the expected flow rate to the actual measured airflow from the MAF sensor. The first few steps of this table verifies the MAP sensor is working properly. Correct any MAP sensor DTCs first.
3. The MAP sensor is difficult to remove. Twist the MAP sensor forward and pull up. This forward motion clears the retaining clip.
5. This step monitors a smooth transition to the original scan tool value.
6. 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 isolates when the DTC failed.
7. Any un-metered air causes this DTC to set. Inspect the PCV system for vacuum leaks. Also inspect the dip stick for being pulled out. Inspect the oil fill cap for being loose.
8. This step verifies the signal circuit from the MAF sensor electrical connector to the PCM.
9. This step verifies whether a ground and B+ circuit is available.
10. This step tests the signal circuit for an open.
11. This step tests the signal circuit for a short to B+.

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DTC P0101 Mass Air Flow (MAF) Sensor Performance

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	If any MAP sensor DTCs are set, refer to the applicable DTC before proceeding. 1. Idle the engine. 2. Monitor the MAP sensor voltage parameter using a scan tool. Is the MAP sensor voltage outside of the specified range?	0.8–4V	Go to *DTC P0107 Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage* or *DTC P0108 Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage*	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Remove the MAP sensor from the intake manifold leaving the electrical harness connected. Refer to *MAP Sensor Replacement*. 3. Connect a hand operated vacuum pump to the MAP sensor. 4. Turn ON the ignition leaving the engine OFF. 5. Observe or record the MAP sensor display while slowly applying vacuum up to 20 inches Hg as indicated on the pump gauge. Each 1 inch of vacuum applied should result in a 3 to 4 kPa drop in the MAP sensor value on the scan tool and the value should change smoothly with each increase in vacuum. Did the MAP sensor value change smoothly through the entire range of the test without any erratic readings?	—	*Go to Step 4*	*Go to Step 19*
4	Apply 20 inches Hg vacuum to the MAP sensor. Is the MAP sensor reading on the scan tool the same or less than the specified value?	34 kPa	*Go to Step 5*	*Go to Step 19*
5	Disconnect the vacuum source from the MAP sensor. Does the MAP sensor reading return to the original value that was observed in step 3?	—	*Go to Step 6*	*Go to Step 19*
6	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Re-install the MAP sensor and any disconnected components. 5. Start the engine. 6. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 7. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 7*	Go to Diagnostic Aids

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

Step	Action	Value(s)	Yes	No
7	1. Inspect for the following conditions: • Objects blocking the MAF sensor inlet screen • Intake manifold vacuum leaks • Vacuum leaks at the throttle body • Crankcase ventilation valve faulty, missing, or incorrectly installed 2. If you find a condition, repair as necessary. Did you find and correct the condition?	—	*Go to Step 21*	*Go to Step 8*
8	1. Turn OFF the ignition. 2. Disconnect the MAF sensor connector. 3. Turn ON the ignition leaving the engine OFF. 4. Measure the voltage between the MAF sensor signal circuit and the battery ground using the DMM. Is the voltage near the specified value?	5V	*Go to Step 9*	*Go to Step 10*
9	Connect a *J 34142-B* test lamp between the MAF sensor ignition feed and the ground circuit at the MAF sensor harness connector. Is the test lamp illuminated?	—	*Go to Step 13*	*Go to Step 12*
10	Is the voltage less than the specified value?	4.5V	*Go to Step 14*	*Go to Step 11*
11	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition leaving the engine OFF. 4. Measure the voltage between the MAF sensor signal circuit and ground. Does the voltage measure near the specified value?	0V	*Go to Step 20*	*Go to Step 17*
12	Connect a *J 34142-B* test lamp between the MAF sensor ignition feed circuit and the battery ground. Is the test lamp illuminated?	—	*Go to Step 15*	*Go to Step 16*
13	1. Inspect for a poor connection at the MAF sensor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, replace the faulty terminal(s). Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find a poor connection?	—	*Go to Step 21*	*Go to Step 18*
14	1. Inspect the MAF sensor signal circuit between the PCM and the MAF sensor for the following: • An open circuit • A short to ground • A short to the MAF sensor ground circuit. 2. Repair the circuit if the MAF sensor signal circuit is open or shorted. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 21*	*Go to Step 20*
15	Locate and repair the open in the ground circuit to the MAF sensor. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 21*	—
16	Locate and repair the open in the ignition feed circuit to the MAF sensor. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 21*	—

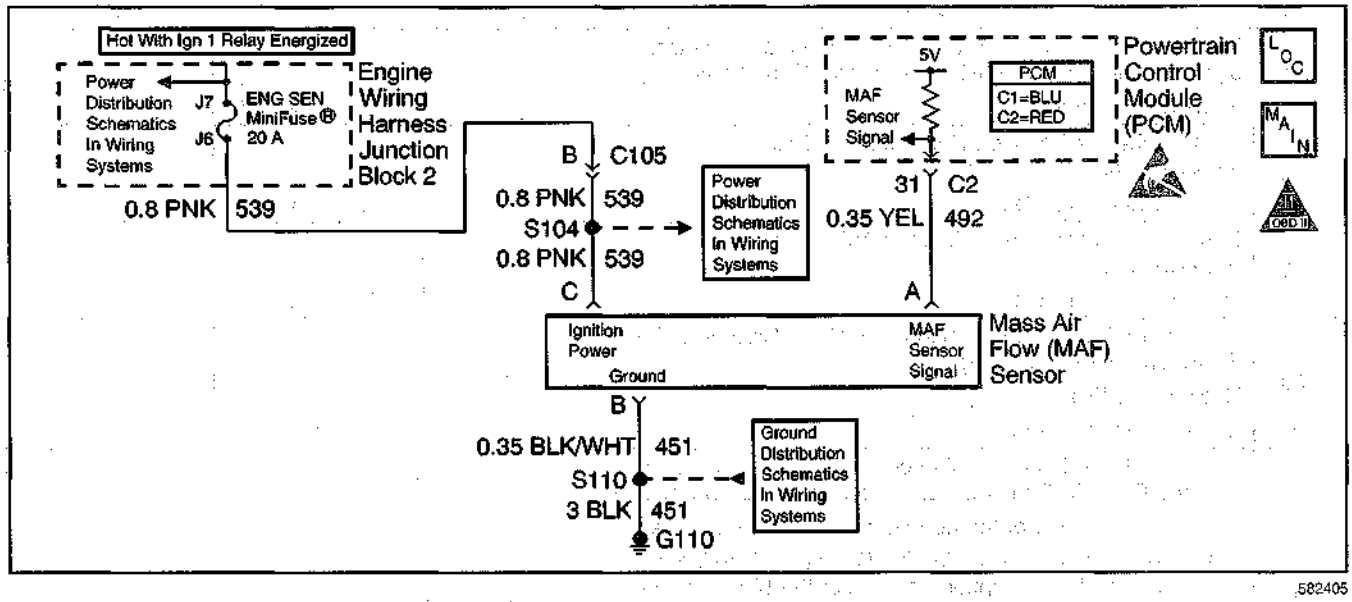
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DTC P0101 Mass Air Flow (MAF) Sensor Performance (cont'd)

Step	Action	Value(s)	Yes	No
17	Locate and repair the short to voltage in the MAF sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 21*	—
18	Replace the MAF sensor. Refer to *MAF Sensor Replacement.* Is the action complete?	—	*Go to Step 21*	—
19	Replace the MAP sensor. Refer to *MAP Sensor Replacement.* Is the action complete?	—	*Go to Step 21*	—
20	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 21*	—
21	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 22*	*Go to Step 2*
22	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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



Circuit Description

The Mass Air Flow (MAF) sensor measures the amount of air ingested by the engine. The direct measurement of the air entering the engine is more accurate than calculating the airflow from the MAP, the IAT, and the engine speed (speed/density). The MAF sensor has a battery feed, a ground, and a signal circuit.

The MAF sensor used on this engine is a hot wire type. This engine uses the MAF sensor in order to measure air flow rate. The MAF output frequency is a function of the power required to keep the air flow sensing elements (hot wires) at a fixed temperature above the ambient temperature. Air flowing through the sensor cools the sensing elements. The amount of cooling is proportional to the amount of air flow. The MAF sensor requires a greater amount of current in order to maintain the hot wires at a constant temperature as the air flow increases. The MAF sensor converts the changes in current draw to a frequency signal read by the PCM. The PCM calculates the air flow (grams per second/hertz) based on this signal. The PCM monitors the MAF sensor frequency. The PCM determines if the sensor is stuck low, stuck high, not providing the airflow value expected for a given operating condition, or that the signal appears to be stuck based on a lack of signal variation expected during the normal operation. This diagnostic tests for too low of an airflow rate. This DTC sets when the PCM detects that the MAF sensor frequency is below a predetermined value.

Conditions for Running the DTC

- The engine is operating longer than 0.5 seconds.
- The engine speed is more than 300 RPM.
- The system voltage is at least 8.0 volts.

Conditions for Setting the DTC

- The MAF frequency is less than 10 Hz.
- All conditions met for 1 second

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.
- Any un-metered air may cause this DTC to set. Inspect for the following:
  - An engine vacuum leak
  - The PCV system for vacuum leaks
  - An incorrect PCV valve
  - The engine oil dip stick not fully seated
  - The engine oil fill cap loose or missing
- For an intermittent, refer to *Symptoms*.

Test Description

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

2. Monitoring the MAF sensor frequency will determine if the fault is present or the malfunction is intermittent.
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 isolates when the DTC failed.
4. This step tests whether the MAF sensor ignition feed circuit is shorted to a ground. If the fuse is open, repair the circuit as necessary and replace the fuse.
5. This step tests whether the 5.0 volts is available to the MAF sensor signal circuit.
6. This step tests if the signal circuit is shorted to another 5.0 volt reference circuit. If another DTC sets, repair the circuits that are shorted together. If no DTCs set it may be necessary to road test the vehicle.
10. Inspect the fuse 19 for being open. If the fuse is open, inspect the MAF sensor ignition feed circuit for a short to ground.
11. This step verifies whether B+ is available to the MAF sensor.

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

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	1. Install a scan tool. 2. Idle the engine. 3. Monitor the MAF sensor frequency display on the Engine 2 Data List of the scan tool. Is the MAF sensor frequency below the specified value?	10 Hz	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids

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

Step	Action	Value(s)	Yes	No
4	Is the ENG SEN fuse open?	—	*Go to Step 19*	*Go to Step 5*
5	1. Turn OFF the ignition. 2. Disconnect the MAF sensor connector. 3. Turn ON the ignition leaving the engine OFF. 4. Measure the voltage between the MAF sensor signal circuit and the battery ground using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Is the voltage near the specified value?	5V	*Go to Step 6*	*Go to Step 7*
6	1. Turn OFF the ignition. 2. Jumper the MAF sensor signal circuit to battery ground using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. 3. Start the engine. Do any additional DTCs set?	—	*Go to Step 20*	*Go to Step 11*
7	1. Turn OFF the ignition. 2. Disconnect the PCM. Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition leaving the engine OFF. 4. Measure the voltage at the MAF sensor signal circuit at the PCM harness connector using a DMM. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the DMM display a voltage?	—	*Go to Step 14*	*Go to Step 8*
8	1. Turn OFF the ignition. 2. Test for continuity of the MAF sensor signal circuit using a DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display OL?	—	*Go to Step 15*	*Go to Step 9*
9	Test for continuity of the MAF sensor signal circuit to battery ground using a DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display OL?	—	*Go to Step 10*	*Go to Step 16*
10	Test for continuity at the PCM harness between the MAF sensor signal circuit and all other circuits at both PCM connectors using a DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display OL?	—	*Go to Step 17*	*Go to Step 22*
11	Connect the *J 34142-B* test lamp between the MAF sensor ignition feed circuit and the ground circuit at the MAF sensor harness connector. Does the test lamp illuminate?	—	*Go to Step 13*	*Go to Step 12*
12	Connect the *J 34142-B* test lamp between the MAF sensor ignition feed circuit and the battery ground. Does the test lamp illuminate?	—	*Go to Step 18*	*Go to Step 19*
13	1. Inspect for a poor connection at the MAF sensor harness terminals. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find a poor connection?	—	*Go to Step 24*	*Go to Step 21*
14	Repair the short to voltage in the MAF sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 24*	—
15	Repair the open in the MAF sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 24*	—

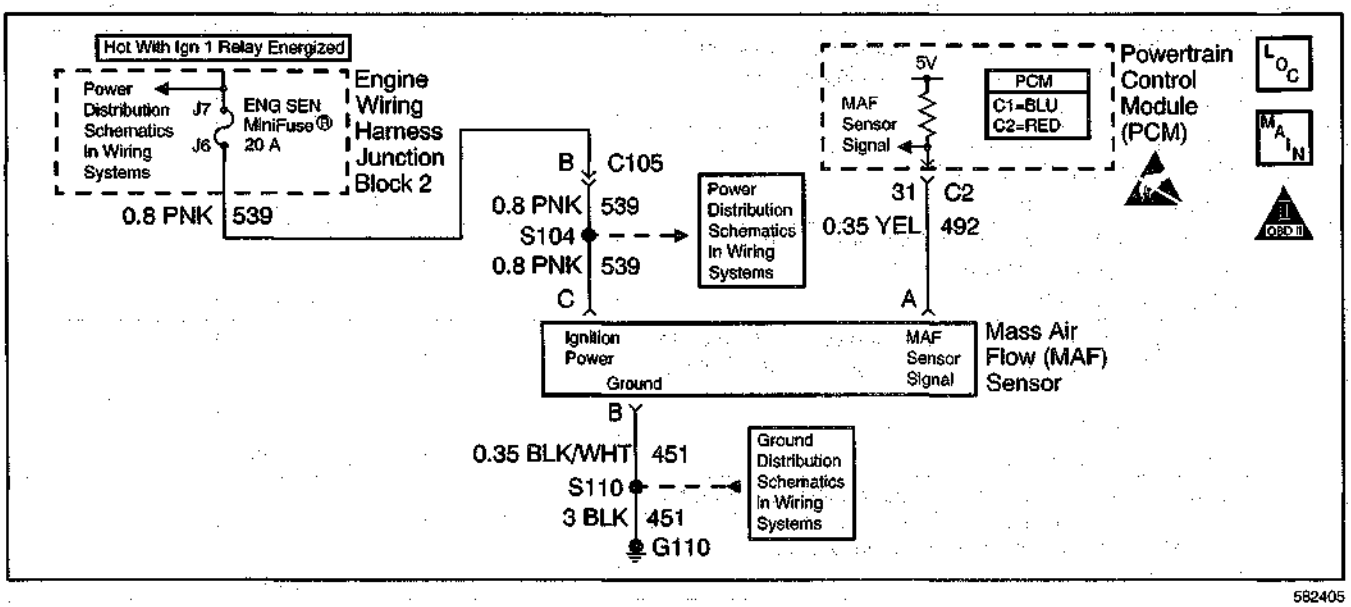
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DTC P0102 Mass Air Flow (MAF) Sensor Circuit Low Frequency (cont'd)

Step	Action	Value(s)	Yes	No
16	Repair the short to ground in the MAF sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 24*	—
17	Repair the circuits that are shorted together. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 24*	—
18	Repair the MAF sensor ground circuit for an open. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 24*	—
19	1. Repair the open or grounded ignition feed circuit to the MAF sensor. Refer to *Wiring Repairs* in Wiring Systems. 2. Replace the fuse if necessary. Is the action complete?	—	*Go to Step 24*	—
20	Repair the circuits that are shorted together between the MAF sensor signal circuit and the circuit for which the DTC set. Refer to *Wiring Repairs* in Wiring Systems Is the action complete?	—	*Go to Step 24*	—
21	Replace the MAF sensor. Refer to *MAF Sensor Replacement.* Is the action complete?	—	*Go to Step 24*	—
22	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 24*	*Go to Step 23*
23	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 24*	—
24	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 25*	*Go to Step 2*
25	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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



582405

Circuit Description

The Mass Air Flow (MAF) sensor measures the amount of air ingested by the engine. The direct measurement of the air entering the engine is more accurate than calculating the airflow from the MAP, the IAT, and the engine speed (speed/density). The MAF sensor has a battery feed, a ground, and a signal circuit.

The MAF sensor used on this engine is a hot wire type. This engine uses the MAF sensor in order to measure air flow rate. The MAF output frequency is a function of the power required to keep the air flow sensing elements (hot wires) at a fixed temperature above the ambient temperature. Air flowing through the sensor cools the sensing elements. The amount of cooling is proportional to the amount of air flow. The MAF sensor requires a greater amount of current in order to maintain the hot wires at a constant temperature as the air flow increases. The MAF sensor converts the changes in current draw to a frequency signal read by the PCM. The PCM calculates the air flow (grams per second/hertz) based on this signal. The PCM monitors the MAF sensor frequency. The PCM determines if the sensor is stuck low, stuck high, not providing the airflow value expected for a given operating condition, or that the signal appears to be stuck based on a lack of signal variation expected during the normal operation. This diagnostic tests for too high of an airflow rate. This DTC sets when the PCM detects that the MAF sensor frequency is above a predetermined value.

Conditions for Running the DTC

- The engine is operating longer than 0.5 seconds.
- The engine speed is more than 300 RPM.
- The system voltage is more than 8.0 volts.

Conditions for Setting the DTC

- The MAF frequency is more than 14,000 Hz.
- All conditions met for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.
- Water entering the air intake system that reaches the MAF sensor could cause this DTC to set. The water rapidly cools the hot wires in the sensor, causing a false indication of excessive airflow. Inspect the following areas for evidence (witness marks) of water intrusion:
  - AIR system
  - Intake air system
- For an intermittent, refer to *Symptoms*.

Test Description

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

2. Monitoring the MAF sensor frequency determines if the fault is present or the malfunction is intermittent. A poor connection at the MAF sensor or at the fuse causes this DTC to set.
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 isolates when the DTC failed.
4. This step tests for electro-magnetic interference on the MAF sensor signal circuit. There should be no signal indicated on the scan tool with the sensor disconnected.

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

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	1. Idle the engine. 2. Monitor the MAF sensor display on the Engine 2 Data List of the scan tool. Is the MAF sensor frequency above the specified value?	14,000 Hz	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the ignition. 2. Disconnect the MAF sensor connector. 3. Idle the engine. 4. Monitor the MAF sensor frequency using the scan tool. Does scan tool indicate a MAF sensor frequency?	—	*Go to Step 7*	*Go to Step 5*

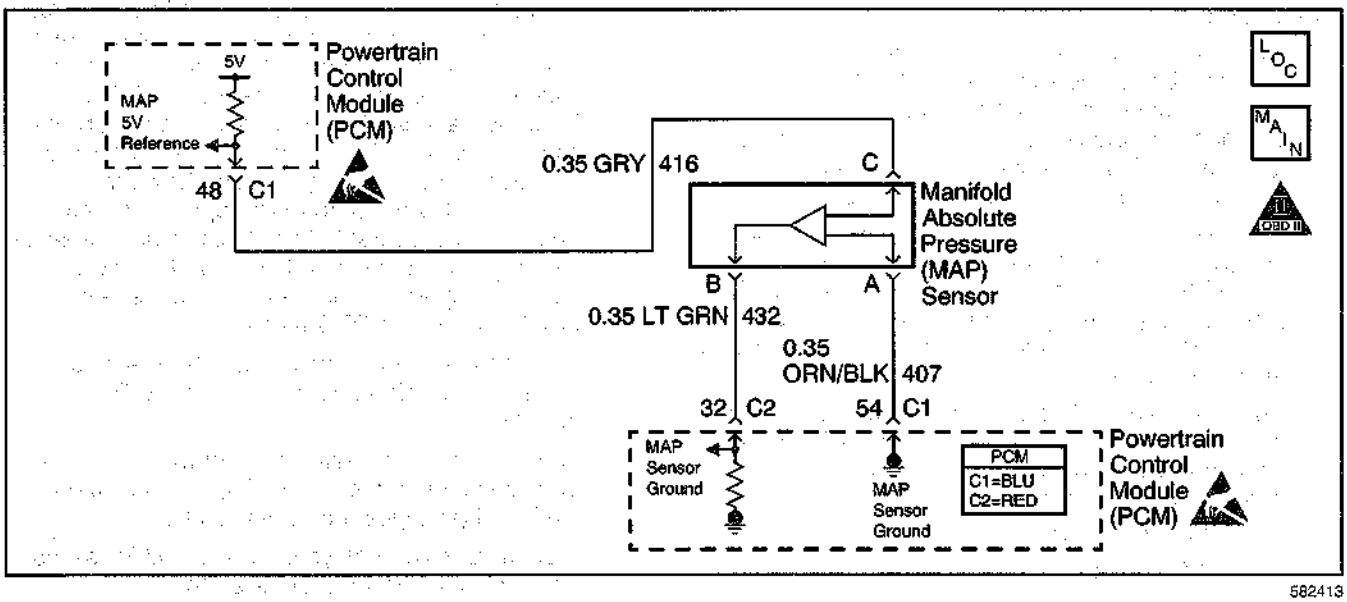
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DTC P0103 Mass Air Flow (MAF) Sensor Circuit High Frequency (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Inspect for a poor connection at the MAF sensor harness terminals. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. 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.* Is the action complete?	—	*Go to Step 10*	—
7	1. Inspect the MAF sensor harness for incorrect routing at the following locations: • Near secondary ignition wires or components. • Other high current components. Such as solenoids, relays, and motors. 2. Correct the harness routing if you find incorrect routing. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 8*
8	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 9*
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 10*	—
10	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 11*	*Go to Step 2*
11	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table.	System OK

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



582413

Circuit Description

The Manifold Absolute Pressure (MAP) sensor is mounted to the rear of the intake manifold. The MAP sensor measures the pressure changes within the intake manifold which is an indication of the engine load. The MAP sensor has a 5.0 volt reference, a ground, and a signal circuit.

The MAP sensor contains a diaphragm which changes the resistance based on pressure. When the manifold pressure is low (high vacuum) the sensor output voltage is low. When the manifold pressure is high (low vacuum) the sensor output voltage is high.

The MAP sensor voltage (depending on altitude) can range from 1.0–1.5 Volts at idle (high vacuum) to 4.0–4.9 volts at wide open throttle (low vacuum).

When the PCM senses a signal voltage lower than the normal operating range of the sensor, this DTC sets.

Conditions for Running the DTC

- No TP sensor DTCs set.
- The engine is operating.
- The TP sensor angle is 0 percent when engine speed is less than 1200 RPM.

  Or

  The TP sensor angle is less than 20 percent when engine speed is more than 1200 RPM.

Conditions for Setting the DTC

- The MAP sensor voltage is less than 0.10 volt.
- All conditions met for more than 2 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.
- The PCM 5.0 volt reference circuits are internally connected within the PCM. If all the MAP sensor circuits are OK, inspect the following component/circuits for malfunctions:
  - Throttle Position sensor
  - EGR Valve
- For an intermittent, refer to *Symptoms*.

Test Description

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

2. If DTC P1635 sets at the same time, this indicates that the 5 voltage reference circuit is either shorted to a ground or shorted to a voltage. The 5 volt reference circuit is internally connected within the PCM. The Throttle Position sensor or the EGR valve may be causing this DTC to set. Refer to DTC P1635 for further diagnosis.
3. This step determines if the malfunction is present.
4. 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 isolates when the DTC failed.
5. If the scan tool displays 5 volts, the MAP sensor signal, 5 volt reference circuit, and the PCM are OK.

   The MAP sensor is difficult to remove. Twist the MAP sensor forward and pull up. This forward motion disengages the retaining clip.
6. If the scan tool displays 5 volts, the MAP sensor signal circuit and the PCM are OK.
7. Disconnecting the PCM allows using the DMM in order to test the continuity of the circuits. This aids in locating an open or a shorted circuit.
11. The MAP sensor is difficult to remove. Twist the MAP sensor forward and pull up. This forward motion disengages the retaining clip.

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

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	1. Install a scan tool. 2. Idle the engine. 3. Monitor the DTC Information option using the scan tool. Did DTC P1635 fail this ignition cycle?	—	Go to *DTC P1635 5 Volt Reference 1 Circuit*	*Go to Step 3*
3	Monitor the MAP sensor voltage on Engine 1 Data List on the scan tool. Is the MAP sensor voltage below the specified value?	0.10V	*Go to Step 5*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids
5	1. Disconnect the MAP sensor electrical connector. Refer to *MAP Sensor Replacement*. 2. Jumper the 5 volt reference circuit and the MAP sensor signal circuit together at the MAP sensor harness connector. 3. Observe the MAP sensor voltage display on the scan tool. Is the MAP sensor voltage near the specified value?	5V	*Go to Step 11*	*Go to Step 6*
6	1. Connect a *J 34142-B* test lamp between B+ and the MAP sensor signal circuit at the MAP sensor harness connector. 2. Observe the MAP sensor voltage display on the scan tool. Is the MAP sensor voltage near the specified value?	5V	*Go to Step 7*	*Go to Step 9*
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the MAP sensor 5 volt reference circuit for an open or short to a ground. Refer to *Circuit Testing* in Wiring Systems. 4. If you find the 5 volt reference circuit is open or shorted to a ground, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 13*	*Go to Step 8*

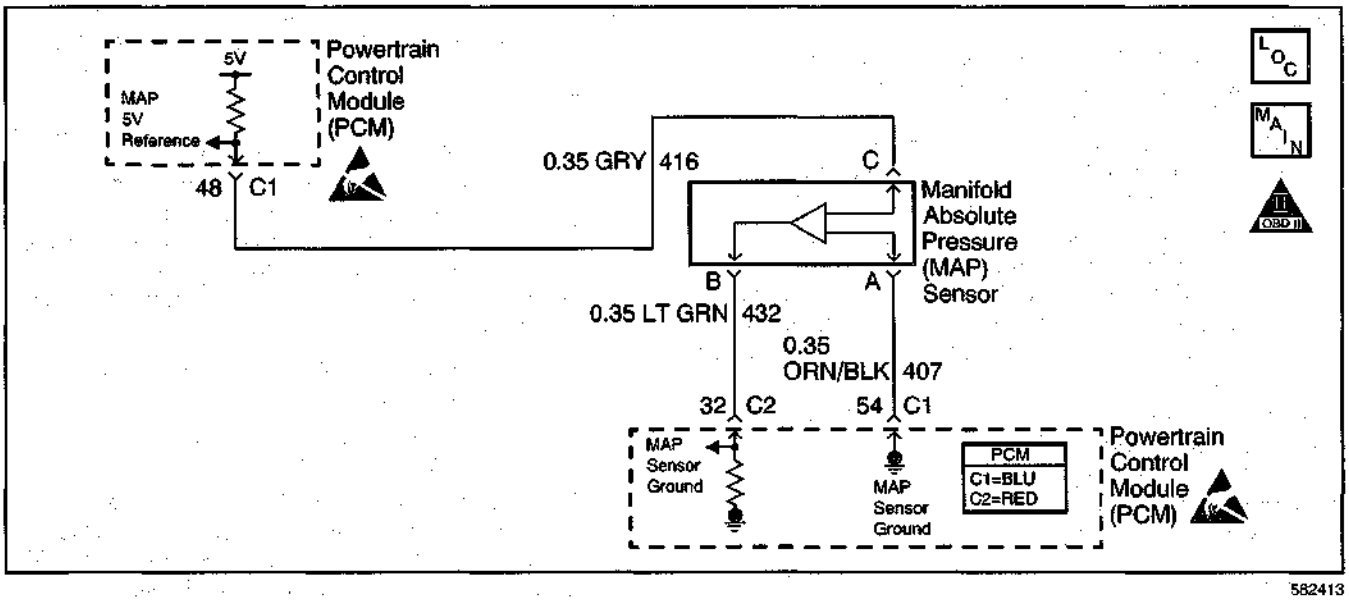
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DTC P0107 Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Inspect the 5 volt reference circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 13*	*Go to Step 12*
9	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the MAP sensor signal circuit for the following: • Open circuit • Short to a ground • Short to sensor ground circuit 4. If you find the MAP sensor signal circuit is open or shorted to a ground, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 13*	*Go to Step 10*
10	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 13*	*Go to Step 12*
11	Replace the MAP sensor. Refer to *MAP Sensor Replacement.* Is the action complete?	—	*Go to Step 13*	—
12	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 13*	—
13	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 14*	*Go to Step 2*
14	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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



582413

Circuit Description

The Manifold Absolute Pressure (MAP) sensor is mounted to the rear of the intake manifold. The MAP sensor measures the pressure changes within the intake manifold which is an indication of the engine load. The MAP sensor has a 5.0 volt reference, a ground, and a signal circuit.

The MAP sensor contains a diaphragm which changes the resistance based on pressure. When the manifold pressure is low (high vacuum) the sensor output voltage is low. When the manifold pressure is high (low vacuum) the sensor output voltage is high.

The MAP sensor voltage (depending on altitude) can range from 1.0–1.5 Volts at idle (high vacuum) to 4.0–4.9 volts at wide open throttle (low vacuum).

When the PCM senses a signal voltage higher than the normal operating range of the sensor, this DTC sets.

Conditions for Running the DTC

- No TP sensor DTCs set.
- The engine is operating.
- The TP sensor angle is less than 5 percent when the engine speed is no more than 1,000 RPM.

  OR
- The TP sensor angle is less than 18 percent when engine speed is more than 1,000 RPM.

Conditions for Setting the DTC

- The MAP sensor voltage is more than 4.3 volts.
- All conditions met for more than 4 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The PCM 5.0 volt reference circuits are internally connected within the PCM. If all the MAP sensor circuits are OK, inspect the following component/circuits for malfunctions:

- Throttle Position Sensor
- EGR Valve

For an intermittent, refer to *Symptoms*.

Test Description

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

2. If DTC P1635 and P1639 set at the same time, this indicates that the 5 voltage reference circuit is shorted voltage. The 5 volt reference circuit is internally connected within the PCM. The EGR or TP sensor circuits may be causing this DTC to set. Refer to DTC P1635 for further diagnosis.
3. This step determines if the malfunction is present.
4. 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 isolates when the DTC failed.
5. This step verifies whether the signal circuit is shorted to a voltage.
6. This step verifies whether a ground circuit is available at the MAP sensor.
9. The MAP sensor is difficult to remove. Twist the MAP sensor forward and pull up. This forward motion clears the retaining clip. Remove the MAP sensor and verify if vacuum is available to the sensor. Also, inspect the MAP sensor seal for nicks and cuts.

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

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	1. Install a scan tool. 2. Idle the engine. 3. Monitor the DTC Information option using the scan tool. Did DTC P1635 and P1639 fail this ignition cycle?	—	Go to *DTC P1635 5 Volt Reference 1 Circuit*	*Go to Step 3*
3	**Important:** If the engine idle is rough, unstable or incorrect, repair the idle condition before using this table; refer to *Symptoms*. Monitor the MAP sensor voltage on the Engine 1 Data List on the scan tool. Is the MAP sensor voltage above the specified value?	4.3V	*Go to Step 5*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids
5	1. Disconnect the MAP sensor electrical connector. Refer to *MAP Sensor Replacement*. 2. Observe the MAP sensor voltage displayed on the scan tool. Is the MAP sensor voltage below the specified value?	1V	*Go to Step 6*	*Go to Step 7*
6	Probe the sensor ground circuit with the *J 34142-B* test lamp connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Is the test lamp illuminated?	—	*Go to Step 8*	*Go to Step 10*
7	1. Test the MAP sensor signal circuit for a short to voltage or a short to the 5 volt reference circuit. 2. Repair the MAP sensor signal circuit if the circuit is shorted. Refer to *Wiring Repairs* in Wiring Systems. Is the MAP sensor signal circuit shorted?	—	*Go to Step 16*	*Go to Step 12*
8	Measure the voltage at the 5 volt reference circuit to the battery ground using the DMM. Is the voltage near the specified value?	5V	*Go to Step 9*	*Go to Step 15*
9	Inspect for a plugged or leaking vacuum supply to the MAP sensor. Is the vacuum supply OK?	—	*Go to Step 13*	*Go to Step 14*

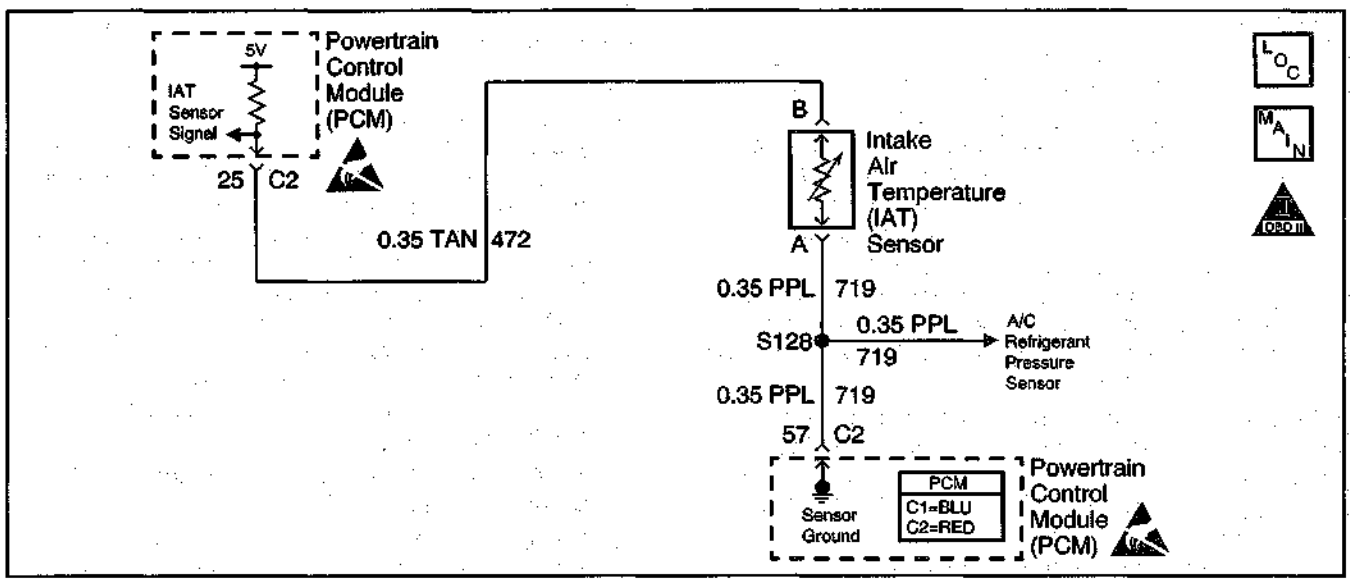
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DTC P0108 Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Disconnect the PCM connector C1 located on the same side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 2. Test for continuity of the MAP sensor ground circuit. Refer to *Testing for Continuity* in Wiring Systems. 3. Repair the open or the poor connection if the MAP sensor ground circuit measures over the specified value. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	2Ω	*Go to Step 16*	*Go to Step 11*
11	1. Inspect for a poor PCM connection. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 16*	*Go to Step 12*
12	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 16*	—
13	Replace the MAP sensor. Refer to *MAP Sensor Replacement.* Is the action complete?	—	*Go to Step 16*	—
14	Repair the faulty vacuum supply. Is the action complete?	—	*Go to Step 16*	—
15	Repair the 5 volt reference circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 16*	—
16	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 17*	*Go to Step 2*
17	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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



Circuit Description

The Intake Air Temperature (IAT) sensor contains a semiconductor device which changes the resistance based on the temperature (a thermistor). The IAT sensor is located in the air intake passage of the engine air induction system. The IAT sensor has a signal circuit and a ground circuit. The PCM applies 5.0 volts on the signal circuit to the sensor. The PCM monitors the changes in this voltage caused by changes in the resistance of the sensor in order to determine intake air temperature.

When the intake air is cold, the sensor (thermistor) resistance is high. The PCMs signal voltage is only pulled down a small amount through the sensor to a ground; therefore, the PCM senses a high signal voltage (low temperature). When the intake air is warm, the sensor resistance is low. The signal voltage is pulled down a greater amount; therefore, the PCM senses a low signal voltage (high temperature).

When the PCM senses a signal voltage lower than the normal operating range of the sensor, this DTC sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0117, P0118, P0125, P0500, P0502, P0503 not set
- The engine run time is more than 30 seconds.
- The vehicle speed at least 40 km/h (25 mph).

Conditions for Setting the DTC

- The Intake Air Temperature is more than 139°C (282°F).
- All conditions met for 5.0 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the engine has sat overnight, the engine coolant temperature and the intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

If you determine that the DTC occurs intermittently, performing the P1112 diagnostic table may isolate the cause of the fault.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. This verifies if the condition 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 isolates when the DTC failed.
4. An IAT below –30°C (–22°F) indicates the PCM an the IAT wiring are OK.
5. Disconnecting the PCM allows using the DMM in order to test continuity of the circuits. This aids in locating an open or a shorted circuit.

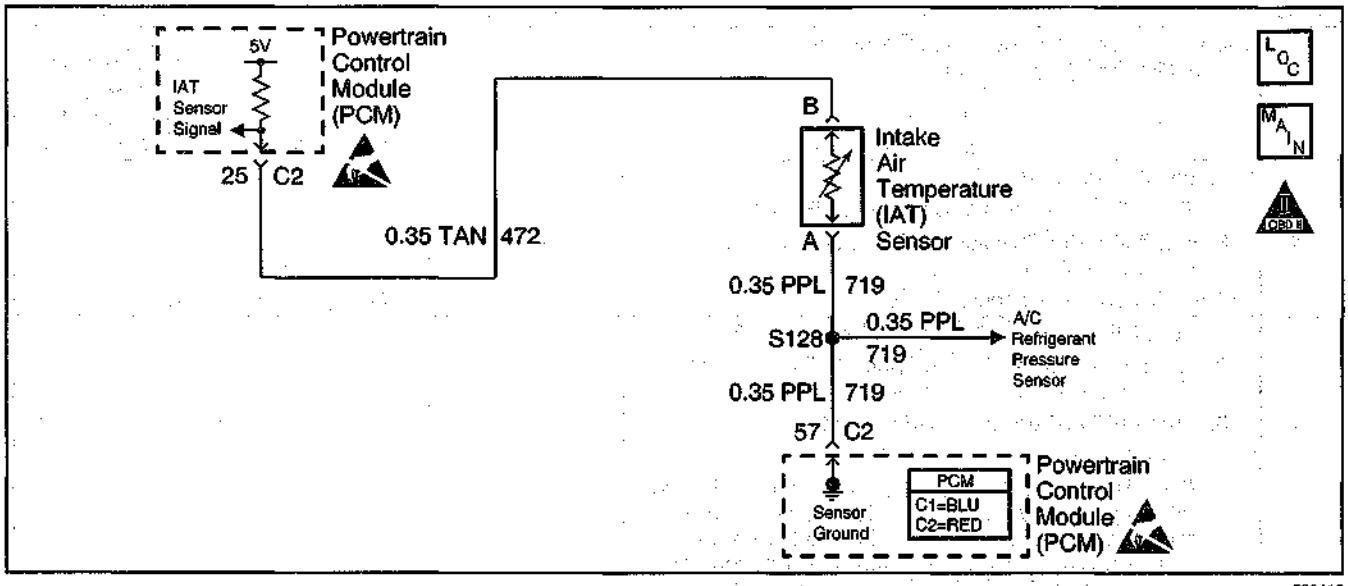
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DTC P0112 Intake Air Temperature (IAT) Sensor Circuit Low Voltage

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	1. Install a scan tool. 2. Turn ON the ignition leaving the engine OFF. 3. Monitor the IAT display on the Engine 1 Data List of the scan tool. Is the IAT above the specified value?	139°C (282°F)	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Disconnect the IAT sensor electrical connector. 2. Observe the IAT display on the scan tool. Is the IAT at the specified value?	–39°C (–38°F)	*Go to Step 6*	*Go to Step 5*
5	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the IAT signal circuit for a short to a ground. 4. If you find the IAT sensor signal circuit is grounded, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Is the IAT signal circuit grounded?	—	*Go to Step 8*	*Go to Step 7*
6	Replace the IAT sensor. Refer to *IAT Sensor Replacement.* Is the action complete?	—	*Go to Step 8*	—
7	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 8*	—
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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



Circuit Description

The Intake Air Temperature (IAT) sensor contains a semiconductor device which changes the resistance based on the temperature (a thermistor). The IAT sensor is located in the air intake passage of the engine air induction system. The IAT sensor has a signal circuit and a ground circuit. The PCM applies 5.0 volts on the signal circuit to the sensor. The PCM monitors the changes in this voltage caused by changes in the resistance of the sensor in order to determine intake air temperature.

When the intake air is cold, the sensor (thermistor) resistance is high. The PCMs signal voltage is only pulled down a small amount through the sensor to a ground; therefore, the PCM senses a high signal voltage (low temperature). When the intake air is warm, the sensor resistance is low. The signal voltage is pulled down a greater amount; therefore, the PCM senses a low signal voltage (high temperature).

When the PCM senses a signal voltage higher than the normal operating range of the sensor, this DTC sets.

Conditions for Running the DTC

- DTC(s) P0101, P0102, P0103, P0117, P0118, P0125, P0500, P0502, P0503 not set.
- The engine coolant temperature is more than 0°C (32°F).
- The vehicle speed is less than 11 km/h (7 mph).
- The mass air flow is less than 15 g/s.

Conditions for Setting the DTC

- The Intake Air Temperature is less than –35°C (–31°F).
- All conditions met for more than 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the engine has sat overnight, the engine coolant temperature and the intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

If you determine that the DTC occurs intermittently, performing the P1111 diagnostic table may isolate the cause of the fault.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. This step determines if the malfunction is present.
3. If DTCs P1635 and P1639 set at the same time, this indicates that the signal circuit is shorted to a voltage.
4. 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.
5. An intake air temperature above 139°C (282°F) indicates the PCM and IAT sensor wiring is OK.
6. An intake air temperature above 139°C (282°F) indicates the PCM and IAT sensor signal circuit is OK.
7. Disconnecting the PCM allows using the DMM in order to test continuity of the circuits. This aids in locating an open or a shorted circuit.
8. Disconnecting the PCM allows using the DMM in order to test for a short to voltage.

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

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	1. Install a scan tool. 2. Turn ON the ignition leaving the engine OFF. 3. Monitor the IAT sensor display on the Engine 1 Data List of the scan tool. Is the IAT sensor at the specified value?	−39°C (−38°F)	*Go to Step 3*	*Go to Step 4*
3	Are DTCs P1635 and P1639 also set?	—	*Go to Step 14*	*Go to Step 5*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids
5	1. Disconnect the IAT sensor electrical connector. 2. Jumper the IAT sensor harness terminals together using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. 3. Observe the IAT parameter on the scan tool. Is the IAT sensor at the specified value?	140°C (284°F)	*Go to Step 8*	*Go to Step 6*
6	Jumper the IAT sensor signal circuit to a known good ground. Is the IAT sensor at the specified value?	140°C (284°F)	*Go to Step 10*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturers logo. Refer to *PCM Replacement/Programming.* 3. Test the IAT sensor signal circuit for an open. Refer to *Testing for Continuity* in Wiring Systems. Is the IAT sensor signal circuit open?	—	*Go to Step 11*	*Go to Step 16*
8	1. Turn OFF the ignition. 2. Remove the jumper harness from the IAT sensor harness connector. 3. Disconnect the PCM connectors. Refer to *PCM Replacement/Programming.* 4. Turn ON the ignition leaving the engine OFF. 5. Probe the IAT signal circuit at the PCM harness connector using the DMM connected to ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the DMM display a voltage?	—	*Go to Step 14*	*Go to Step 9*

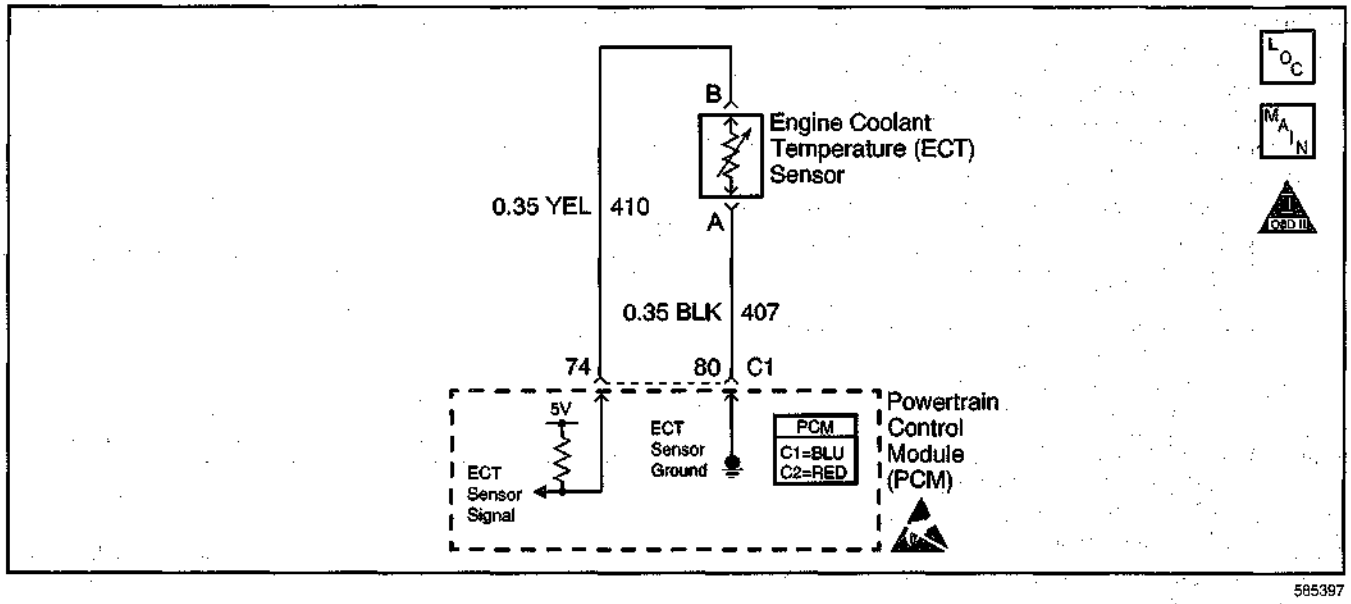
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DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
9	Test continuity from the IAT signal circuit to all other PCM circuits at the PCM harness connectors using the DMM. Example: probe one lead to the IAT sensor signal circuit (at the PCM harness connector) and probe the other lead to each terminal at the PCM harness connectors. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity within the specified range from the IAT sensor signal circuit to any other PCM circuit?	0–2Ω	*Go to Step 15*	*Go to Step 12*
10	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2. Refer to *PCM Replacement/Programming.* 3. Inspect the IAT sensor ground circuit for an open. Refer to *Testing for Continuity* in Wiring Systems. Is the IAT sensor ground circuit open?	—	*Go to Step 13*	*Go to Step 16*
11	Repair the IAT sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	Replace the IAT sensor. Refer to *IAT Sensor Replacement.* Is the action complete?	—	*Go to Step 18*	—
13	Repair the IAT sensor ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
14	Repair the IAT sensor signal circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the short between the IAT sensor signal circuit and the PCM circuit that had continuity. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the conditions as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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



Circuit Description

The Engine Coolant Temperature (ECT) sensor contains a semiconductor device which changes the resistance based on the temperature (a thermistor). The ECT sensor is mounted in the left bank cylinder head near the front of the engine. The ECT 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 the changes in this voltage caused by changes in the resistance of the sensor in order to determine the coolant temperature.

When the coolant is cold, the sensor (thermistor) resistance is high. The PCMs signal voltage is only pulled down a small amount through the sensor to a ground; therefore, the PCM senses a high signal voltage (low temperature). When the coolant is warm, the sensor resistance is low. The signal voltage is pulled down a greater amount; therefore the PCM senses a low signal voltage (high temperature). At normal operating temperature, the scan tool should display an ECT value of 1.5–2.0 volts.

When the PCM senses a signal voltage lower than the normal operating range of the sensor, this DTC sets.

The engine coolant temperature information is sent to the instrument panel cluster via the class 2 circuit.

Conditions for Running the DTC

The engine run time is more than 10 seconds.

OR

The engine run time is less than 10 seconds, when the IAT is less than 50°C (122°F).

Conditions for Setting the DTC

- The engine coolant temperature is more than 139°C (282°F).
- All conditions met for 20 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the engine has sat overnight, the engine coolant temperature and the intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

If you do determine that the DTC occurs intermittently, performing the P1114 diagnostic table may isolate the cause of the fault.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. This step determines if the malfunction 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 isolates when the DTC failed.
4. An engine coolant temperature below –30°C (–22°F) indicates the PCM and the ECT sensor wiring are OK.
5. Disconnecting the PCM allows using the DMM in order to test continuity of the circuits. This aids in locating an open or a shorted circuit.
7. Inspect for proper terminal tension/connections at the PCM harness before replacing the PCM.

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

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	**Important:** If the engine is overheating, correct the overheating condition before proceeding with this table. An over heat condition causes this DTC to set. 1. Install a scan tool. 2. Turn ON the ignition leaving the engine OFF. 3. Monitor the ECT sensor display on the Engine 1 Data List of the scan tool. Is the ECT sensor above the specified value?	139°C (282°F)	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids

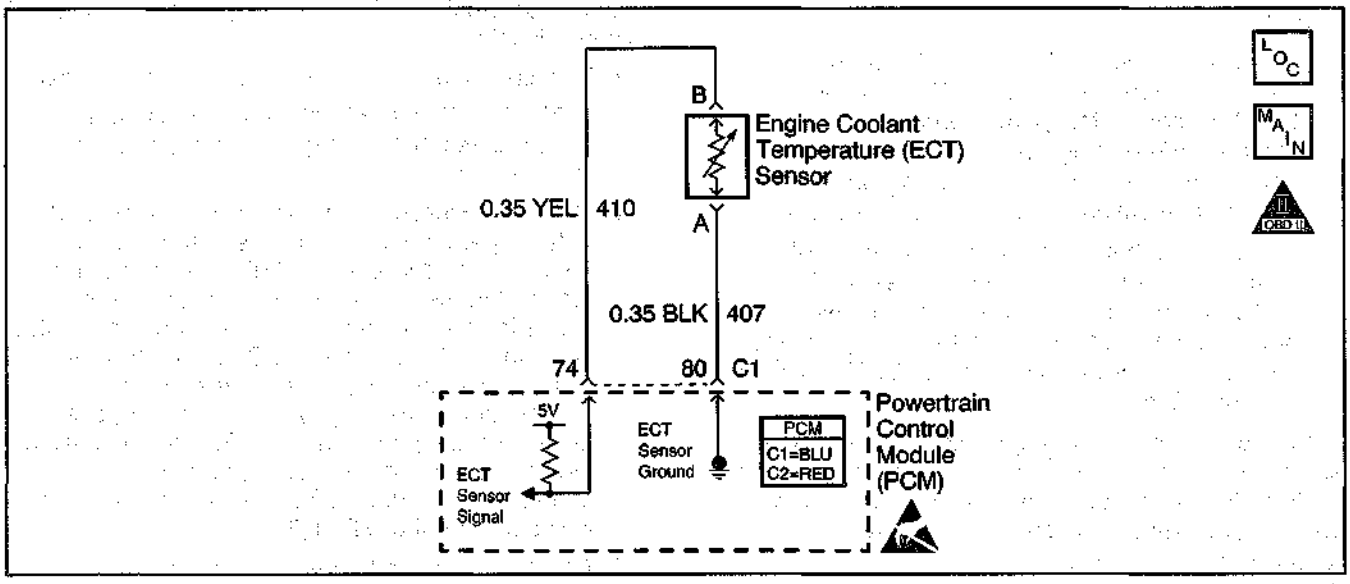
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DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Disconnect the ECT sensor electrical connector. 2. Observe the ECT sensor display on the scan tool. Is the ECT sensor below the specified value?	-30°C (-22°F)	*Go to Step 6*	*Go to Step 5*
5	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the ECT sensor signal circuit for a short to a ground. 4. If you find the ECT sensor signal circuit is grounded, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find the ECT sensor signal circuit grounded?	—	*Go to Step 8*	*Go to Step 7*
6	Replace the ECT sensor. Refer to *ECT Sensor Replacement.* Is the action complete?	—	*Go to Step 8*	—
7	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 8*	—
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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



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Circuit Description

The Engine Coolant Temperature (ECT) sensor contains a semiconductor device which changes the resistance based on the temperature (a thermistor). The ECT sensor is mounted in the left bank cylinder head near the front of the engine. The ECT 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 the changes in this voltage caused by changes in the resistance of the sensor in order to determine the coolant temperature.

When the coolant is cold, the sensor (thermistor) resistance is high. The PCMs signal voltage is only pulled down a small amount through the sensor to a ground; therefore, the PCM senses a high signal voltage (low temperature). When the coolant is warm, the sensor resistance is low. The signal voltage is pulled down a greater amount; therefore, the PCM senses a low signal voltage (high temperature). At normal operating temperature, the scan tool should display an ECT value of 1.5–2.0 volts.

When the PCM senses a signal voltage higher than the normal operating range of the sensor, this DTC sets.

The engine coolant temperature information is sent to the instrument panel cluster via the class 2 circuit.

Conditions for Running the DTC

The engine run time is more than 60 seconds.

OR

The engine run time is less than 60 seconds when the IAT is more than 0°C (32°F).

Conditions for Setting the DTC

- The engine coolant temperature is less than −39°C (−38°F).
- All conditions met for 20 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the engine has sat overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance.*

If you determine that the DTC occurs intermittently, performing the P1115 diagnostic table may isolate the cause of the fault.

For an intermittent, refer to *Symptoms.*

Test Description

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

2. This step determines if the malfunction is present.
3. If DTC P1635 and P1639 set at the same time, this indicates that the signal circuit is shorted to a voltage.
4. 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 isolates when the DTC failed.
5. An engine coolant temperature above 139°C (282°F) indicates the PCM and ECT sensor wiring is OK.
6. An engine coolant temperature above 139°C (282°F) indicates the PCM and ECT sensor signal circuit is OK.
7. Disconnecting the PCM allows using the DMM in order to test continuity of the circuits. This aids in locating an open or a shorted circuit.
8. Disconnecting the PCM allows using the DMM in order to test for a short to voltage.

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

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	1. Install a scan tool. 2. Turn ON the ignition leaving the engine OFF. 3. Monitor the ECT sensor display on the Engine 1 Data List of the scan tool. Is the ECT sensor at the specified value?	−39°C (−38°F)	*Go to Step 3*	*Go to Step 4*
3	Are DTCs P1635 and P1639 also set?	—	*Go to Step 14*	*Go to Step 5*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids
5	1. Disconnect the ECT sensor electrical connector. 2. Jumper the ECT sensor harness terminals together. 3. Observe the ECT parameter on the scan tool. Is the ECT sensor at the specified value?	140°C (284°F)	*Go to Step 8*	*Go to Step 6*
6	Jumper the ECT sensor signal circuit to a known good ground. Is the ECT sensor at the specified value?	140°C (284°F)	*Go to Step 10*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the ECT sensor signal circuit for an open. Is the ECT sensor signal circuit open?	—	*Go to Step 11*	*Go to Step 16*
8	1. Turn OFF the ignition. 2. Remove the jumper harness from the ECT sensor harness connector. 3. Disconnect the PCM. Refer to *PCM Replacement/Programming.* 4. Turn ON the ignition leaving the engine OFF. 5. Probe the ECT signal circuit at the PCM harness connector using the DMM connected to ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the DMM display a voltage?	—	*Go to Step 14*	*Go to Step 9*

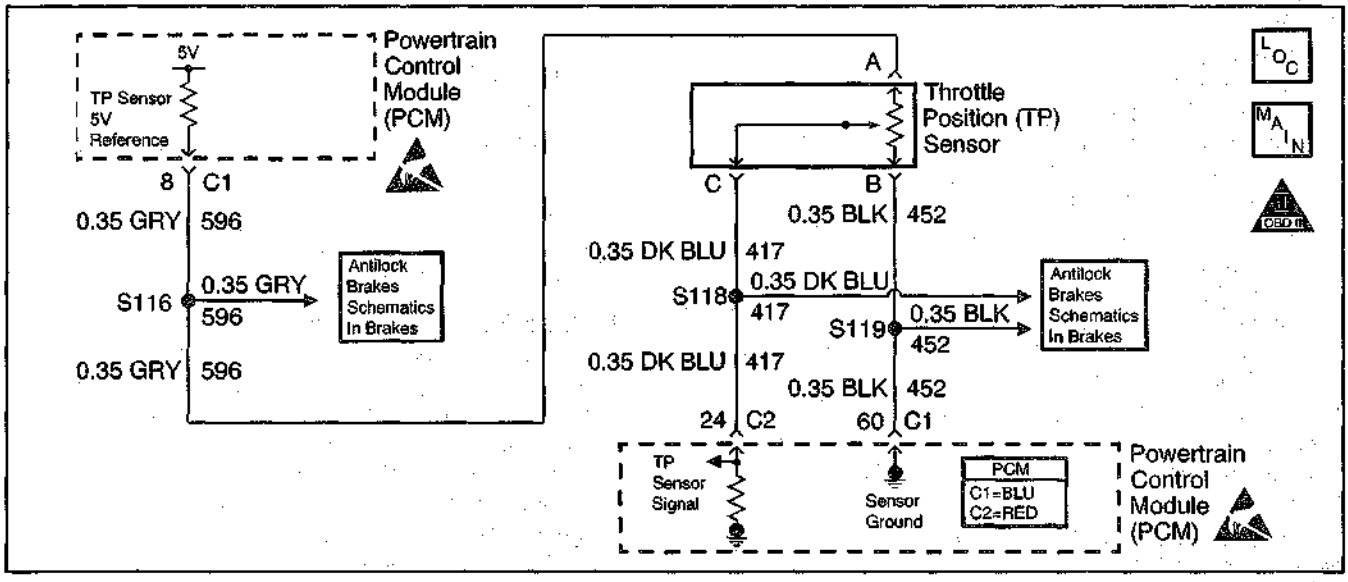
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DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
9	Test for continuity from the ECT signal circuit to all other PCM circuits at the PCM harness connectors using the DMM. Example: probe one lead to the ECT sensor signal circuit (at the PCM harness connector) and probe the other lead to each terminal at the PCM harness connectors. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity within the specified range from the ECT sensor signal circuit to any other PCM circuit?	0–2Ω	*Go to Step 15*	*Go to Step 12*
10	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Inspect the ECT sensor ground circuit for an open. Refer to *Testing for Continuity* in Wiring Systems. Is the ECT sensor ground circuit open?	—	*Go to Step 13*	*Go to Step 16*
11	Repair the ECT sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	Replace the ECT sensor. Refer to *ECT Sensor Replacement*. Is the action complete?	—	*Go to Step 18*	—
13	Repair the ECT sensor ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
14	Repair the ECT sensor signal circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the short between the ECT sensor signal circuit and the PCM circuit that had continuity. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect the PCM harness connector for poor connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the conditions as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0121 TP Sensor Circuit Insufficient Activity



Circuit Description

The Throttle Position (TP) sensor is a potentiometer. The TP sensor is mounted to the left side of the throttle body. The TP sensor provides a voltage signal that changes relative to throttle blade angle. This signal voltage is one of the most important inputs used by the PCM. The TP sensor has a 5.0 volt reference, a ground and a signal circuit.

The TP sensor signal voltage should be near 0.6 volt at idle. The TP sensor voltage should increase to above 4.0 volts at wide open throttle (WOT).

This diagnostic compares actual throttle position from the TP sensor to a predicted throttle position value. The predicted throttle position is calculated from engine speed and other inputs. If the PCM detects the predicted throttle position is below the actual TP sensor value, this DTC sets.

Conditions for Running the DTC

- No MAP sensor or TP sensor DTCs set.
- The engine run time is more than 10 seconds.
- The engine coolant temperature is more than 0°C (32°F).
- The IAC is between 0 and 255 counts.
- The MAP is less than 55 kPa.

  OR

- The MAP is more than 65 kPa.
- MAP steady.

Conditions for Setting the DTC

- The predicted throttle angle does not match the actual throttle angle.
- All conditions present for 20 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The PCM 5.0 volt reference circuits are internally connected within the PCM. If all the TP sensor circuits are OK, inspect the MAP sensor and EGR valve for malfunctions.

If it is determined that the DTC occurs intermittently, performing the DTC P1121 diagnostic table may isolate the cause of the fault.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. If DTC P1635 sets at the same time, this indicates that the 5 volt reference circuit is either shorted to a ground or shorted to a voltage. The 5 volt reference circuit is internally connected within the PCM.
3. The MAP value should change with the engine speed. If a MAP sensor voltage changes, there is no malfunction with the MAP sensor.
4. This step tests for an intermittent connection at the sensor.
5. The MAP sensor is difficult to remove. Twist the MAP sensor forward and pull up. This forward motion clears the retaining clip.
8. If the TP sensor voltage changes, there is no malfunction with the TP sensor wiring or the PCM.
9. Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicated 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 vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This isolates when the DTC failed.
11. This tests the 5 volt reference circuit, signal circuit, and the PCM. If the scan tool displayed 5 volts, the TP sensor circuits are OK.

DTC P0121 TP Sensor Circuit Insufficient Activity

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	1. Install the scan tool. 2. Idle the engine. 3. Monitor the DTC Information option using the scan tool. Did P1404 or P1635 or any MAP sensor DTCs also set?	—	Go to the applicable DTC table	*Go to Step 3*
3	1. Start the engine. 2. Monitor the MAP sensor voltage. 3. Increase the engine speed to the specified value. Does the MAP sensor voltage change when the engine speed changed?	2000 RPM	*Go to Step 8*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Move the MAP sensor electrical connector, the harness and the PCM connectors (by hand only) while observing the scan tool display. Is the MAP value affected by moving the harness or connectors?	—	*Go to Step 16*	*Go to Step 5*

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DTC P0121 TP Sensor Circuit Insufficient Activity (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Remove the MAP sensor from the intake manifold but leave the electrical harness connected. Refer to *MAP Sensor Replacement.* 2. Connect a hand operated vacuum pump to the MAP sensor. 3. Observe and/or record the MAP display while slowly applying vacuum up to 20 inches Hg as indicated on the pump gauge. Each 1 inch of vacuum applied should result in a 3 to 4 kPa drop in the MAP sensor value on the scan tool and the value should change smoothly with each increase in vacuum. Did the MAP value change smoothly through the entire range of the test without any erratic readings?	—	*Go to Step 6*	*Go to Step 17*
6	Apply 20 inches Hg vacuum to the MAP sensor. Is the MAP sensor reading the same or less than the specified value?	34 kPa	*Go to Step 7*	*Go to Step 17*
7	Disconnect the vacuum source from the MAP sensor. Does the MAP sensor reading return to the original value that you observed in step 5?	—	*Go to Step 8*	*Go to Step 17*
8	1. Turn ON the ignition leaving the engine OFF. 2. Monitor the TP sensor voltage while moving the accelerator pedal from a closed throttle to a wide open throttle. Does the TP sensor voltage go from below the specified value to above the specified value?	Below 1.0V to above 4.0V	*Go to Step 9*	*Go to Step 10*
9	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and record the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Re-install the MAP sensor and any other disconnected components. 5. Start the engine. 6. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 7. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number which was set using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 10*	Go to Diagnostic Aids
10	1. Disconnect the TP sensor. 2. Observe the TP sensor display on the scan tool. Is the TP sensor voltage near the specified value?	0.0V	*Go to Step 11*	*Go to Step 13*
11	Jumper the TP sensor 5 volt reference circuit to the TP sensor signal circuit using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. Is the TP sensor voltage near the specified value?	5V	*Go to Step 12*	*Go to Step 14*
12	Replace the TP sensor. Refer to *TP Sensor Replacement.* Is the action complete?	—	*Go to Step 18*	—

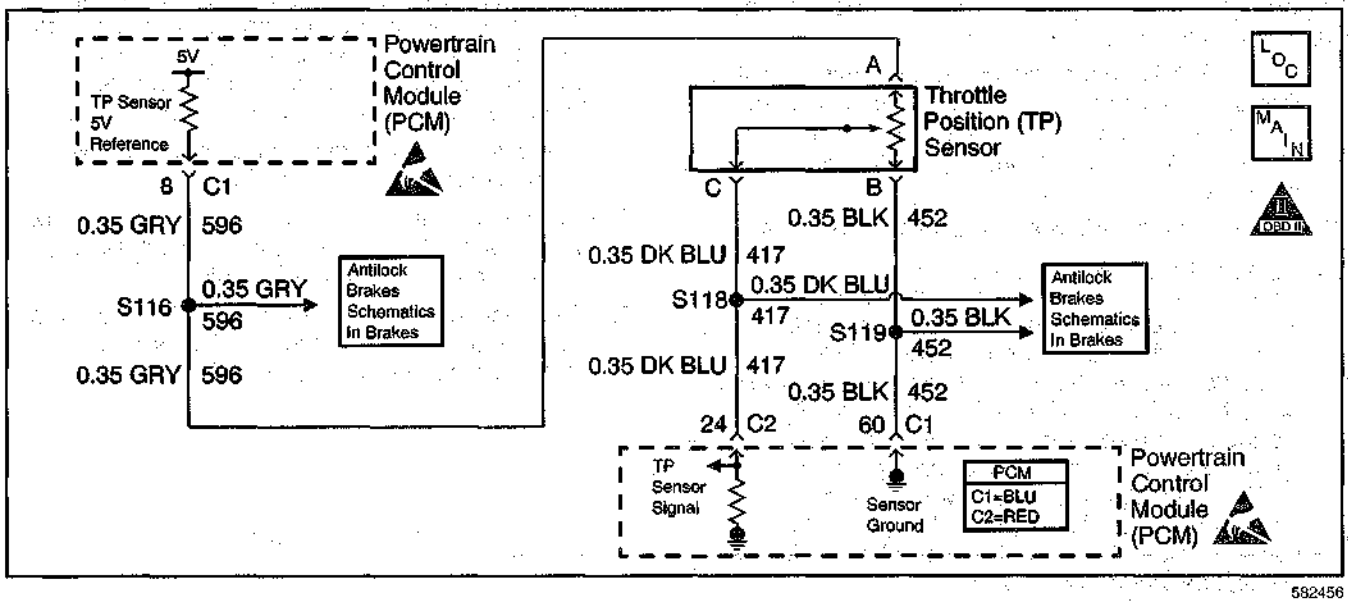
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DTC P0121 TP Sensor Circuit Insufficient Activity (cont'd)

Step	Action	Value(s)	Yes	No
13	1. Test for the following conditions: • TP signal circuit for a short to voltage. • TP sensor ground circuit for high resistance between the PCM and the TP sensor. • TP sensor ground circuit for a poor connection. 2. If you find a condition repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 15*
14	• Test for the following conditions: • TP signal circuit or 5 volt reference circuit for a poor connection. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. • TP signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP sensor. • If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 15*
15	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
16	Locate and repair the affected circuits. Is the action complete?	—	*Go to Step 18*	—
17	Replace the MAP Sensor. Refer to *MAP Sensor Replacement*. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0122 Throttle Position (TP) Sensor Circuit Low Voltage



Circuit Description

The Throttle Position (TP) sensor is a potentiometer. The TP sensor is mounted to the left side of the throttle body. The TP sensor provides a voltage signal that changes relative to throttle blade angle. This signal voltage is one of the most important inputs used by the PCM. The TP sensor has a 5.0 volt reference, a ground and a signal circuit.

The TP sensor Signal voltage should be near 0.6 volt at idle. The TP sensor voltage should increase to above 4.0 volts at wide open throttle (WOT).

When the PCM senses a signal voltage lower than the normal operating range of the sensor, this DTC sets.

Conditions for Running the DTC

The ignition switch is in the ON position or the engine is operating.

Conditions for Setting the DTC

- The TP sensor signal voltage is less than 0.2 volt.
- The above conditions are present for 10 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The PCM 5.0 volt reference circuits are internally connected within the PCM. If all the TP sensor circuits are OK, inspect the MAP sensor and EGR valve for malfunctions.

If it is determined that the DTC occurs intermittently, performing the DTC P1122 diagnostic table may isolate the cause of the fault.

For an intermittent, refer to *Symptoms*.

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Test Description

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

2. If DTC P1639 sets at the same time, this indicates that the 5 volt reference circuit is either shorted to ground or shorted to a voltage. The 5 volt reference circuit is internally connected within the PCM.
3. This step verifies that a malfunction is present.
4. 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 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 vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed.
5. This determines if the short is caused from the Accelerator and Servo Control Module (ASM). After repairs are made, reconnect the Accelerator and Servo Control Module (ASM) and clear any DTCs that set when the Accelerator and Servo Control Module (ASM) was disconnected.
6. If the scan tool indicates 5 volts, indicates the TP sensor circuits and PCM are OK.
8. Disconnecting the PCM will allow using the DMM to test continuity of the circuits. This will aid in locating an open or shorted circuit.
10. Disconnecting the PCM will allow using the DMM to test continuity of the circuits. This will aid in locating an open or shorted circuit.

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DTC P0122 Throttle Position (TP) Sensor Circuit Low Voltage

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	1. Install the scan tool. 2. Idle the engine. 3. Monitor the Diagnostic Trouble Code (DTC) Information using the scan tool. Did DTC P1639 fail this ignition?	—	Go to *DTC P1639 5 Volt Reference 2 Circuit*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. With the throttle closed, monitor the TP sensor display on the scan tool. Is the TP sensor voltage below the specified value?	0.2V	*Go to Step 5*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and record the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number which was set using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids
5	**Important:** After you complete this diagnosis reconnect the Accelerator and Servo Control Module (ASM). Also, clear any ASM DTCs that may have set when the ASM was disconnected. 1. Turn OFF the ignition. 2. Disconnect the ASM. Refer to *Accelerator and Servo Control Module (ASM) Replacement* in Antilock Brake System. 3. Turn ON the ignition. Is the TP sensor voltage still below the specified value?	0.2V	*Go to Step 6*	Go to *A Diagnostic System Check - ABS* in Antilock Brake System.
6	1. Disconnect the TP sensor electrical connector. 2. Jumper the 5 volt reference circuit and the TP signal circuit together at the TP sensor harness connector. 3. Observe the TP sensor voltage display on the scan tool. Is the TP sensor voltage above the specified value?	4.7V	*Go to Step 12*	*Go to Step 7*
7	1. Connect the test lamp *J 34142-B* between B+ and the TP sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor voltage display on the scan tool. Is the TP sensor voltage above the specified value?	4.7V	*Go to Step 8*	*Go to Step 10*

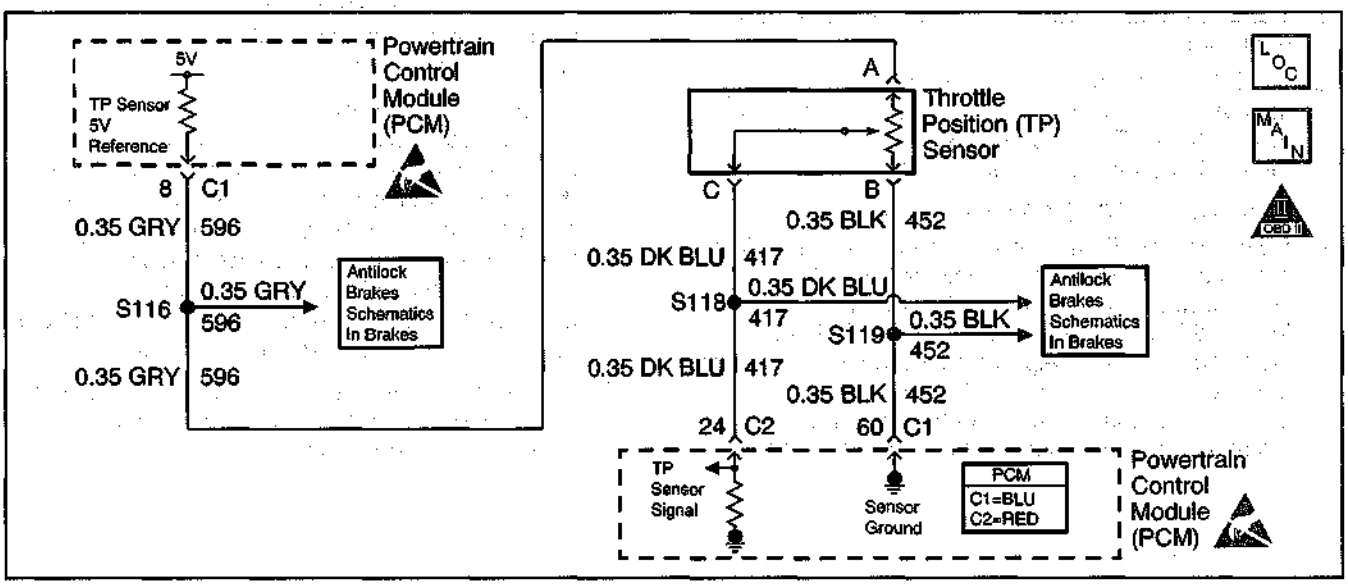
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DTC P0122 Throttle Position (TP) Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the 5 volt reference circuit for an open or short to ground. 4. If the 5 volt reference circuit is open or shorted to ground, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 9*
9	1. Test the 5 volt reference circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
10	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. 3. Test the signal circuit for an open, short to ground, or for a short to the sensor ground circuit. 4. If you find the sensor signal circuit is open or shorted to ground, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 11*
11	1. Test the sensor signal circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
12	Replace the TP sensor. Refer to *TP Sensor Replacement.* Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 14*	—
14	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 15*	*Go to Step 2*
15	Select the Capture Info option and the Review Info using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0123 Throttle Position (TP) Sensor Circuit High Voltage



582456

Circuit Description

The Throttle Position (TP) sensor is a potentiometer. The TP sensor is mounted to the left side of the throttle body. The TP sensor provides a voltage signal that changes relative to throttle blade angle. This signal voltage is one of the most important inputs used by the PCM. The TP sensor has a 5.0 volt reference, a ground and a signal circuit.

The TP sensor Signal voltage should be near 0.6 volt at idle. The TP sensor voltage should increase to above 4.0 volts at wide open throttle (WOT).

When the PCM senses a signal voltage higher than the normal operating range of the sensor, this DTC sets.

Conditions for Running The DTC

The ignition switch is in the ON position or the engine is operating.

Conditions for Setting The DTC

- The TP sensor signal voltage is more than 4.75 volts.
- Condition present for 10 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The PCM 5.0 volt reference circuits are internally connected within the PCM. If all the TP sensor circuits are OK, inspect the MAP sensor and EGR valve for malfunctions.

If it is determined that the DTC occurs intermittently, performing the DTC P1121 diagnostic table may isolate the cause of the fault.

For an intermittent, refer to *Symptoms*.

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Test Description

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

2. If DTCs P1635 sets at the same time, this indicates that the 5 volt reference circuit is shorted to a voltage. The 5 volt reference circuit is internally connected within the PCM.
3. This step verifies if the fault is present.
4. 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 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 vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed.
5. Vehicles equipped with Accelerator and Servo Control Module (ASM) will have to disconnect the Accelerator and Servo Control Module (ASM). This will determine if the short is caused from the Accelerator and Servo Control Module (ASM). After repairs are made, reconnect Accelerator and Servo Control Module (ASM) and clear the DTCs that set when the Accelerator and Servo Control Module (ASM) was disconnected.
7. This tests whether the ground circuit is available to the TP sensor. Inspect for poor electrical connections at the TP sensor.

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DTC P0123 Throttle Position (TP) Sensor Circuit High Voltage

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	1. Install the scan tool. 2. Idle the engine. 3. Monitor the Diagnostic Trouble Code (DTC) Information using the scan tool. Did DTC P1635 fail this ignition?	—	Go to *DTC P1635 5 Volt Reference 1 Circuit*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. With the throttle closed, observe the TP sensor voltage and percentage display on the scan tool. Is the TP sensor voltage or the Throttle Angle above the specified values?	4.7V, 0%	*Go to Step 5*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and record the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number which was set using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids
5	**Important:** After you complete this diagnosis reconnect the Accelerator and Servo Control Module (ASM). Also, clear any ASM DTCs that may have set when the ASM was disconnected. 1. Turn OFF the ignition. 2. Disconnect the Accelerator and Servo Control Module (ASM). Refer to *Accelerator and Servo Control Module (ASM) Replacement* in Antilock Brake System. 3. Turn ON the ignition. Is the TP sensor voltage above the specified value?	4.7V	*Go to Step 6*	Go to *A Diagnostic System Check - ABS* in Antilock Brake System.
6	1. Disconnect the TP sensor electrical connector. 2. Observe the TP sensor voltage display on the scan tool. Is the TP sensor voltage below the specified value?	0.20V	*Go to Step 7*	*Go to Step 10*
7	Probe the sensor ground circuit at the TP sensor harness connector with the *J 34142-B* test lamp connected to B+. Does the test lamp illuminate?	—	*Go to Step 8*	*Go to Step 11*
8	Measure the voltage at the 5 volt reference circuit to ground using the DMM. Is the voltage more than the specified value?	5V	*Go to Step 14*	*Go to Step 9*
9	Replace the TP sensor. Refer to *TP Sensor Replacement.* Is the action complete?	—	*Go to Step 15*	—

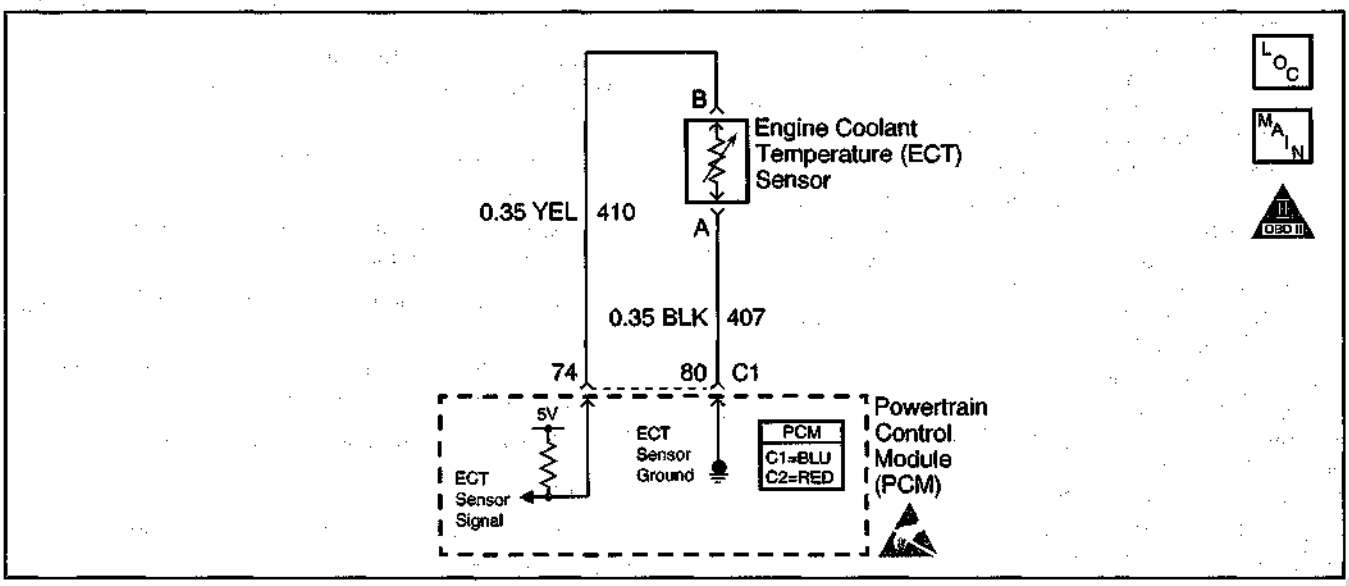
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DTC P0123 Throttle Position (TP) Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test for a short to voltage on the TP sensor signal circuit; also test for a shorted circuit between the TP sensor signal circuit and the Accelerator and Servo Control Module (ASM). 4. If you find the TP sensor signal circuit shorted, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 13*
11	1. Test for an open TP sensor ground circuit. Refer to *Testing for Continuity* in Wiring Systems. 2. If you find the TP sensor ground circuit open, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 12*
12	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side of the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 4. If you find a poor connection, repair the terminal as necessary. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 13*
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 15*	—
14	Repair the 5 volt reference circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 15*	—
15	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 16*	*Go to Step 2*
16	Select the Capture Info option and the Review Info using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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



Circuit Description

The PCM monitors the ECT sensor in order to determine how long it takes the engine to reach the coolant temperature required for Closed Loop operation. DTC P0125 sets if the PCM determines that the engine does not reach Closed Loop temperature in a specified amount of time. This test will not run if either the intake air or engine coolant temperature is too low at start-up.

Conditions for Running the DTC

- DTCs P0112, P0113, P0117, P0118 not set
- The engine is operating.
- The engine coolant temperature is between –36°C (–33°F) and 40°C (104°F) at engine start-up.
- The intake air temperature is mor e than –7°C (19°F).
- The vehicle speed is more than 1.6 km/h (1 mph).

Conditions for Setting the DTC

The closed loop coolant temperature of 34°C (93°F) is not reached within a predetermined time. The maximum allowable time depends on the start-up coolant temperature and the amount of airflow into the engine. The range for the time is from 2 minutes and 20 seconds to 22 minutes and 30 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the engine has sat overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

If you determine that the DTC occurs intermittently, performing the P1114 or P1115 diagnostics table may isolate the cause of the fault.

An engine coolant temperature exceeding 34°C (93°F), indicates that the engine is capable of reaching the proper temperature, but not necessarily in the correct amount of time. Repeat this diagnostic table on a cold engine, and measure the time required to reach the temperature threshold. When starting a cold engine, measure the amount of time it takes the engine to reach the specified temperature. The engine should reach the specified temperature within 5 minutes or less. If the engine does not reach the specified temperature within 5 minutes, inspect for the following:

- Coolant level: refer to *Loss of Coolant* in Engine Cooling.
- Thermostat operation: refer to *Thermostat Diagnosis* in Engine Cooling.
- Are fans on at all times? Refer to *Electric Cooling Fan Diagnosis*.
- Refer to *Engine Fails To Reach Normal Operating Temperature* in Engine Cooling.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. An ECT failure could cause a DTC P0125 to set, so correct any ECT DTCs that are set.
6. If it is obvious that the engine is not reaching full operating temperature, for example the radiator hoses never get very warm, or there is a concern of little or no heat from the heater, you can skip this step.

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

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 engine coolant temperature DTCs set?	—	Go to the applicable DTC table	*Go to Step 3*
3	1. Install a scan tool. 2. Turn ON the ignition leaving the engine OFF. 3. Disconnect the ECT sensor. Does scan tool indicate the ECT sensor is less than the specified value?	-35°C (-31°F)	*Go to Step 4*	Go to *DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage*
4	Jumper the terminals of the ECT sensor harness connector together using a jumper wire. Does the scan tool indicate the ECT is greater than the specified value?	139°C (282°F)	*Go to Step 5*	Go to *DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage*

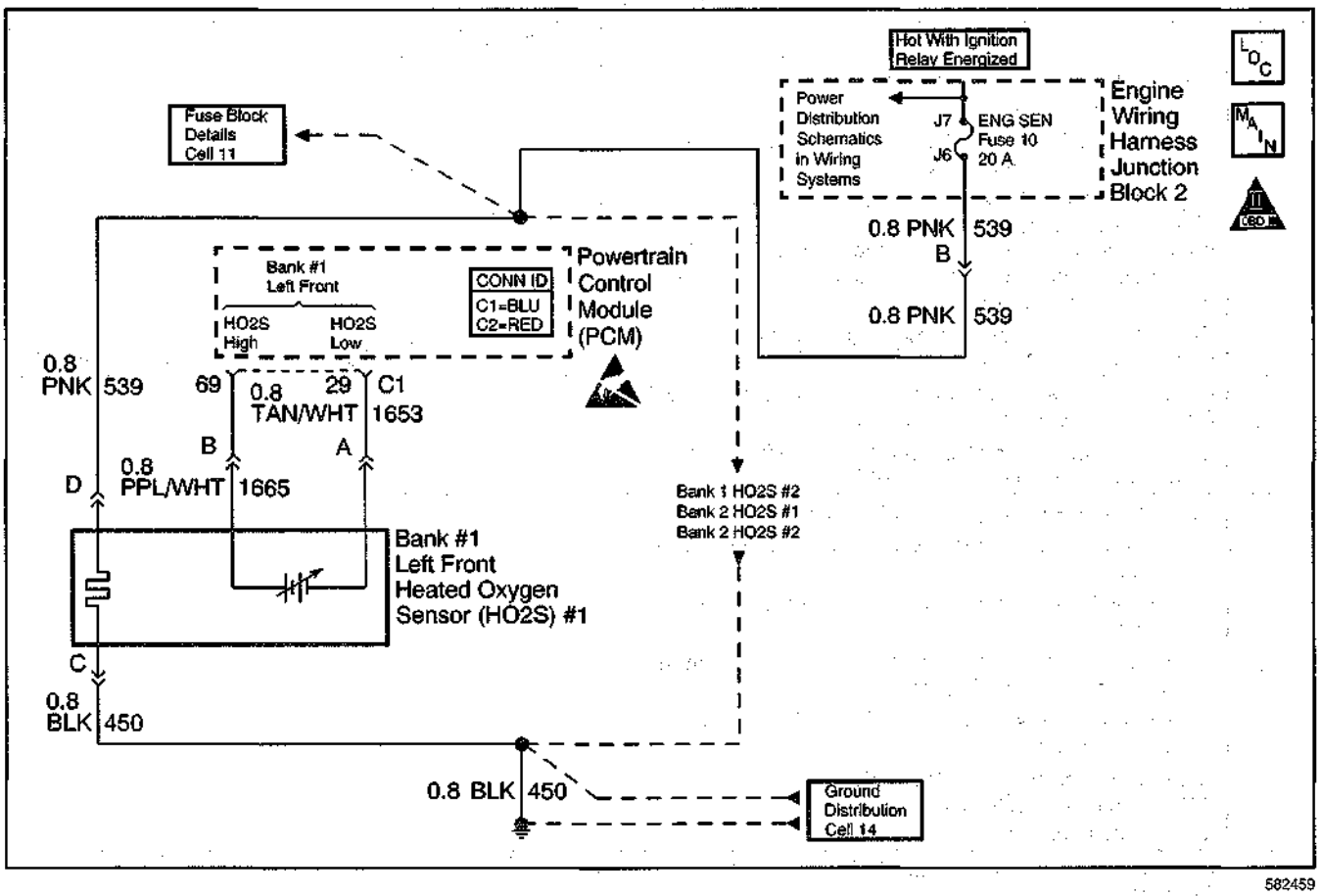
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DTC P0125 Engine Coolant Temperature (ECT) Excessive Time to Closed Loop Fuel Control (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Reconnect the ECT sensor. 2. Idle the engine. 3. Observe the ECT sensor display on the Engine 1 Data List of the scan tool. **Important:** Allow the engine to warm up if it has not already reached the specified temperature. 5 minutes is the maximum amount of time it should take to reach this temperature from a cold start. Less time is required if the engine is already warm. Does the scan tool indicate the engine coolant temperature reached the specified value?	34°C (93°F)	Go to Diagnostic Aids	*Go to Step 6*
6	Measure the resistance of the ECT sensor using a DMM. Refer to *Temperature vs Resistance.* Is the ECT resistance close to the value indicated in the Temperature vs Resistance Table?	—	*Go to Step 7*	*Go to Step 8*
7	Test the engine cooling system for the following: • Thermostat operation: refer to *Thermostat Diagnosis* in Engine Cooling. • Coolant level: refer to *Loss of Coolant* in Engine Cooling. • Coolant to water ratio: refer to *Coolant Concentration Testing* in Engine Cooling. • Cooling fan operation etc.: refer to *Electric Cooling Fan Diagnosis.* Refer to *Engine Fails To Reach Normal Operating Temperature* in Engine Cooling. Is the action complete?	—	*Go to Step 9*	—
8	Replace the ECT sensor. Refer to *ECT Sensor Replacement.* Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test failed?	—	*Go to Step 2*	*Go to Step 10*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1



Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage for being fixed below a predetermined voltage. If the PCM detects the voltage is below a predetermined voltage, this DTC sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The AIR, EGR, and the catalyst diagnostics are not active.
- The ignition voltage is more than 9.0 volts.
- The fuel system is operating in Closed Loop.
- The fuel trim learn is enabled.
- The TP sensor angle is between 2–70 percent.

Conditions for Setting the DTC

- The HO2S signal voltage remains below 200 mV.
- The conditions are present for 33 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The PCM sets this DTC when the vehicle runs out of fuel.

- Heated Oxygen Sensor (HO2S) wire: Sensor pigtail may be in contact with the exhaust manifold or the exhaust system.
- An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provide the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.
- Inspect for an intermittent ground in the signal wire between the connector and the sensor.
- Lean injector(s): Perform the Injector Balance Test. Refer to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool*.
- Fuel contamination: Water near the in-tank fuel pump inlet can be delivered to the injectors. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. The water causes a lean exhaust and can set a DTC.
- Fuel pressure: System will be lean if fuel pressure is low. Refer to *Fuel System Diagnosis*.
- Exhaust leaks: An exhaust leak near the HO2S can cause a lean condition. Refer to *Exhaust Leakage* in Engine Exhaust.
- Vacuum or crankcase leaks can cause a lean condition.

If the above are OK, the HO2S may be at fault.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. If the HO2S voltage is fixed well below 200 mV, this indicates a short to battery ground or chassis ground. If the voltage is fixed near or above 200 mV, this indicates a short to a PCM ground.

   The engine must be at the normal operating temperature before performing this test.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you can not 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 aid in 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 the PCM recorded. This isolates when the DTC failed.
4. A sensor that is disconnected should indicate a bias voltage. If the voltage is low inspect the signal circuit for a short to ground.
5. Disconnecting the PCM allows using a DMM in order to test continuity of the circuits. This aids in locating an open or shorted circuit.

DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1

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	**Important:** Inspect the HO2S for being secure before proceeding with this DTC. A sensor that is loose could cause this DTC to set. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within parameters specified under Conditions for Running the DTC in the supporting text. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Is the HO2S voltage less than the specified value?	200 mV	*Go to Step 4*	*Go to Step 3*

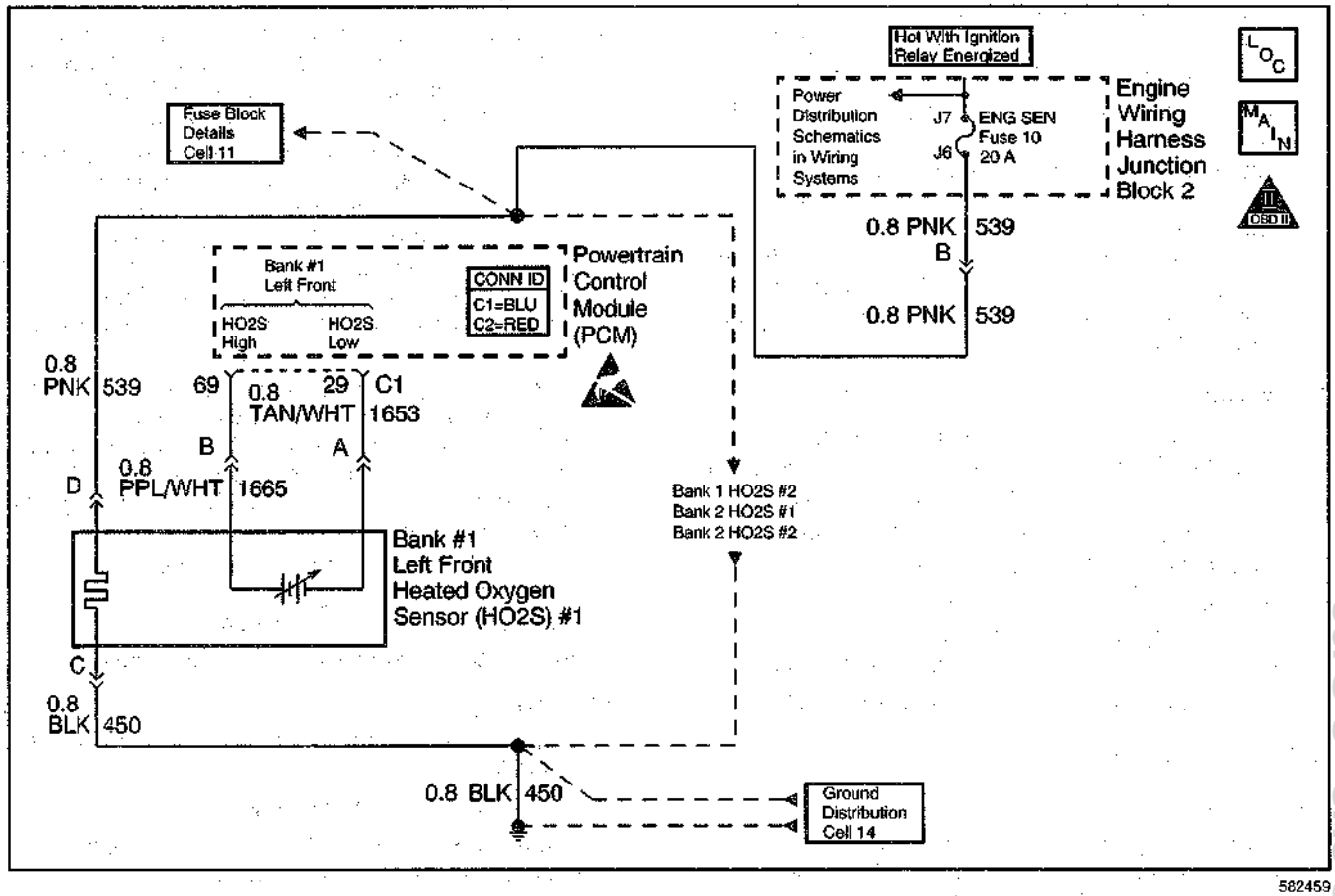
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DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, and then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage using the scan tool. Is the HO2S voltage within the specified range?	350–550 mV	Go to Diagnostic Aids	*Go to Step 5*
5	**Important:** Disconnecting the PCM may eliminate the short to ground if the signal circuit is shorted to another C1 circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the HO2S high signal circuit for a short to ground or a short to the sensor ground circuit. Refer to *Testing for Short to Ground* in Wiring Systems. Is the HO2S signal circuit shorted?	—	*Go to Step 6*	*Go to Step 7*
6	Repair the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 8*	—
7	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 8*	—
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1



Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage for being fixed above a predetermined voltage. If the PCM detects the voltage is above a predetermined voltage, this DTC sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The AIR, EGR, and catalyst diagnostics are not active.
- The ignition voltage is more than 9.0 volts.
- The fuel system is operating in Closed Loop.
- The fuel trim learn is enabled.
- The TP sensor angle is between 2–70 percent.

Conditions for Setting the DTC

- The HO2S signal voltage remains above 775 mV.
- The conditions are present for 33 seconds.

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Inspect the HO2S electrical connections for evidence of water intrusion. Water present in the connector causes the B+ supply to the heater to bleed over to the signal circuit.

- Fuel pressure: The system goes rich if the pressure is too high. The PCM compensates for some increase. However, if the fuel pressure is too high, a DTC may set. Refer to *Fuel System Diagnosis.*
- Rich injector(s): Perform the Injector Balance Test. Refer to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool.*
- Leaking injector: Refer to the *Fuel System Diagnosis.*
- Evaporative emissions (EVAP) canister purge. Inspect for fuel saturation. If full of fuel, inspect the canister control and hoses. Refer to *EVAP Control System Operation Description.*
- MAF sensor: Disconnect the MAF sensor and see if the rich condition is corrected. If so, inspect for proper installation. If installed OK, replace the MAF sensor. If the MAF sensor is installed backwards, the system goes rich. The plastic portion of the sensor has arrows cast into it indicating proper air flow direction. The arrows must point towards the engine.
- An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provides the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.
- TP sensor: An intermittent TP sensor output causes the system to go rich, due to a false indication of the engine accelerating.

For an intermittent condition, refer to *Symptoms.*

Test Description

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

2. This step tests for a rich condition.

   The engine must be at the normal operating temperature before performing this test.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you can not 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 aid in 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 the PCM recorded. This isolates when the DTC failed.
4. If the voltage remains high, this indicates the signal circuit is shorted to a voltage. If the voltage goes low, this indicates a rich condition.
5. This step isolates the condition. If the voltage remains high, this indicates the signal circuit is not shorted to the heater feed circuit.
8. Test for a short between the HO2S signal circuit and any other wires powered by this fuse that run together inside the same harness.

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DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1

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	1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the engine above 1200 RPM for two minutes. 4. Monitor the HO2S voltage display on the Engine 1 Data List using a scan tool. Is the HO2S voltage greater than the specified value?	775 mV	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, and then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn ON the ignition leaving the engine OFF. 2. Monitor the HO2S voltage. Is the HO2S voltage greater than the specified value?	775 mV	*Go to Step 5*	Go to Diagnostic Aids
5	Remove the HO2S heater fuse while monitoring the HO2S voltage. Does the voltage drop to within the specified range when the power to the heater is disconnected?	350–550 mV	*Go to Step 6*	*Go to Step 7*
6	1. Reinstall the fuse. 2. Disconnect the HO2S. 3. Jumper the HO2S low circuit (PCM side) to a known good ground. 4. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate the HO2S voltage within the specified range?	350–550 mV	*Go to Step 10*	*Go to Step 8*
7	**Important:** Disconnecting the PCM may eliminate the short to voltage if the signal circuit is shorted to another C1 circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Disconnect the HO2S. 4. Turn ON the ignition. 5. Test for a voltage on the HO2S sensor signal circuit at the PCM harness connector using the DMM. Is a voltage present?	—	*Go to Step 8*	*Go to Step 9*
8	Repair the short to voltage in the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 11*	—

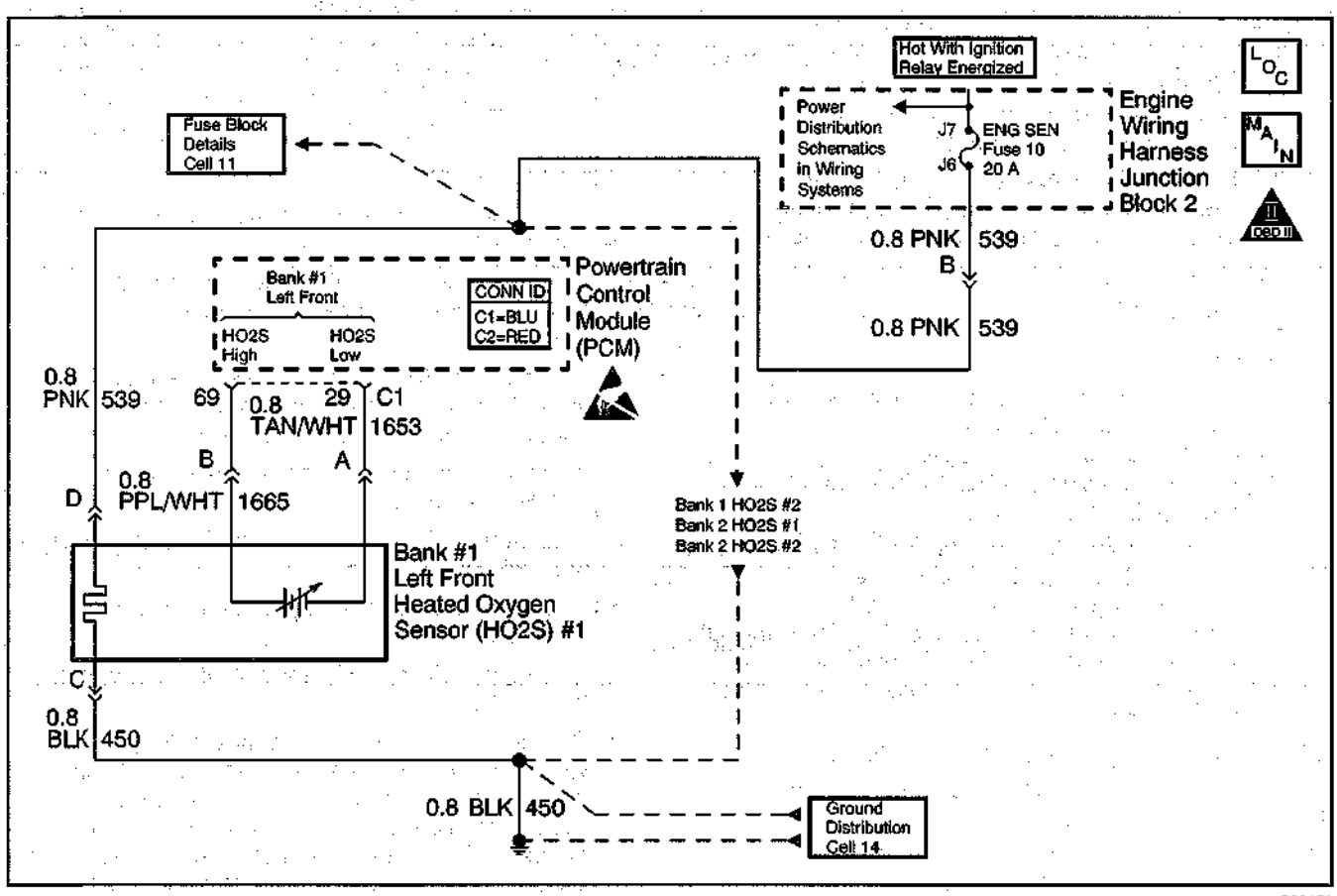
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DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 11*	—
10	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1.* Is the action complete?	—	*Go to Step 11*	—
11	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 12*	*Go to Step 2*
12	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0133 HO2S Slow Response Bank 1 Sensor 1



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Circuit Description

The PCM continuously monitors the Heated Oxygen Sensor (HO2S) activity for 100 seconds. During the monitor period 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. With this information, the PCM can determine the average time for all transitions. If the average response time is too slow, a DTC will set.

The PCM determines the lean to rich transition when the HO2S voltage changes from less than 300 mV to greater than 600 mV. The PCM determines the rich to lean transition when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is most likely defective. Replace the HO2S.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258, not set.
- The engine coolant temperature is more than 50°C (122°F).
- The ignition voltage is more than 9.0 volts.
- The fuel system is operating in Closed Loop.
- The engine speed between 1,000 RPM and 2,300 RPM.
- The engine air flow is between 20 g/s and 50 g/s.
- The EVAP canister purge duty cycle is more than 0 percent.
- The engine run time is more than 120 seconds.

Conditions for Setting the DTC

- The lean to rich response (below 300 mV to above 600 mV) average time is more than 250 milliseconds.
- The rich to lean response (above 600 mV to below 300 mV) average time is more than 250 milliseconds.
- The above conditions are met for 60 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

This diagnostic only runs once per ignition cycle.

A malfunction in the HO2S heater circuits causes a DTC to set. Inspect the HO2S heater circuits for an intermittent open or for a poor connection.

A malfunction in the HO2S heater circuits causes a DTC to set. Inspect the HO2S heater circuits for an intermittent open or for a poor connection.

An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provides the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step determines if the fault is present. This test may take 5 minutes for the diagnostic to run.
3. When DTCs P0133 and P0153 are set at the same time, it is a good indication that a fuel contamination condition is present.
4. An exhaust leak 6–12 inches away from the HO2S can cause a DTC to set.
5. This step verifies whether a good ground circuit is available.
6. This step verifies the integrity of the signal circuit to the PCM.
7. This step verifies the integrity of the signal circuit to the PCM.
8. Certain RTV silicone gasket materials give off vapors that can contaminate the HO2S. There is also a possibility of silicone contamination caused by silicone in the fuel. If the sensors appear to be contaminated by silicone and all the silicone sealant is a non silicone base, advise the customer to try a different fuel company. A missing fuel filler restrictor indicates the customer may have used leaded fuel.

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DTC P0133 HO2S Slow Response Bank 1 Sensor 1

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	**Important:** If any DTCs are set (except P0153), refer to those DTCs before proceeding with this diagnostic table. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within the parameters specified under Conditions for Running the DTC in the supporting text. 4. Monitor the DTC Information option using the scan tool. Did DTC P0133 fail this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	Did DTC P0153 also fail this ignition?	—	*Go to Step 8*	*Go to Step 4*
4	1. Inspect the exhaust system for a leak. Refer to *Exhaust System Inspection* in Engine Exhaust. After you inspect the exhaust system, return to this diagnostic. 2. If you find an exhaust leak, repair the exhaust leak as necessary. Did you isolate an exhaust leak?	—	*Go to Step 14*	*Go to Step 5*
5	1. Visually/physically inspect the following items: • Ensure that the HO2S is securely installed. • Inspect for corrosion on the terminals. • Inspect the terminal tension at the HO2S and at the PCM. • Inspect for damaged wiring. 2. If you find a condition repair as necessary. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 6*
6	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage on the Engine 1 Data List using the scan tool. Does the scan tool indicate a voltage within the specified range?	350–550 mV	*Go to Step 7*	*Go to Step 10*
7	1. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 2. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate a voltage below the specified value?	200 mV	*Go to Step 13*	*Go to Step 9*
8	**Important:** Determine and correct the cause of the contamination before replacing a sensor. Inspect for the following conditions: • Fuel contamination • Use of improper RTV sealant • Engine oil/coolant consumption Replace the affected Heated Oxygen sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1* and/or *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1*. Is the action complete?	—	*Go to Step 14*	—

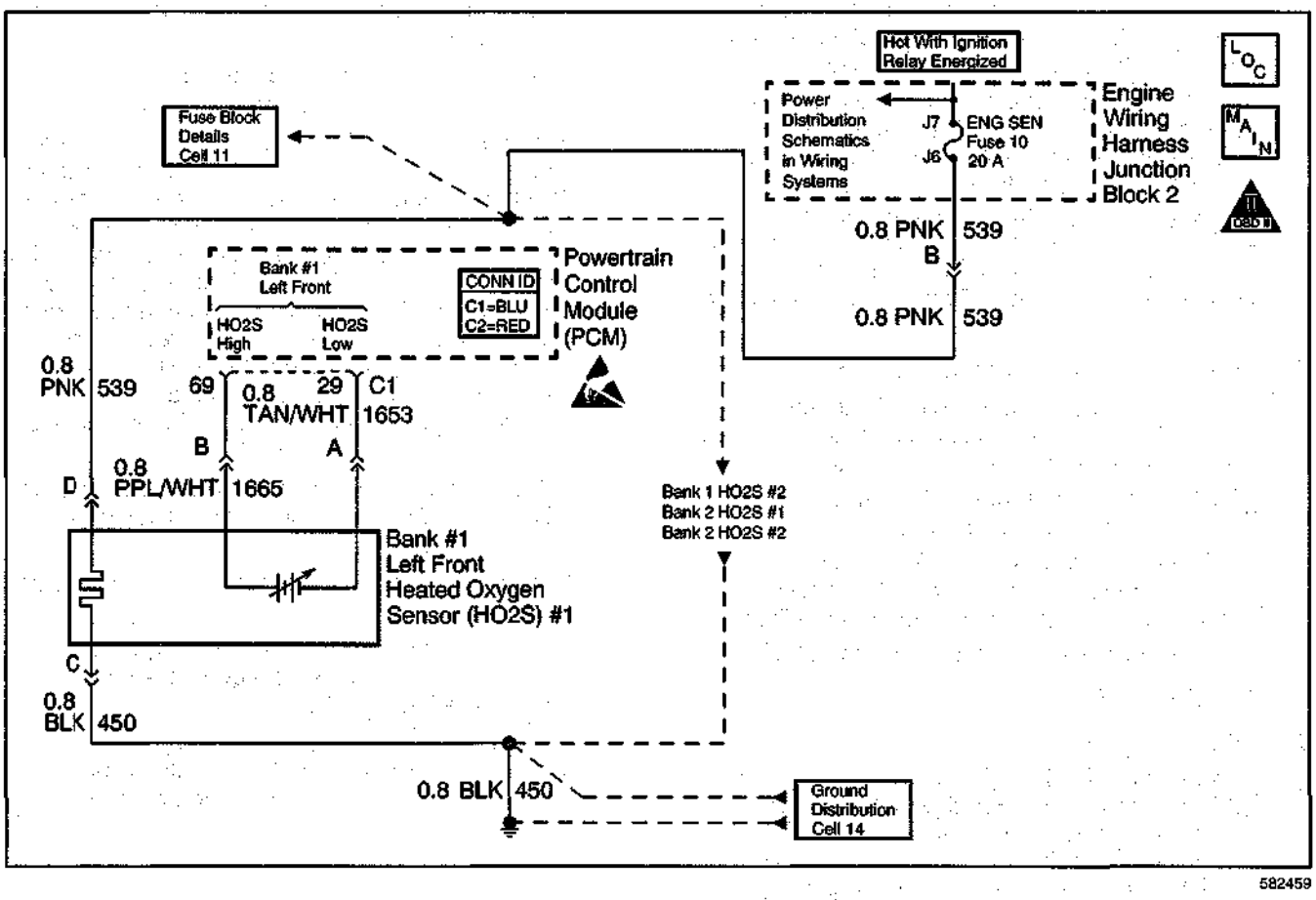
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DTC P0133 HO2S Slow Response Bank 1 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
9	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM. Does the DMM indicate a voltage near the specified value?	5V	*Go to Step 12*	*Go to Step 11*
10	Repair the high signal circuit for a short to ground or for a shorted to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
11	Repair the open HO2S low circuit or repair the faulty PCM connections. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Repair the HO2S high signal circuit for an open or repair the faulty PCM connections. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
13	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1.* Is the action complete?	—	*Go to Step 14*	—
14	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 15*	*Go to Step 2*
15	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1



Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage and detects if the voltage goes out of the bias range. If the PCM does not detect the voltage went out of the bias range, this DTC sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The ignition voltage is more than 9.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The fuel system is operating in Closed Loop.
- The engine run time is more than 70 seconds.

Conditions for Setting the DTC

- The HO2S signal voltage is steady between 350 mV and 550 mV.
- The conditions are present for 60 seconds.

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provides the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The engine must be at the normal operating temperature before performing this test.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you can not 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 be used to 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 the PCM recorded. This isolates when the DTC failed.
4. If the scan tool indicates the HO2S voltage goes below 200 mV, this indicates the HO2S circuits and PCM are OK.
5. This step verifies whether the signal circuit from the PCM is OK.
6. This step verifies whether the low signal circuit from the PCM is OK. A voltage indicates the PCM and wiring are OK.
7. Disconnecting the PCM allows using a DMM in order to test continuity of the circuits. This aids in locating an open or shorted circuit.

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DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1

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	**Important:** Inspect the HO2S for being secure before proceeding with this DTC. A sensor that is loose could cause this DTC to set. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the engine above 1200 RPM for two minutes. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Does the scan tool indicate the HO2S voltage varying outside the specified range?	350–550 mV	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn ON the ignition leaving the engine OFF. 2. Disconnect the HO2S. 3. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 4. Monitor the HO2S voltage using the scan tool. Is the HO2S voltage below the specified value?	200 mV	*Go to Step 8*	*Go to Step 5*
5	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM. Does the DMM indicate near the specified value?	5 Volts	*Go to Step 6*	*Go to Step 7*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity of the HO2S high circuit. Refer to *Testing for Continuity* in Wiring Systems. 4. Repair the open circuit if no continuity is indicated on the DMM. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the HO2S high circuit condition?	—	*Go to Step 12*	*Go to Step 10*

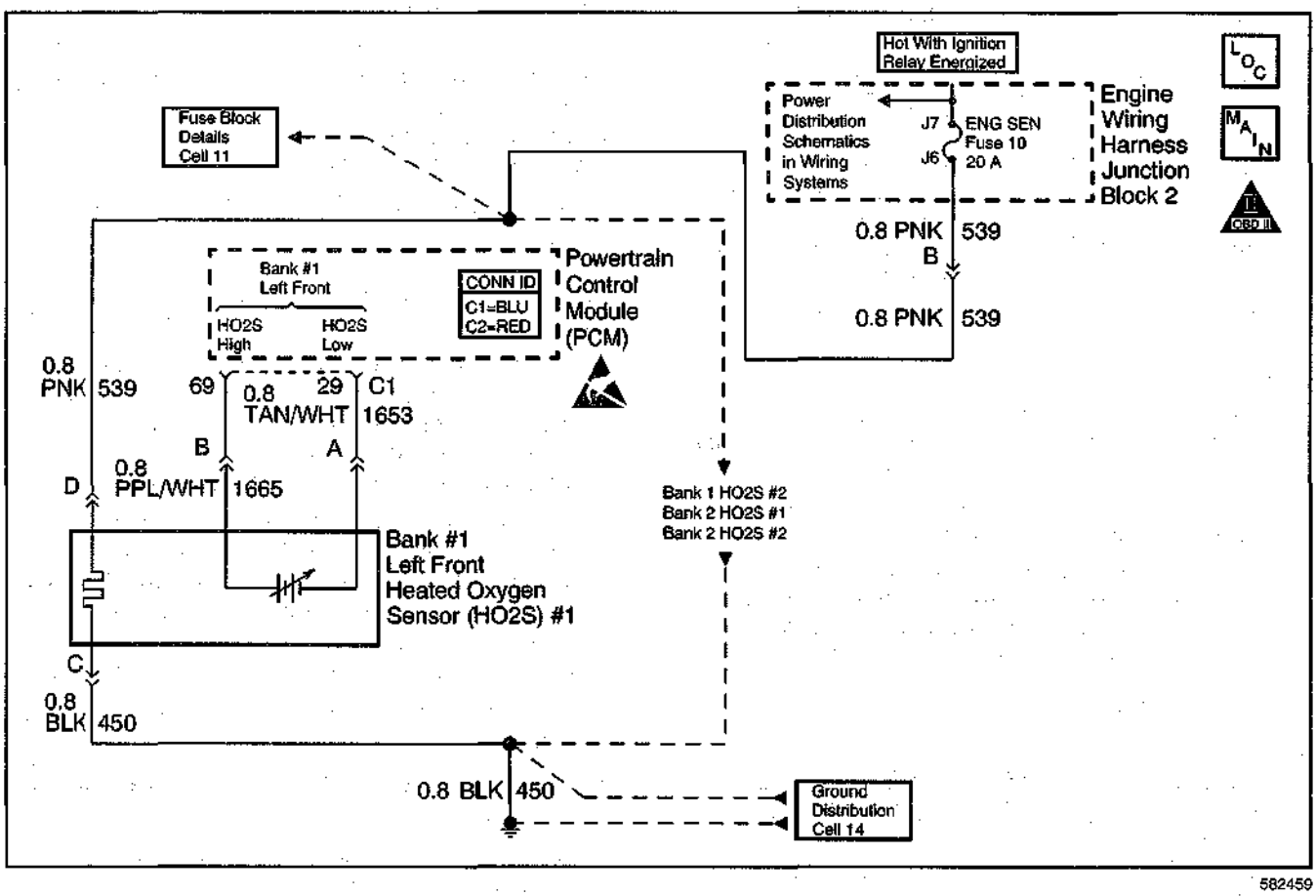
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DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the continuity of the HO2S low circuit. Refer to *Testing for Continuity* in Wiring Systems. 4. Repair the open or the poor connection if no continuity is indicated on the DMM. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 10*
8	1. Inspect the HO2S circuits for a poor connection at the HO2S harness connector. 2. If you find a poor connection, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 9*
9	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1*. Is the action complete?	—	*Go to Step 12*	—
10	1. Inspect the HO2S circuits for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 11*
11	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0135 HO2S Heater Performance Bank 1 Sensor 1



Circuit Description

The PCM supplies a bias voltage (approximately 450 mV) on the Heated Oxygen Sensor (HO2S) signal high and low circuits. When you turn the ignition to the ON position, battery voltage is supplied to the HO2S heater. As the heater reaches the operating temperature, the HO2S voltage responds by changing from a bias voltage range to the normal operation. Typically, as the HO2S reaches the operating temperature, the HO2S voltage goes from a bias voltage to a voltage below 300 mV. Depending on the exhaust gas content, it is possible for the HO2S voltage to go above 450 mV.

The PCM runs the heater test only on a cold start (depends on the cumulative air flow) and only once an ignition cycle. When you start the engine the PCM monitors the HO2S voltage. When the HO2S voltage goes above or below the bias range threshold, the PCM determines how much time it took. If the PCM detects that the process took too much time for the HO2S to enter into normal operating range, this DTC sets. The time the process takes the HO2S to reach operating temperature is based on the amount of air that flows into the engine.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The intake air temperature and the engine coolant temperature are less than 50°C (122°F) and are within 8°C (14.5°F) of each other at engine start-up.
- The ignition voltage is between 10.0 volts and 18.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.

Conditions for Setting the DTC

The HO2S voltage remains between 300 mV and 700 mV for a predetermined amount of time (depends on engine coolant temperature and air flow).

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The heater diagnostic only runs on a cold start and runs once per ignition cycle.

An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provides the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. Allow the engine to cool before performing this test. If the sensor is at the operating temperature the HO2S voltage will stay high or low. If the HO2S voltage stays between 300–700 mV indicates the HO2S heater is inoperative.
3. If more than one HO2S DTC is set, this is a good indication that the HO2S fuse is open. Test all the related circuits going to all the heated oxygen sensors for a short to ground. If all the wiring is OK, it may be necessary to disconnect each HO2S one at a time to locate a shorted sensor.
4. This step verifies whether a B+ supply is available at the sensor.
5. This step verifies whether a ground is available at the sensor.
6. This step verifies whether the HO2S heater element is internally open.
7. Inspect the ignition feed circuits at the Underhood Electrical Center for poor connections.
8. Test the ground circuits for an open if more then one heater DTC sets.

DTC P0135 HO2S Heater Performance Bank 1 Sensor 1

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	**Important:** Allow the engine to cool for about one half hour before proceeding with this table. 1. Turn OFF the ignition. 2. Install the scan tool. 3. Turn ON the ignition leaving the engine OFF. 4. Monitor the HO2S voltage display on the Engine 1 Data List of the scan tool. Does the HO2S voltage go from a bias voltage to above or below the specified range?	300–700 mV	Go to Diagnostic Aids	*Go to Step 3*
3	Inspect the HO2S fuse for an open. Is the HO2S fuse open?	—	*Go to Step 11*	*Go to Step 4*

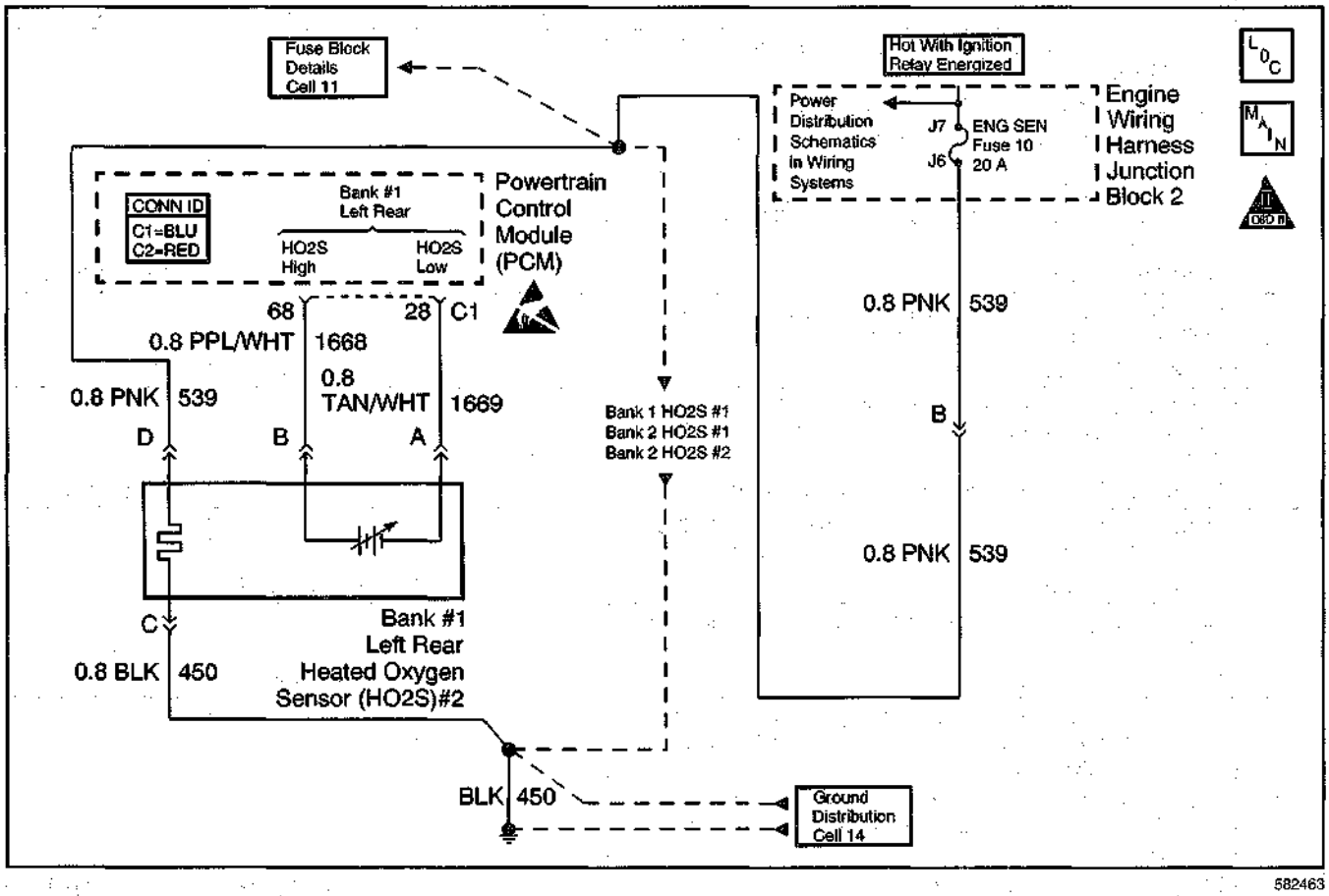
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DTC P0135 HO2S Heater Performance Bank 1 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information. 2. Disconnect the HO2S electrical connector. 3. Probe the ignition feed circuit at the HO2S electrical connector (PCM side) using a *J 34142-B* test lamp connected to ground (a known good ground. Do not use the HO2S heater ground or the HO2S low circuits). Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 7*
5	Connect the *J 34142-B* test lamp between the HO2S ignition feed and the HO2S heater ground. Does the test lamp illuminate?	—	*Go to Step 6*	*Go to Step 8*
6	Measure the resistance between the HO2S ignition feed and the HO2S heater ground at the HO2S pigtail using a DMM. Is the HO2S resistance within the specified range?	3.5–14.0Ω	*Go to Step 9*	*Go to Step 10*
7	Repair the open in the HO2S ignition feed circuit to the HO2S. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
8	Repair the open in the HO2S heater ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
9	1. Inspect for a poor connection at the HO2S. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 10*
10	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1.* Is the action complete?	—	*Go to Step 12*	—
11	1. Locate and repair the short to ground in the HO2S ignition feed circuit. 2. Replace the faulty fuse. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2



Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage for being fixed below a predetermined voltage. If the PCM detects the voltage is below a predetermined voltage, this DTC sets.

Conditions for Running the DTC

Criteria 1

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The ignition voltage is more than 9.0 volts.
- The fuel system is operating in Closed Loop.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The fuel trim learn is enabled.
- The TP sensor angle is between 2–70 percent.

OR

Criteria 2

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The ignition voltage is more than 9.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The Power Enrichment mode is enabled for more than 1.0 second.

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Conditions for Setting the DTC

Criteria 1

- The HO2S signal voltage remains below 80 mV.
- The Criteria 1 conditions are present for 80 seconds.

OR

Criteria 2

- The HO2S signal voltage remains below 420 mV.
- The Criteria 2 conditions are present for 10 seconds during the Power Enrichment mode.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The PCM sets this DTC when the vehicle runs out of fuel.

- Heated Oxygen Sensor (HO2S) wire: Sensor pigtail may be in contact with the exhaust manifold or the exhaust system.
- An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provides the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.
- Inspect for an intermittent ground in the signal wire between the connector and the sensor.
- Lean injector(s): Perform the Injector Balance Test. Refer to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool.*
- Fuel contamination: Water near the in-tank fuel pump inlet can be delivered to the injectors. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.* The water causes a lean exhaust and can set a DTC.
- Fuel pressure: System will be lean if fuel pressure is low. Refer to *Fuel System Diagnosis.*
- Exhaust leaks: An exhaust leak near the HO2S can cause a lean condition. Refer to *Exhaust Leakage* in Engine Exhaust.

Vacuum or crankcase leaks can cause a lean condition.

If the above are OK, the HO2S may be at fault.

For an intermittent condition, refer to *Symptoms.*

Test Description

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

2. If the HO2S voltage is fixed well below 200 mV, this indicates a short to battery ground or chassis ground. If the voltage is fixed near or above 200 mV, this indicates a short to a PCM ground. When the HO2S voltage is fixed near 200 mV, indicates the DTC set when the fuel system was in a Power Enrichment mode of operation. This DTC sets if the HO2S voltage is less than 420 mV during a Power Enrichment mode of operation.

   The engine must be at the normal operating temperature before performing this test.

3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you can not 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 be used to 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 the PCM recorded. This isolates when the DTC failed.
4. Lower the exhaust system to gain sufficient access to the HO2S and/or the HO2S connector if necessary. Disconnecting the HO2S should cause the HO2S voltage to display a bias voltage. A voltage staying near 0.0 volts indicates the low circuit is open, or the high circuit is open or grounded.
5. Disconnecting the PCM allows using a DMM in order in order to test continuity of the circuits. This aids in locating an open or shorted circuit.

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DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2

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	**Important:** Inspect the HO2S for being secure before proceeding with this DTC. A sensor that is loose could cause this DTC to set. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within the parameters specified under Conditions for Running the DTC in the supporting text. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Is the HO2S voltage fixed below the specified value?	80 mV	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate the HO2S voltage is within the specified range?	350–550 mV	Go to Diagnostic Aids	*Go to Step 5*
5	**Important:** Disconnecting the PCM may eliminate the short to ground if the signal circuit is shorted to another C1 circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the HO2S signal circuit for a short to ground or a short to the sensor ground circuit. Refer to *Testing for Short to Ground* in Wiring Systems. Is the HO2S signal circuit shorted?	—	*Go to Step 6*	*Go to Step 7*
6	Repair the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 8*	—
7	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 8*	—

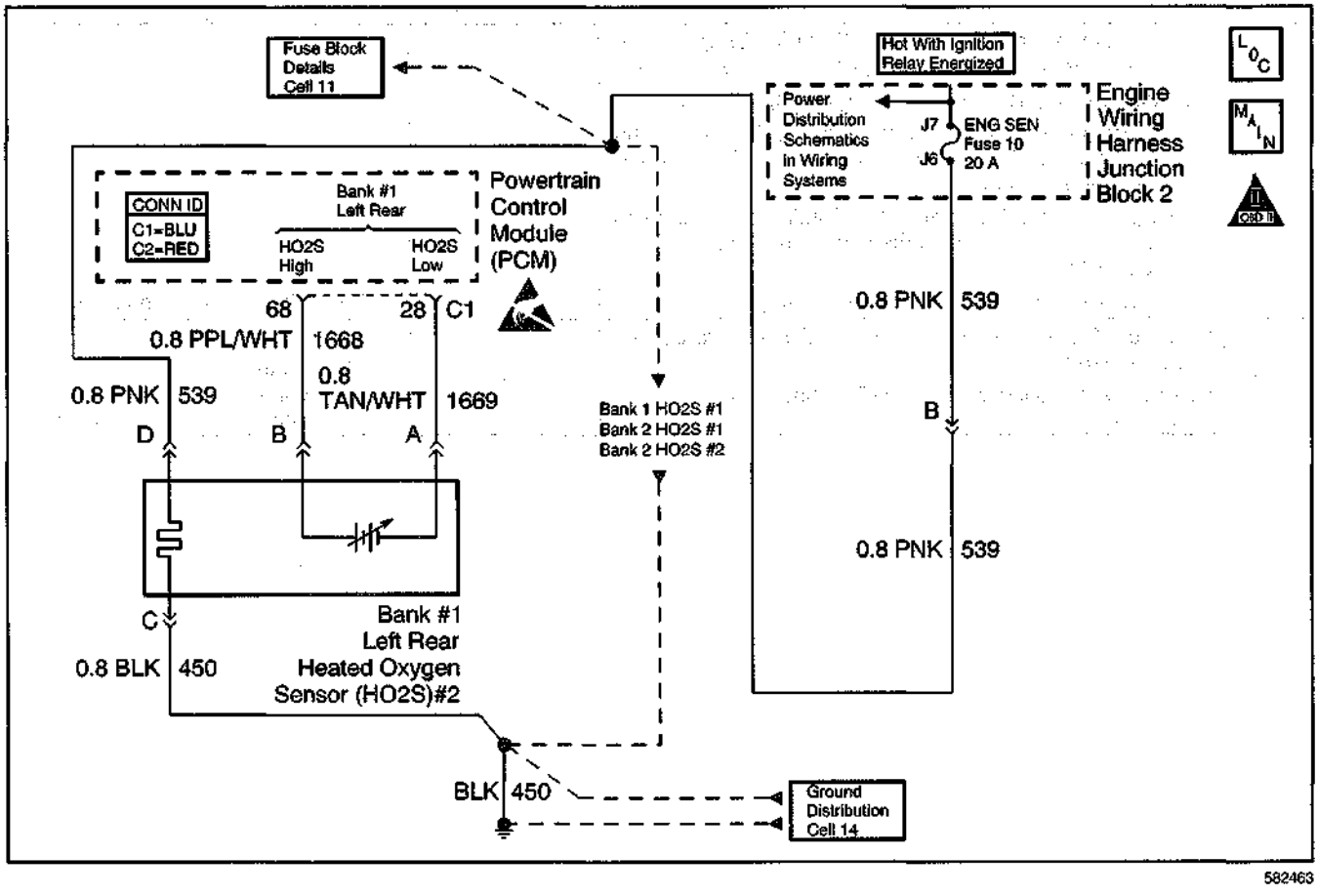
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DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2 (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2



Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage for being fixed above a predetermined voltage. If the PCM detects the voltage is above a predetermined voltage, this DTC sets.

Conditions for Running the DTC

Criteria 1

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The ignition voltage is more than 9.0 volts.
- The fuel system is operating in Closed Loop.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The TP sensor angle is between 2–70 percent.

OR

Criteria 2

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The ignition voltage is more than 9.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The Deceleration Fuel Cut-off mode is enabled for 3 seconds to 10 seconds.

Conditions for Setting the DTC

Criteria 1

- The HO2S signal voltage remains above 930 mV.
- The Criteria 1 conditions are present for 40 seconds.

OR

Criteria 2

- The HO2S signal voltage remains above 480 mV.
- The Criteria 2 conditions are present for 5 seconds during the Deceleration Fuel Cut-off mode.

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Inspect the HO2S electrical connections for evidence of water intrusion. Water present in the connector causes the B+ supply to the heater to bleed over to the signal circuit.

- Fuel pressure: The system goes rich if the pressure is too high. The PCM compensates for some increase. However, if the fuel pressure is too high, a DTC may set. Refer to *Fuel System Diagnosis*.
- Rich injector(s): Perform the Injector Balance Test. Refer to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool*.
- Leaking injector: Refer to the *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) canister purge. Inspect for fuel saturation. If full of fuel, inspect the canister control and hoses. Refer to *EVAP Control System Operation Description*.
- MAF sensor: Disconnect the MAF sensor and see if the rich condition is corrected. If so, inspect for proper installation. If installed OK, replace the MAF sensor. If the MAF sensor is installed backwards, the system goes rich. The plastic portion of the sensor has arrows cast into it indicating proper air flow direction. The arrows must point towards the engine.
- An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provide the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.
- TP sensor: An intermittent TP sensor output causes the system to go rich, due to a false indication of the engine accelerating.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This DTC also sets during a deceleration fuel cut-off. Inspect items which could cause a rich exhaust during a deceleration (leaking injectors, stuck injectors etc.). Refer to Conditions for Setting the DTC.

   The engine must be at the normal operating temperature before performing this test.

3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicated 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 be used to 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.
4. If the voltage remains high, this indicates the signal circuit is shorted to a voltage. If the voltage goes low, this indicates a rich condition.
5. This step isolates the condition. If the voltage remains high, this indicates the signal circuit is not shorted to the heater feed circuit.
8. Test for a short between the HO2S signal circuit and any other wires powered by this fuse that run together inside the harness.

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DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2

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	**Important:** Monitor the front HO2S voltage before proceeding with this DTC. If the front HO2S voltage is fixed below 300 mV, refer to *DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1*. 1. Install the scan tool. 2. Idle the engine until the normal operating temperature is reached. 3. Raise the engine speed to 1200 RPM. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Is the HO2S voltage greater than the specified value?	930 mV	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, and then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn ON the ignition leaving the engine OFF. 2. Monitor the HO2S voltage. Is the HO2S voltage greater than the specified value?	350–550 mV	*Go to Step 5*	Go to Diagnostic Aids
5	Remove the HO2S heater fuse while monitoring the HO2S voltage. Does the voltage drop to within the specified range when the power to the heater is disconnected?	350–550 mV	*Go to Step 6*	*Go to Step 7*
6	1. Reinstall the fuse. 2. Disconnect the HO2S. 3. Jumper the HO2S low circuit (PCM side) to a known good ground. 4. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate the HO2S voltage within the specified range?	350–550 mV	*Go to Step 10*	*Go to Step 8*

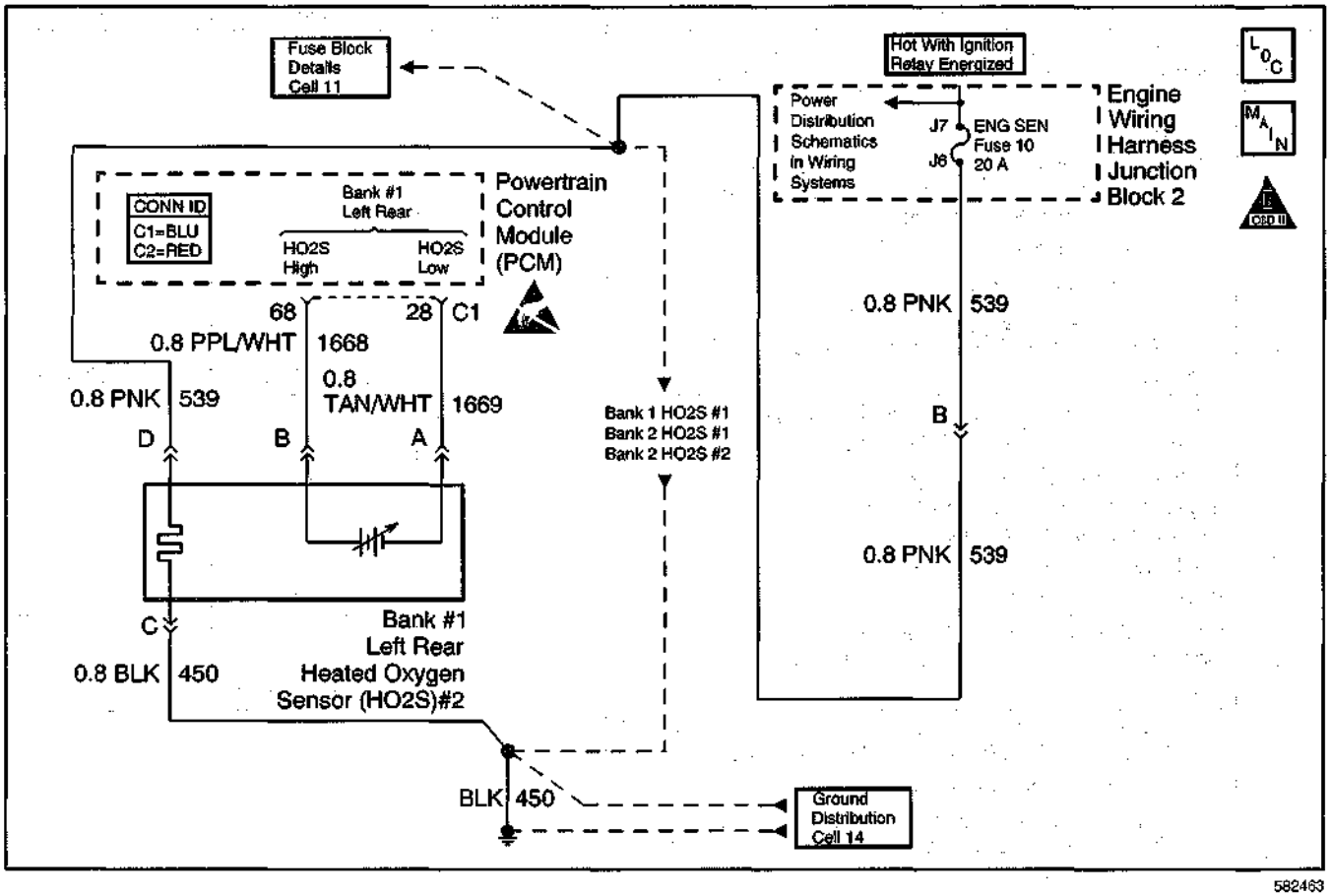
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DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2 (cont'd)

Step	Action	Value(s)	Yes	No
7	**Important:** Disconnecting the PCM may eliminate the short to voltage if the signal circuit is shorted to another C1 circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Disconnect the HO2S. 4. Turn ON the ignition. 5. Test for a voltage on the HO2S sensor signal circuit at the PCM harness connector using the DMM. Is a voltage present?	—	*Go to Step 8*	*Go to Step 9*
8	Repair the short to voltage in the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 11*	—
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 11*	—
10	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1.* Is the action complete?	—	*Go to Step 11*	—
11	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 12*	*Go to Step 2*
12	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2



Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage and detects if the voltage goes out of the bias range. If the PCM does not detect the voltage went out of the bias range, this DTC sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The ignition voltage is more than 9.0 volts.
- The engine run time is more than 70 seconds.
- The fuel system is operating in Closed Loop.
- The AIR, EGR, and the Catalyst diagnostics are not active.

Conditions for Setting the DTC

The HO2S signal voltage is steady between 409 mV and 489 mV for 2.5 minutes.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provides the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The engine must be at the normal operating temperature before performing this test.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you can not 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 be used to 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 the PCM recorded. This isolates when the DTC failed.
4. If the scan tool indicates the HO2S voltage goes below 200 mV, this indicates the HO2S circuits and PCM are OK.
5. This step verifies whether the signal circuit from the PCM is OK.
6. This step verifies whether the low signal circuit from the PCM is OK. A voltage indicates the PCM and wiring are OK.
7. Disconnecting the PCM allows using a DMM in order to test continuity of the circuits. This aids in locating an open or shorted circuit.

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DTC P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2

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	**Important:** Inspect the HO2S for being secure before proceeding with this DTC. A sensor that is loose could cause this DTC to set. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the engine above 1200 RPM for 2 minutes. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Does the scan tool indicate the HO2S voltage varying outside the specified range?	350–550 mV	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn ON the ignition leaving the engine OFF. 2. Disconnect the HO2S. 3. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 4. Monitor the HO2S voltage using the scan tool. Is the HO2S voltage below the specified value?	200 mV	*Go to Step 8*	*Go to Step 5*
5	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM. Does the DMM indicate near the specified value?	5 Volts	*Go to Step 6*	*Go to Step 7*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity of the HO2S high circuit. Refer to *Testing for Continuity* in Wiring Systems. 4. Repair the open circuit if no continuity is indicated on the DMM. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 10*

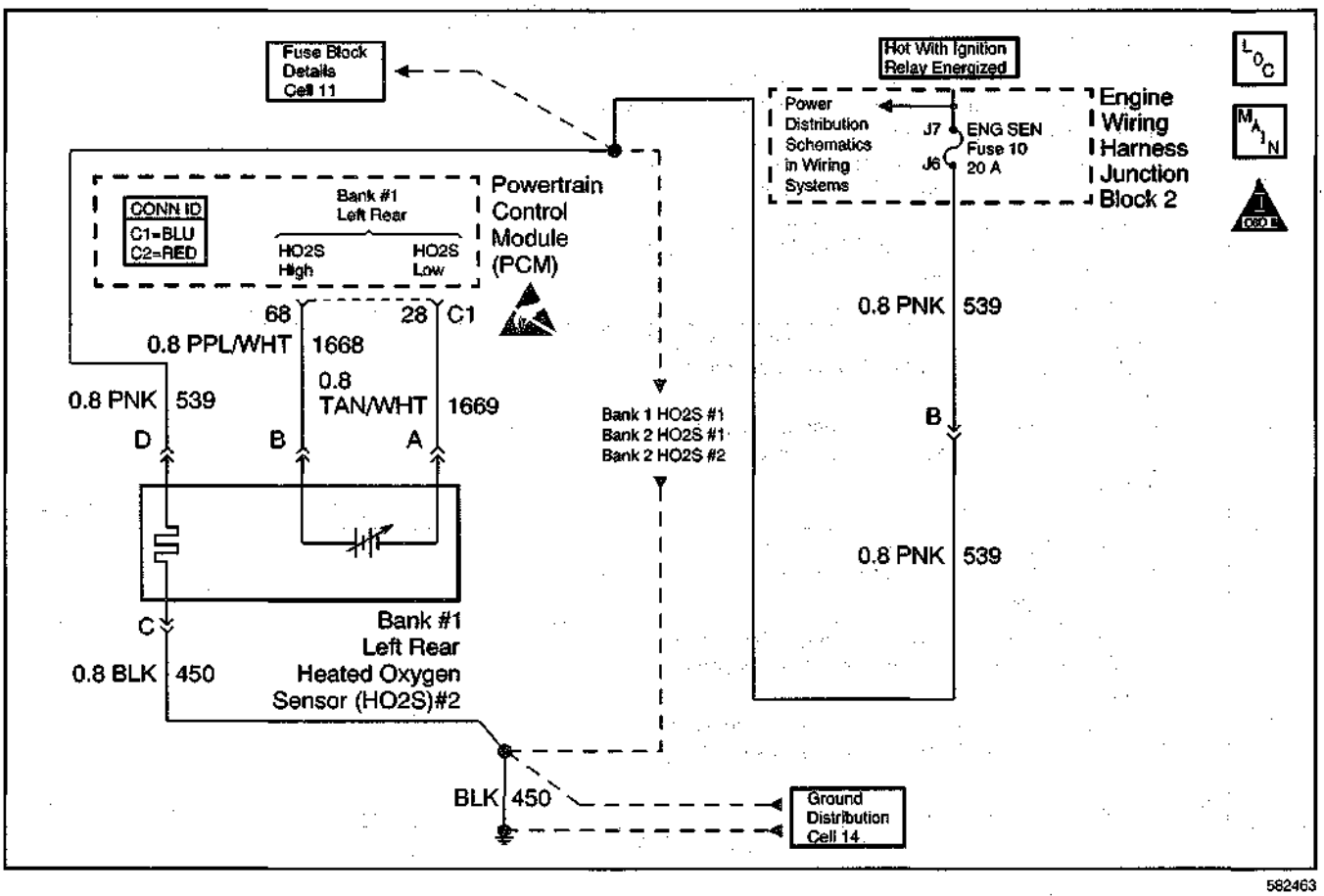
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DTC P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2 (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity of the HO2S low circuit. Refer to *Testing for Continuity* in Wiring Systems. 4. Repair the open or the poor connection if no continuity is indicated on the DMM. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 10*
8	1. Inspect for a poor connection at the HO2S. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 9*
9	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2.* Is the action complete?	—	*Go to Step 12*	—
10	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 11*
11	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0141 HO2S Heater Performance Bank 1 Sensor 2



Circuit Description

The PCM supplies a bias voltage (approximately 450 mV) on the Heated Oxygen Sensor (HO2S) signal high and low circuits. When the ignition is turned to the ON position, battery voltage is supplied to the HO2S heater. As the heater reaches operating temperature, the HO2S voltage responds by changing from a bias voltage range to normal operation. Typically, as the HO2S reaches operating temperature, the HO2S voltage goes from a bias voltage to a voltage below 300 mV. Depending on the exhaust gas content, it is possible for the HO2S voltage to go above 450 mV.

The PCM will run the heater test only on a cold start (depends on cumulative air flow) and only once an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage goes above or below the bias range threshold, the PCM will determine how much time it took. If the PCM detects that it took too much time for the HO2S to enter into normal operating range, this DTC sets. The time it takes the HO2S to reach the operating temperature is based on the amount of air that flows into the engine.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The intake air temperature and engine coolant temperature are less than 50°C (122°F) and are within 8°C (14.5°F) of each other at engine start-up.
- The ignition voltage is between 10.0 volts and 18.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.

Conditions for Setting the DTC

The HO2S voltage remains between 300 mV and 700 mV for a predetermined amount of time (depends on engine coolant temperature and air flow).

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The heater diagnostic only runs on a cold start and runs once per ignition cycle.

An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provides the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. Allow the engine to cool, before proceeding with this diagnostic table. The HO2S may be at the operating temperature and no drop or rise in the HO2S voltage would occur. If the HO2S voltage stays between 300–700 mV indicates the HO2S heater is inoperative.
3. If more then one HO2S heater DTC is set, this is good indication that the HO2S fuse is open. Test all the related circuits going to all of the heated oxygen sensors for a short to ground. If all wiring is OK, it may be necessary to disconnect each HO2S one at a time to locate a shorted sensor.
4. This step verifies whether B+ supply is available at the sensor.
5. This step verifies whether a ground is available at the sensor.
6. This step verifies whether the HO2S heater element is internally open.
7. Inspect the ignition feed circuits at the Underhood Electrical Center for poor connections.
8. Test the ground circuits for an open if more then one heater DTC sets.

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DTC P0141 HO2S Heater Performance Bank 1 Sensor 2

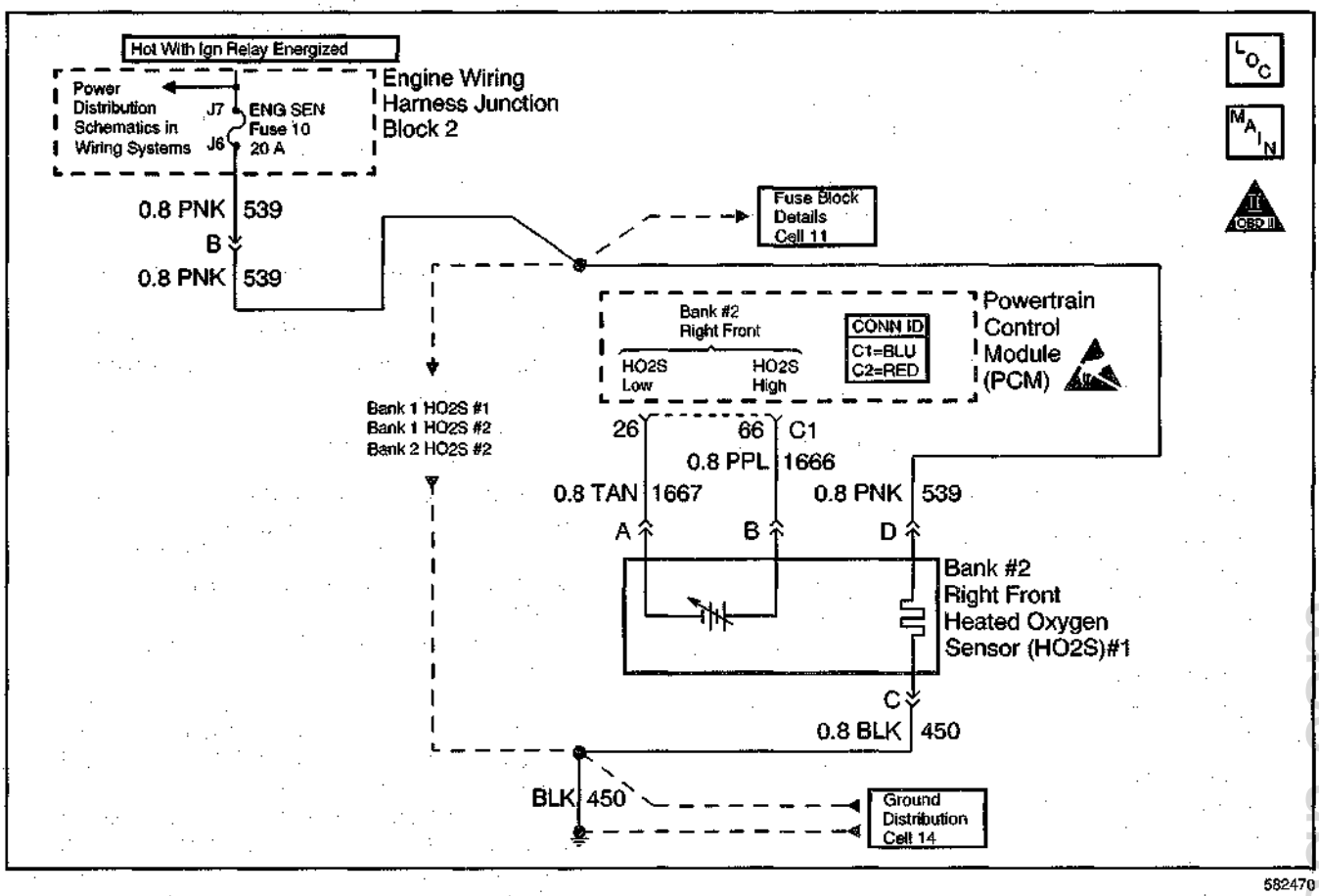
Step	Action	Value(s)	Yes	No
1	Did you perform the Powertrain On-Board Diagnostic (OBD) System Check?	—	*Go to Step 2*	Go to *A Powertrain On Board Diagnostic (OBD) System Check*
2	**Important:** If the engine has just been operating, allow the engine to cool for about one half hour before proceeding. 1. Turn OFF the ignition. 2. Install the scan tool. 3. Turn ON the ignition leaving the engine OFF. 4. Monitor the HO2S voltage display on the Engine 1 Data List of the scan tool. Does the HO2S voltage go from a bias voltage to above or below the specified range?	300–700 mV	Go to Diagnostic Aids	*Go to Step 3*
3	Inspect the fuse for the HO2S ignition feed circuit. Is the HO2S fuse open?	—	*Go to Step 11*	*Go to Step 4*

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

Step	Action	Value(s)	Yes	No
4	1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information. 2. Disconnect the HO2S electrical connector. 3. Probe the ignition feed circuit at the HO2S electrical connector (PCM side) using a *J 34142-B* test lamp connected to a known good ground. Do Not use the HO2S heater ground or the HO2S low circuit. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 7*
5	Connect the *J 34142-B* test lamp between the HO2S ignition feed and the HO2S heater ground. Does the test lamp illuminate?	—	*Go to Step 6*	*Go to Step 8*
6	Measure the resistance between the HO2S ignition feed and the HO2S heater ground at the HO2S pigtail using the DMM. Is the HO2S resistance within the specified range?	3.5–14.0Ω	*Go to Step 9*	*Go to Step 10*
7	Repair the open in the HO2S ignition feed circuit to the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
8	Repair the open in the HO2S heater ground circuit. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
9	1. Inspect for a poor connection at the HO2S. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 10*
10	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2.* Is the action complete?	—	*Go to Step 12*	—
11	Locate and repair the short to ground in the HO2S ignition feed circuit and replace the fuse. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1



Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage for being fixed below a predetermined voltage. If the PCM detects the voltage is below a predetermined voltage, this DTC sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The ignition voltage is more than 9.0 volts.
- The fuel system is operating in Closed Loop.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The TP sensor angle is between 2–70 percent.

Conditions for Setting the DTC

- The HO2S signal voltage remains below 200 mV.
- The conditions are present for 33 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The PCM sets this DTC when the vehicle runs out of fuel.

- Heated Oxygen Sensor (HO2S) wire: Sensor pigtail may be in contact with the exhaust manifold or the exhaust system.
- An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provide the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.
- Inspect for an intermittent ground in the signal wire between the connector and the sensor.
- Lean injector(s): Perform the Injector Balance Test. Refer to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool.*
- Fuel contamination: Water near the in-tank fuel pump inlet can be delivered to the injectors. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.* The water causes a lean exhaust and can set a DTC.
- Fuel pressure: System will be lean if fuel pressure is low. Refer to *Fuel System Diagnosis.*
- Exhaust leaks: An exhaust leak near the HO2S can cause a lean condition. Refer to *Exhaust Leakage* in Engine Exhaust.
- Vacuum or crankcase leaks can cause a lean condition.

If the above are OK, the HO2S may be at fault.

For an intermittent condition, refer to *Symptoms.*

Test Description

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

2. If the HO2S voltage is fixed well below 200 mV, this indicates a short to battery ground or chassis ground. If the voltage is fixed near or above 200 mV, this indicates a short to a PCM ground.
   The engine must be at the normal operating temperature before performing this test.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you can not 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 be used to 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 the PCM recorded. This isolates when the DTC failed.
4. A sensor that is disconnected should indicate a bias voltage. If the voltage is low inspect the signal circuit for a short to ground.
5. Disconnecting the PCM allows using a DMM in order to test continuity of the circuits. This aids in locating an open or shorted circuit.

DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1

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	**Important:** Inspect the HO2S for being secure before proceeding with this DTC. A sensor that is loose could cause this DTC to set. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within the parameters specified under Conditions for Running the DTC in the supporting text. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Is the HO2S voltage less than the specified value?	200 mV	*Go to Step 4*	*Go to Step 3*

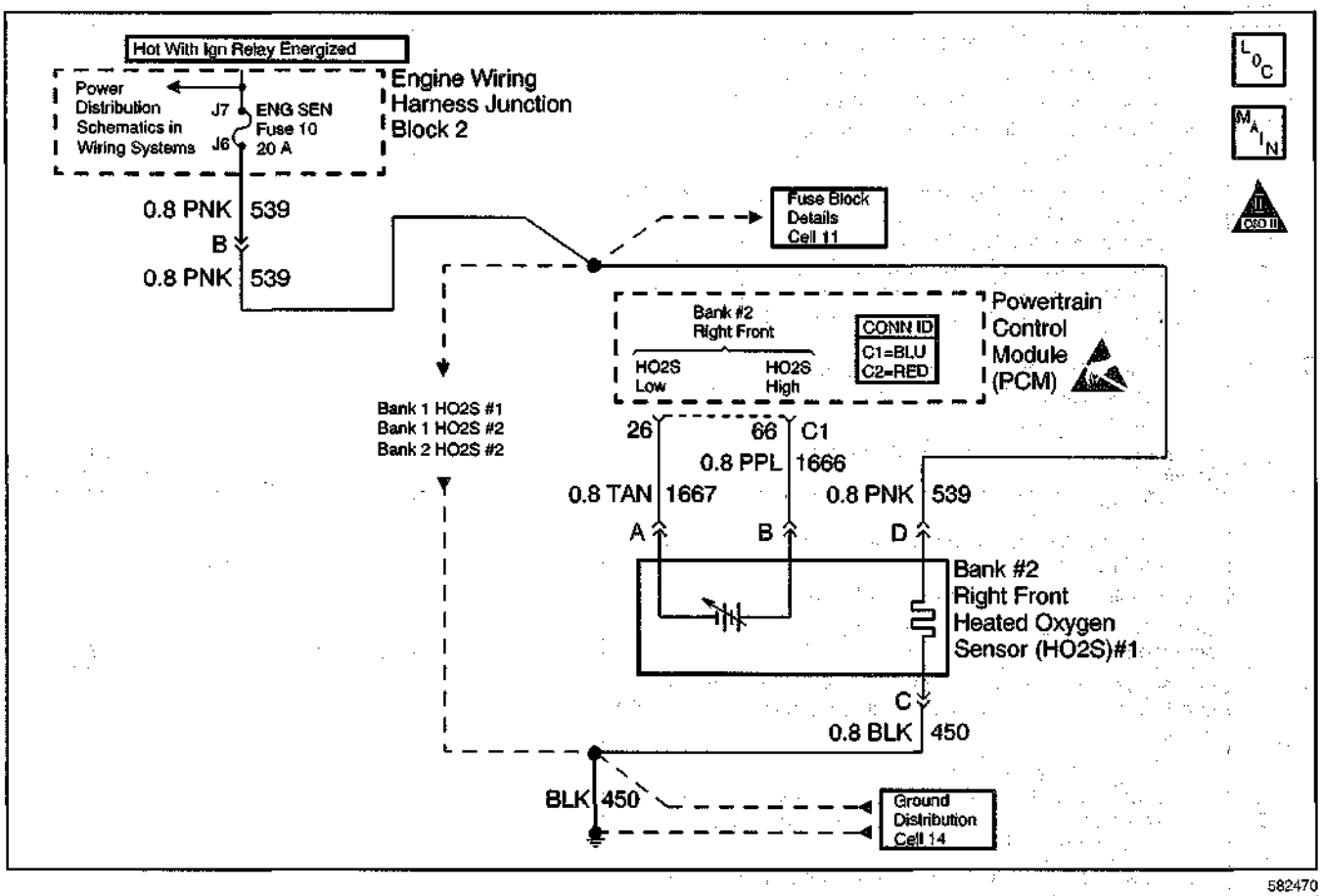
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DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate the HO2S voltage within the specified range?	350–550 mV	Go to Diagnostic Aids	*Go to Step 5*
5	**Important:** Disconnecting the PCM may eliminate the short to ground if the signal circuit is shorted to another C1 circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the HO2S signal circuit for a short to ground or a short to the sensor ground circuit. Refer to *Testing for Short to Ground* in Wiring Systems. Is the HO2S signal circuit shorted?	—	*Go to Step 6*	*Go to Step 7*
6	Repair the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 10*	—
7	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 10*	—
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1



Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage for being fixed above a predetermined voltage. If the PCM detects the voltage is above a predetermined voltage, a DTC will set.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The fuel system is operating in Closed Loop.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The ignition voltage is more than 9.0 volts.
- The TP sensor angle is between 2–70 percent.

Conditions for Setting the DTC

- The HO2S signal voltage remains above 775 mV.
- The conditions are present for 33 seconds.

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Inspect the HO2S electrical connections for evidence of water intrusion. Water present in the connector causes the B+ supply to the heater to bleed over to the signal circuit.

- Fuel pressure: The system goes rich if the pressure is too high. The PCM compensates for some increase. However, if the fuel pressure is too high, a DTC may set. Refer to *Fuel System Diagnosis*.
- Rich injector(s): Perform the Injector Balance Test. Refer to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool*.
- Leaking injector: Refer to the *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) canister purge. Inspect for fuel saturation. If full of fuel, inspect the canister control and hoses. Refer to *EVAP Control System Operation Description*.
- MAF sensor: Disconnect the MAF sensor and see if the rich condition is corrected. If so, inspect for proper installation. If installed OK, replace the MAF sensor. If the MAF sensor is installed backwards, the system goes rich. The plastic portion of the sensor has arrows cast into it indicating proper air flow direction. The arrows must point towards the engine.
- An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provide the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.
- TP sensor: An intermittent TP sensor output causes the system to go rich, due to a false indication of the engine accelerating.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The engine must be at the normal operating temperature before performing this test.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you can not 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 be used to 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 the PCM recorded. This isolates when the DTC failed.
4. If the voltage remains high, this indicates the signal circuit is shorted to a voltage. If the voltage goes low, this indicates a rich condition.
5. This step isolates the condition. If the voltage remains high, this indicates the signal circuit is not shorted to the heater feed circuit.
8. Test for a short between the HO2S signal circuit and any other wires powered by this fuse that run together inside the same harness.

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DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1

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	1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the engine above 1200 RPM for 2 minutes. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Is the HO2S voltage greater than the specified value?	775 mV	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn ON the ignition leaving the engine OFF. 2. Monitor the HO2S voltage. Is the HO2S voltage greater than the specified value?	775 mV	*Go to Step 5*	Go to Diagnostic Aids
5	Remove the HO2S heater fuse while monitoring the HO2S voltage. Does the voltage drop to within the specified range when the power to the heater is disconnected?	350–550 mV	*Go to Step 6*	*Go to Step 7*
6	1. Reinstall the fuse. 2. Disconnect the HO2S. 3. Jumper the HO2S low circuit (PCM side) to a known good ground. 4. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate the HO2S voltage within the specified range?	350–550 mV	*Go to Step 10*	*Go to Step 8*
7	**Important:** Disconnecting the PCM may eliminate the short to voltage if the signal circuit is shorted to another C1 circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Disconnect the HO2S. 4. Turn ON the ignition. 5. Test for a voltage on the HO2S sensor signal circuit at the PCM harness connector using the DMM. Is a voltage present?	—	*Go to Step 8*	*Go to Step 9*
8	Repair the short to voltage in the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 11*	—

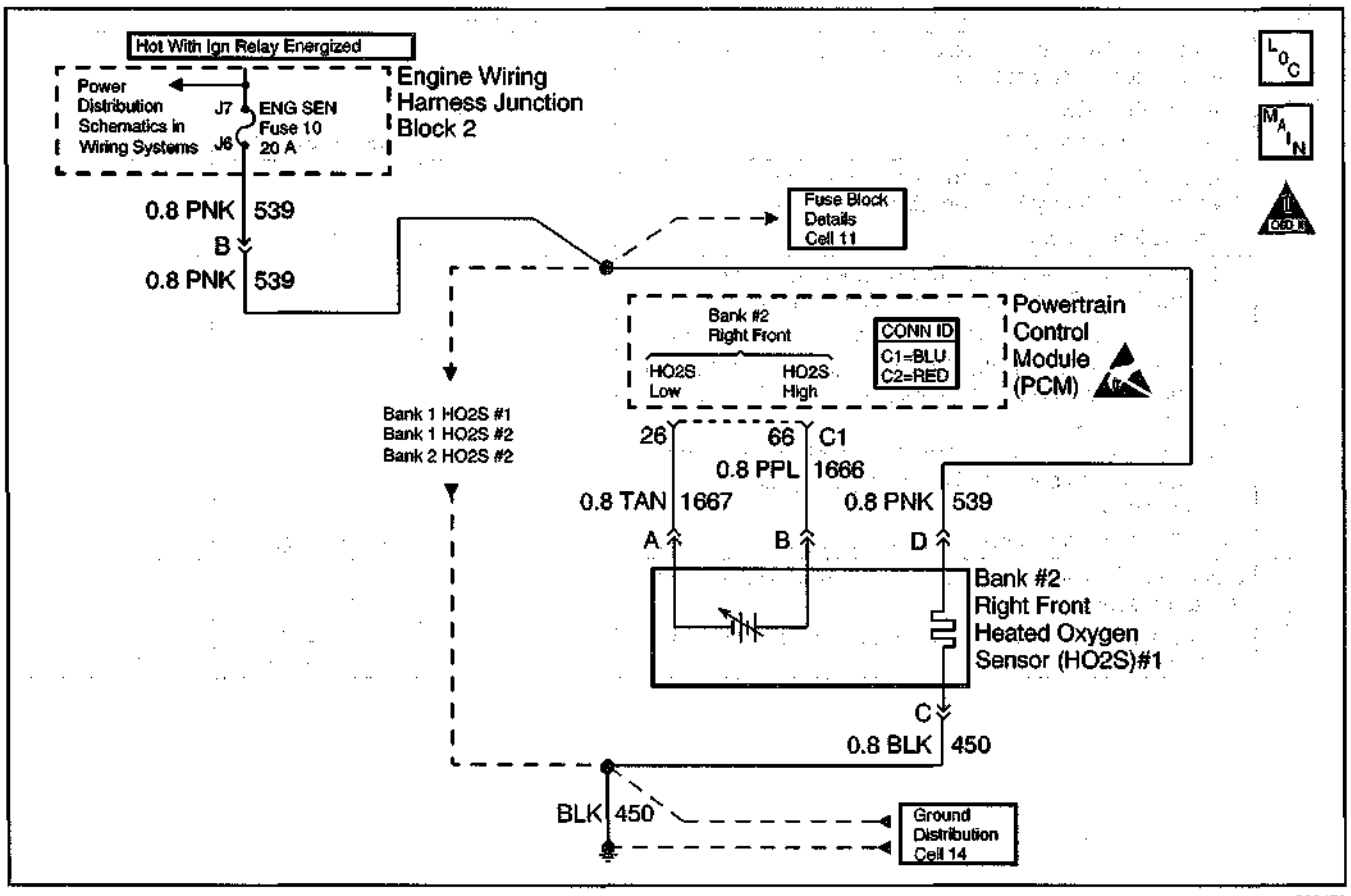
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DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 11*	—
10	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1.* Is the action complete?	—	*Go to Step 11*	—
11	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 12*	*Go to Step 2*
12	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0153 HO2S Slow Response Bank 2 Sensor 1



Circuit Description

The PCM continuously monitors the Heated Oxygen Sensor (HO2S) activity for 100 seconds. During the monitor period 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. With this information, the PCM can determine the average time for all transitions. If the average response time is too slow, a DTC will set.

The PCM determines the lean to rich transition when the HO2S voltage changes from less than 300 mV to greater than 600 mV. The PCM determines the rich to lean transition when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is most likely defective. Replace the HO2S.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The engine coolant temperature is greater than 50°C (122°F).
- The ignition voltage is more than 9.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The fuel system is operating in Closed Loop.
- The engine speed is between 1,000 RPM and 2,300 RPM.
- The engine air flow is between 20 g/s and 50 g/s.
- The EVAP canister purge duty cycle is more than 0 percent.
- The engine run time is more than 120 seconds.

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Conditions for Setting the DTC

- The lean to rich response (below 300 mV to above 600 mV) average time is more than 250 milliseconds.
- The rich to lean response (above 600 mV to below 300 mV) average time is more than 250 milliseconds.
- The above conditions are met for 60 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the Connector Test Adapter Kit *J 35616-A*. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

A malfunction in the HO2S heater circuits cause a DTC to set. Inspect the HO2S heater circuits for intermittent opens/connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.

An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provide the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step determines if the fault is present. This test may take 5 minutes for the diagnostic to run.
3. When DTCs P0133 and P0153 are set at the same time, it is a good indication that a fuel contamination condition is present.
4. An exhaust leak 6–12 inches away from the HO2S can cause a DTC to set.
5. This step verifies whether a good ground circuit is available.
6. This step verifies the integrity of the signal circuit to the PCM.
7. This step verifies the integrity of the signal circuit to the PCM.
8. Certain RTV silicone gasket materials give off vapors that can contaminate the HO2S. There is also a possibility of silicone contamination caused by silicone in the fuel. If the sensors appear to be contaminated by silicone and all the silicone sealant is a non silicone base, advise the customer to try a different fuel company. A missing fuel filler restrictor indicates the customer may have used leaded fuel.

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DTC P0153 HO2S Slow Response Bank 2 Sensor 1

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	**Important:** If any DTCs are set (except P0133), refer to those DTCs before proceeding with this diagnostic table. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within the parameters specified under Conditions for Running the DTC in the supporting text. 4. Monitor the DTC Information option using the scan tool. Did DTC P0153 fail this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	Did DTC P0133 also fail this ignition?	—	*Go to Step 8*	*Go to Step 4*
4	1. Inspect the exhaust system for a leak. Refer to *Exhaust System Inspection* in Engine Exhaust. After you inspect the exhaust system, return to this diagnostic. 2. If you find an exhaust leak, repair the exhaust leak as necessary. Did you isolate an exhaust leak?	—	*Go to Step 14*	*Go to Step 5*
5	1. Visually/physically inspect the following items: • Ensure that the HO2S is securely installed. • Inspect for corrosion on the terminals. • Inspect the terminal tension at the HO2S and at the PCM. • Inspect for damaged wiring. 2. If you find a condition repair as necessary. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 6*
6	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage on the Engine 1 Data List using the scan tool. Does the scan tool indicate a voltage within the specified range?	350–550 mV	*Go to Step 7*	*Go to Step 10*
7	1. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 2. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate a voltage below the specified value?	200 mV	*Go to Step 13*	*Go to Step 9*
8	**Important:** Determine and correct the cause of the contamination before replacing a sensor. Inspect for the following conditions: • Fuel contamination • Use of improper RTV sealant • Engine oil/coolant consumption Replace the affected Heated Oxygen sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1* and/or *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1*. Is the action complete?	—	*Go to Step 14*	—

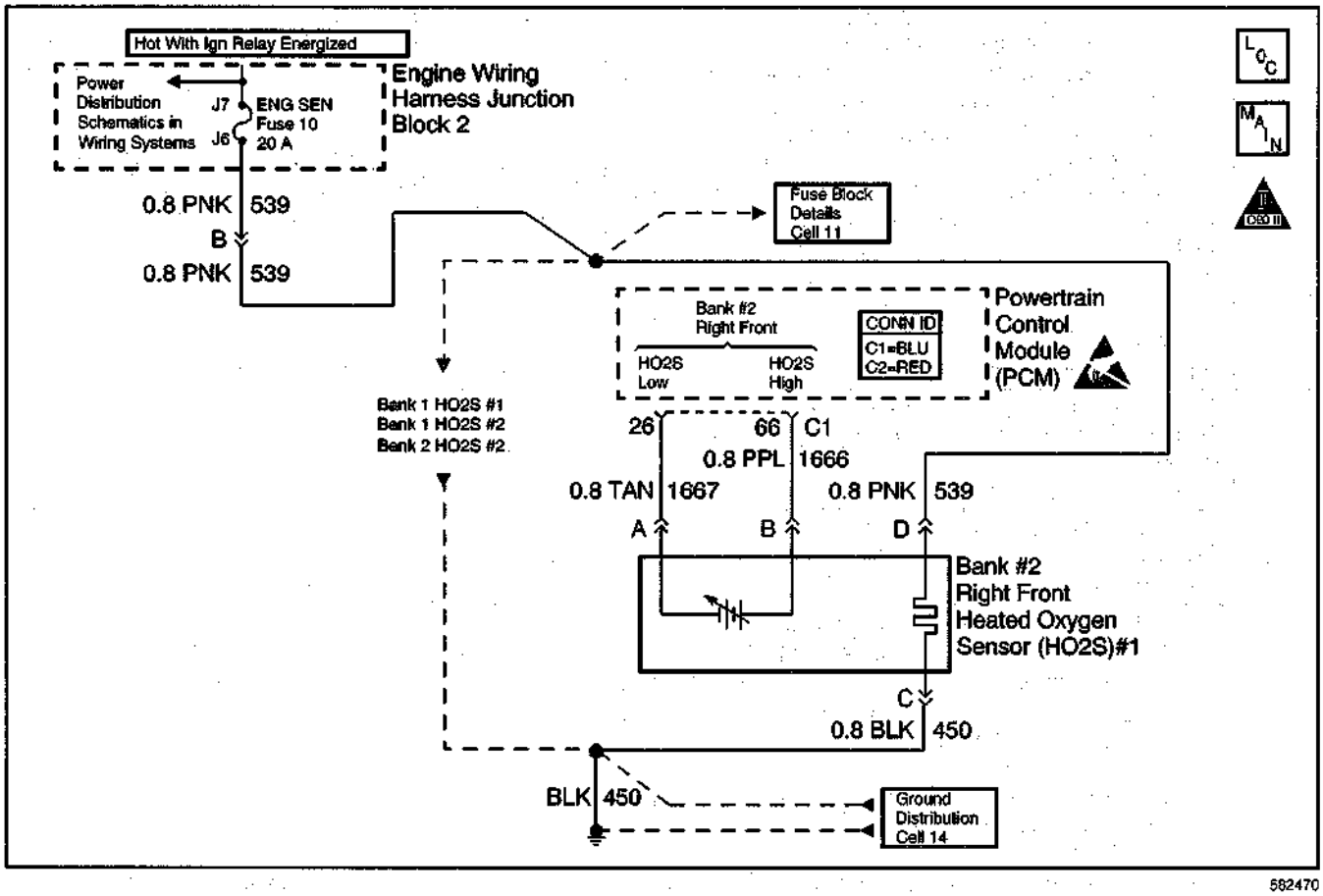
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DTC P0153 HO2S Slow Response Bank 2 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
9	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM. Does the DMM indicate a voltage near the specified value?	5V	*Go to Step 12*	*Go to Step 11*
10	Repair the high signal circuit for a short to ground or for a shorted to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
11	Repair the open HO2S low circuit or repair the faulty PCM connections. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Repair the HO2S high signal circuit for an open or repair the faulty PCM connections. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
13	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1.* Is the action complete?	—	*Go to Step 14*	—
14	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 15*	*Go to Step 2*
15	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1



582470

Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage and detects if the voltage goes out of the bias range. If the PCM does not detect the voltage went out of the bias range, a DTC will set.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258, not set.
- The AIR, EGR, and the Catalyst system diagnostics are not active.
- The fuel system is operating in Closed Loop.
- The ignition voltage is more than 9.0 volts.
- The engine run time is more than 70 seconds.

Conditions for Setting the DTC

- The HO2S signal voltage is steady between 350 mV and 550 mV.
- All conditions present for 60 seconds.

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provide the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The engine must be at the normal operating temperature before performing this test.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you can not 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 be used to 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 the PCM recorded. This will isolate when the DTC failed.
4. If the scan tool indicates the HO2S voltage goes below 200 mV, this indicates the HO2S circuits and PCM are OK.
5. This step verifies whether the signal circuit from the PCM is OK.
6. This step verifies whether the low signal circuit from the PCM is OK. A voltage indicates the PCM and wiring are OK.
7. Disconnecting the PCM allows using a DMM to test the continuity of the circuits. This aids in locating an open or shorted circuit.

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DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1

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	**Important:** Verify that the HO2S is secure before proceeding with this DTC. A sensor that is loose could cause this DTC to set. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the engine above 1200 RPM for 2 minutes. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Does the scan tool indicate the HO2S voltage varying outside the specified range?	350–550 mV	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn ON the ignition leaving the engine OFF. 2. Disconnect the HO2S. 3. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 4. Monitor the HO2S voltage using the scan tool. Is the HO2S voltage below the specified value?	200 mV	*Go to Step 8*	*Go to Step 5*
5	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM *J 39200*. Does the DMM indicate near the specified value?	5 Volts	*Go to Step 6*	*Go to Step 7*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the continuity of the HO2S high circuit using the DMM *J 39200*. Refer to *Testing for Continuity* in Wiring Systems. 4. Repair the open circuit if no continuity is indicated on the DMM. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the HO2S high circuit condition?	—	*Go to Step 12*	*Go to Step 10*

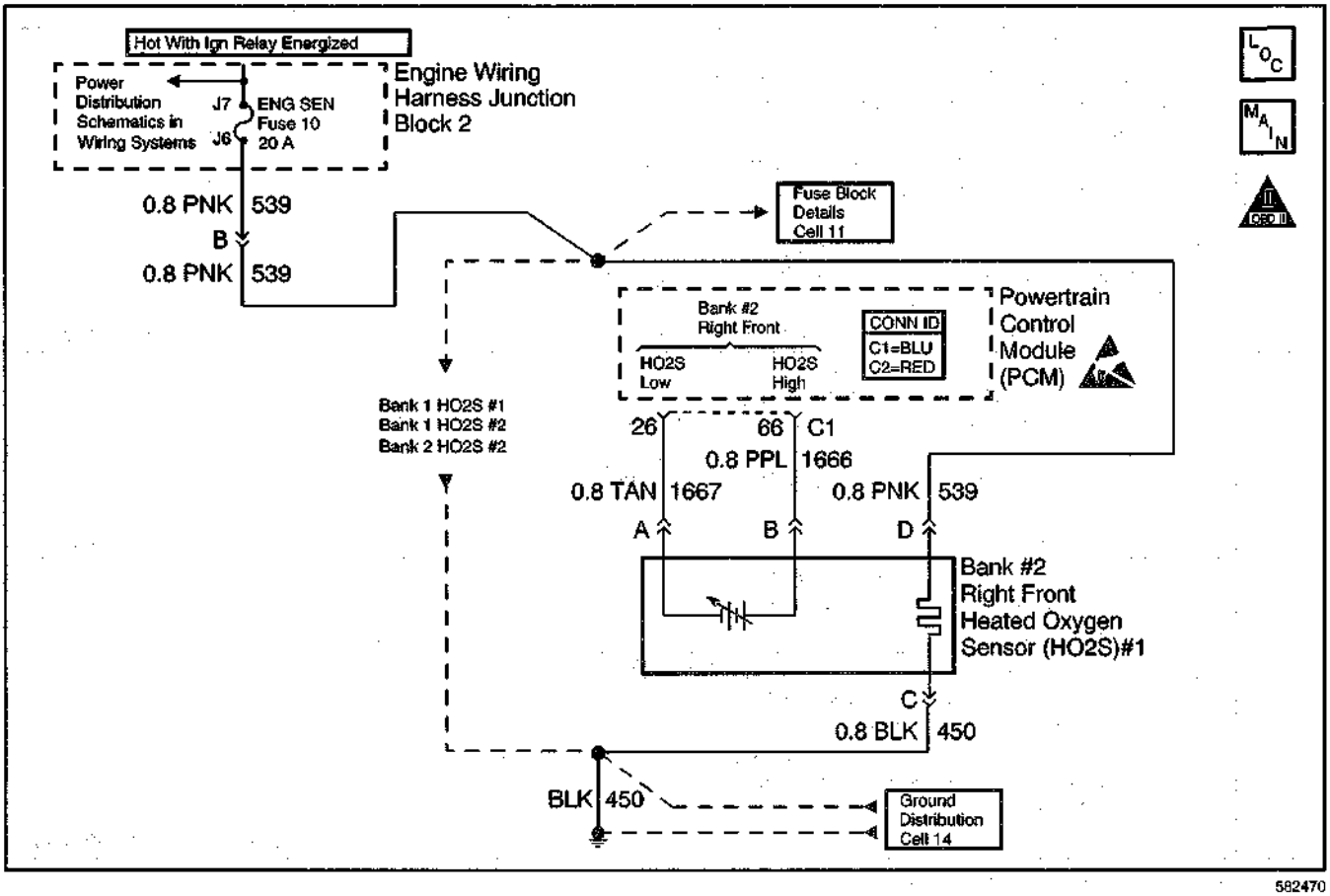
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DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the continuity of the HO2S low circuit using the DMM *J 39200*. Refer to *Testing for Continuity* in Wiring Systems. 4. Repair the open or the poor connection if no continuity is indicated on the DMM. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the HO2S low circuit condition?	—	*Go to Step 12*	*Go to Step 10*
8	1. inspect the HO2S circuits for a poor connection at the HO2S harness connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you repair the condition?	—	*Go to Step 12*	*Go to Step 9*
9	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1*. Is the action complete?	—	*Go to Step 12*	—
10	1. Inspect the HO2S circuits for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems for procedure. Did you repair the condition?	—	*Go to Step 12*	*Go to Step 11*
11	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0155 HO2S Heater Performance Bank 2 Sensor 1



Circuit Description

The PCM supplies a bias voltage (approximately 450 mV) on the Heated Oxygen Sensor (HO2S) signal high and low circuits. When you turn the ignition to the ON position, battery voltage is supplied to the HO2S heater. As the heater reaches the operating temperature, the HO2S voltage responds by changing from a bias voltage range to the normal operation. Typically, as the HO2S reaches the operating temperature, the HO2S voltage goes from a bias voltage to a voltage below 300 mV. Depending on the exhaust gas content, it is possible for the HO2S voltage to go above 450 mV.

The PCM runs the heater test only on a cold start (depends on the cumulative air flow) and only once an ignition cycle. When you start the engine the PCM monitors the HO2S voltage. When the HO2S voltage goes above or below the bias range threshold, the PCM determines how much time it took. If the PCM detects that the process took too much time for the HO2S to enter into normal operating range, this DTC sets. The time the process takes the HO2S to reach operating temperature is based on the amount of air that flows into the engine.

Conditions for Setting the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The intake air temperature and the engine coolant temperature are less than 50°C (122°F) and are within 8°C (14.5°F) of each other at engine start-up.
- The ignition voltage is between 10.0 volts and 18.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.

Conditions for Setting the DTC

The HO2S voltage remains between 300 mV and 700 mV for a predetermined amount of time (depends on engine coolant temperature and air flow).

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The heater diagnostic only runs on a cold start and runs once per ignition cycle.

An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provide the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The engine must be allowed to cool. The HO2S may be at operating temperature and no drop or rise in HO2S voltage will occur. If the HO2S voltage stays between 300–700 mV indicates the HO2S heater is inoperative.
3. An open HO2S fuse causes multiple HO2S DTCs to set. Test all the related circuits going to all of the heated oxygen sensors for a short to ground. If all of the wiring is OK, it may be necessary to disconnect each HO2S one at a time to locate a shorted sensor.
4. This step verifies whether the B+ supply is available at the sensor.
5. This step verifies whether a ground is available at the sensor.
6. This step verifies whether the HO2S heater element is internally open.
7. Inspect the ignition feed circuits at the Underhood Fuse Block for poor connections.
8. Test the ground circuits for an open if more then one heater DTC sets.

DTC P0155 HO2S Heater Performance Bank 2 Sensor 1

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	**Important:** Allow engine to cool for about one half hour before proceeding. 1. Turn OFF the ignition. 2. Install a scan tool. 3. Turn ON the ignition leaving the engine OFF. 4. Monitor the HO2S voltage display on the Engine 1 Data List of the scan tool. Does the HO2S voltage go from a bias voltage to above or below the specified range?	300–700 mV	Go to Diagnostic Aids	*Go to Step 3*
3	Inspect the fuse for HO2S ignition feed. Is the HO2S fuse open?	—	*Go to Step 11*	*Go to Step 4*

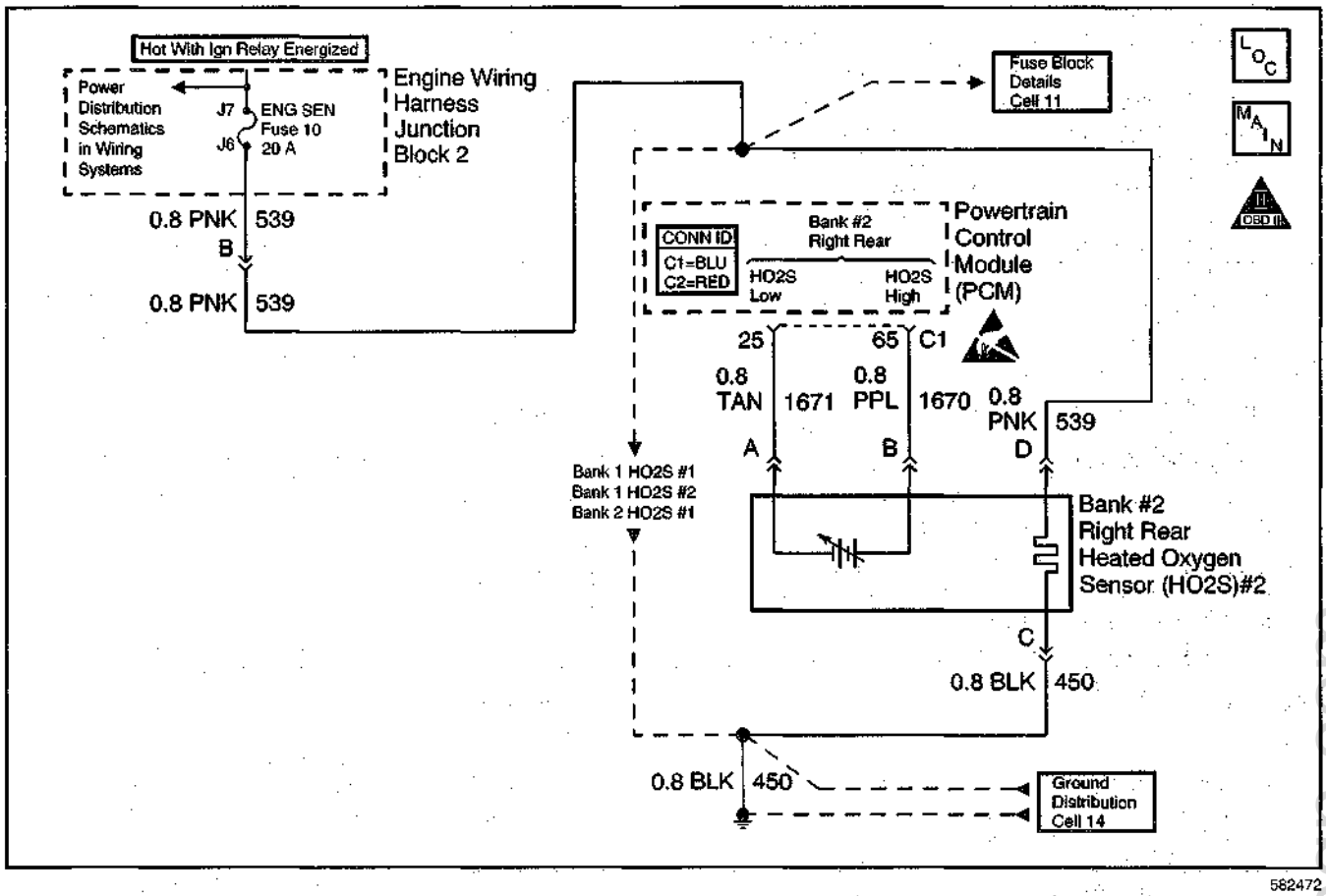
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DTC P0155 HO2S Heater Performance Bank 2 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information. 2. Disconnect the HO2S. 3. Probe the ignition feed circuit at the HO2S electrical connector (PCM side) using the *J 34142-B* test lamp connected to a known good ground. Do not use the HO2S heater ground or the HO2S low circuit. Is the test lamp illuminated?	—	*Go to Step 5*	*Go to Step 7*
5	Connect the *J 34142-B* test lamp between the HO2S ignition feed and the HO2S heater ground. Is the test lamp illuminated?	—	*Go to Step 6*	*Go to Step 8*
6	Measure the resistance between the HO2S ignition feed and the HO2S heater ground at the HO2S pigtail using the DMM. Is the HO2S resistance within the specified range?	3.5–14.0Ω	*Go to Step 9*	*Go to Step 10*
7	Repair the open HO2S ignition feed circuit to the HO2S. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
8	Repair the open HO2S heater ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
9	1. Inspect for a poor connection at the HO2S. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 10*
10	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1.* Is the action complete?	—	*Go to Step 12*	—
11	Locate and repair the short to ground in the HO2S ignition feed circuit and replace the faulty fuse. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2



Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage for being fixed below a predetermined voltage. If the PCM detects the voltage is below a predetermined voltage, this DTC sets.

Conditions for Running the DTC

Criteria 1

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351-P0358, P1258 not set.
- The fuel system is operating in Closed Loop.
- The ignition voltage is more than 9.0 volts.
- The AIR, EGR, and Catalyst diagnostics are not active.
- The TP sensor angle is between 2–70 percent.

OR

Criteria 2

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The ignition voltage is more than 9.0 volts.
- The AIR, EGR, and Catalyst diagnostics are not active.
- The Power Enrichment mode is enabled for more than 1 second.

Conditions for Setting the DTC

Criteria 1

- The HO2S signal voltage remains below 80 mV.
- The Criteria 1 conditions are present for 80 seconds.

OR

Criteria 2

- The HO2S signal voltage remains below 420 mV.
- The Criteria 2 conditions are present for 10 seconds during the Power Enrichment mode.

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The PCM sets this DTC when the vehicle runs out of fuel.

- Heated Oxygen Sensor (HO2S) wire: Sensor pigtail may be in contact with the exhaust manifold or exhaust system.
- An oxygen supply inside the HO2S is necessary for proper operation. This supply of oxygen is provided through the HO2S wires. All HO2S wires and connections should be inspected for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.
- Inspect for an intermittent ground in the signal wire between the connector and the sensor.
- Lean injector(s): Perform the Injector Balance Test. Refer to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool*.
- Fuel contamination: Water near the in-tank fuel pump inlet can be delivered to the injectors. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. The water causes a lean exhaust and can set a DTC.
- Fuel pressure: System will be lean if fuel pressure is low. Refer to *Fuel System Diagnosis*.
- Exhaust leaks: An exhaust leak near the HO2S can cause a lean condition. Refer to *Exhaust Leakage* in Engine Exhaust.
- Vacuum or crankcase leaks can cause a lean condition.

If the above are OK, the HO2S may be at fault.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. If the HO2S voltage is fixed well below 200 mV, this indicates a short to battery ground or chassis ground. If the voltage is fixed near or above 200 mV, this indicates a short to a PCM ground. When the HO2S voltage is fixed near 200 mV, indicates the DTC set when the fuel system was in a Power Enrichment mode of operation.

   Idle the engine at the normal operating temperature before performing this test.

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 isolates when the DTC failed.
4. Lower the exhaust system to gain sufficient access to the HO2S and/or the HO2S connector if necessary. Grounding the low side circuit of the HO2S causes the HO2S voltage to display a bias voltage. If the voltage stays near 0.0 volts, this indicates the low circuit is open, or the high circuit is open or grounded.
5. Disconnecting the PCM allows using the DMM in order to test continuity of the circuits. This aids in locating an open or shorted circuit.

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DTC P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2

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	1. Install the scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Is the HO2S voltage less than the specified value?	80 mV	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage using the scan tool. Is the HO2S voltage within the specified range?	350–550 mV	Go to Diagnostic Aids	*Go to Step 5*
5	**Important:** Disconnecting the PCM may eliminate the grounded circuit if the signal circuit is shorted to another C1 circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturers logo. Refer to *PCM Replacement/Programming.* 3. Test the HO2S signal circuit for a short to ground or a short to the sensor ground circuit. Refer to *Testing for Short to Ground* in Wiring Systems. Is the HO2S signal circuit shorted?	—	*Go to Step 6*	*Go to Step 7*
6	Repair the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 8*	—
7	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 8*	—

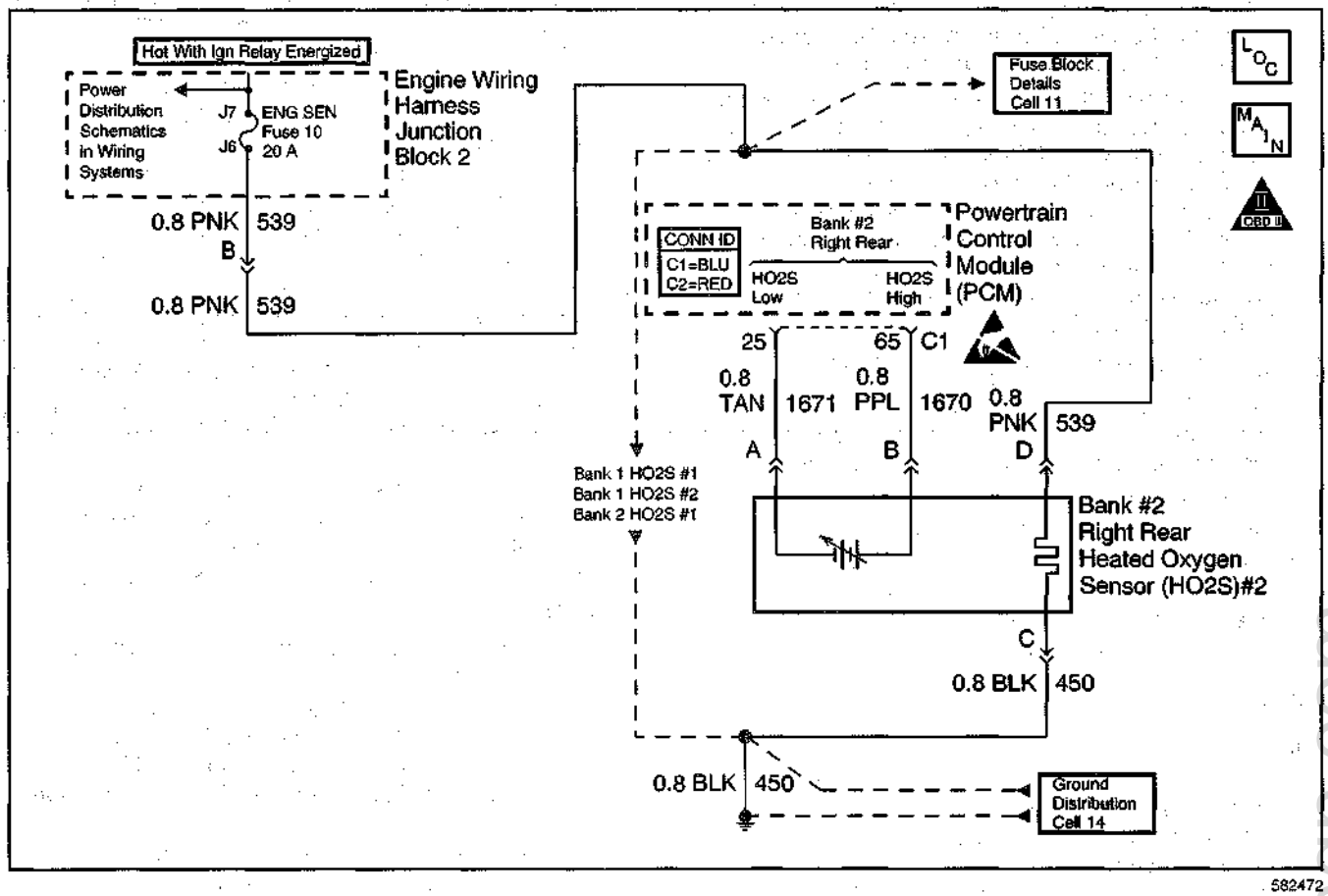
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DTC P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2 (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0158 HO2S Circuit High Voltage Bank 2 Sensor 2



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Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage for being fixed above a predetermined voltage. If the PCM detects the voltage is above a predetermined voltage, this DTC sets.

Conditions for Running the DTC

Criteria 1

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The fuel system is operating in Closed Loop.
- The fuel trim learn is enabled.
- The ignition voltage is more than 9.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The TP sensor angle is between 2–70 percent.

OR

Criteria 2

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351-P0358, P1258 not set.
- The ignition voltage is more than 9.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.
- The Deceleration Fuel Cut-off mode is enabled for 3 seconds to 10 seconds.

Conditions for Setting the DTC

Criteria 1

- The HO2S signal voltage remains above 930 mV.
- The Criteria 1 conditions are present for 40 seconds.

OR

Criteria 2

- The HO2S signal voltage remains above 480 mV.
- The Criteria 2 conditions are present for 5 seconds during Deceleration Fuel Cut-off mode.

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Inspect the HO2S electrical connections for evidence of water intrusion. Water present in the connector causes the B+ supply to the heater to bleed over to the signal circuit.

- Fuel pressure: The system goes rich if the pressure is too high. The PCM compensates for some increase. However, if the fuel pressure is too high, a DTC may set. Refer to *Fuel System Diagnosis*.
- Rich injector(s): Perform the Injector Balance Test. Refer to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool*.
- Leaking injector: Refer to the *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) canister purge. Inspect for fuel saturation. If full of fuel, inspect the canister control and hoses. Refer to *EVAP Control System Operation Description*.
- MAF sensor: Disconnect the MAF sensor and see if the rich condition is corrected. If so, inspect for proper installation. If installed OK, replace the MAF sensor. If the MAF sensor is installed backwards, the system goes rich. The plastic portion of the sensor has arrows cast into it indicating proper air flow direction. The arrows must point towards the engine.
- An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provide the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.
- TP sensor: An intermittent TP sensor output causes the system to go rich, due to a false indication of the engine accelerating.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This DTC also sets during a deceleration fuel cut-off. Inspect items which could cause a rich exhaust during a deceleration (leaking injectors, stuck injectors etc.). Refer to Conditions for Setting the DTC.

   Idle the engine at the normal operating temperature before performing this test.
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 isolates when the DTC failed.
4. If the voltage remains high, this indicates the signal circuit is shorted to a voltage. If the voltage goes low, this indicates a rich condition.
5. This step isolates the condition. If the voltage remains high, this indicates the signal circuit is not shorted to the heater feed circuit.
8. Review the system mechanization. Test for a short between the HO2S signal circuit and any other wires powered by this fuse that run together inside the harness.

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DTC P0158 HO2S Circuit High Voltage Bank 2 Sensor 2

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	**Important:** Monitor the front HO2S voltage before proceeding with this DTC. If the front HO2S voltage is fixed below 300 mV, refer to *DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1*. 1. Install the scan tool. 2. Start the engine. 3. Increase the engine speed to 1200 RPM. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Is the HO2S voltage greater than the specified value?	930 mV	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn ON the ignition leaving the engine OFF. 2. Monitor the HO2S voltage. Is the HO2S voltage greater than the specified value?	930 mV	*Go to Step 5*	Go to Diagnostic Aids
5	Remove the HO2S heater fuse while monitoring the HO2S voltage. Does the voltage drop to within the specified range when the power to the heater is disconnected?	350–550 mV	*Go to Step 6*	*Go to Step 7*
6	1. Reinstall the fuse. 2. Disconnect the HO2S. 3. Jumper the HO2S low circuit (PCM side) to a known good ground. 4. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate the HO2S voltage within the specified range?	350–550 mV	*Go to Step 10*	*Go to Step 8*

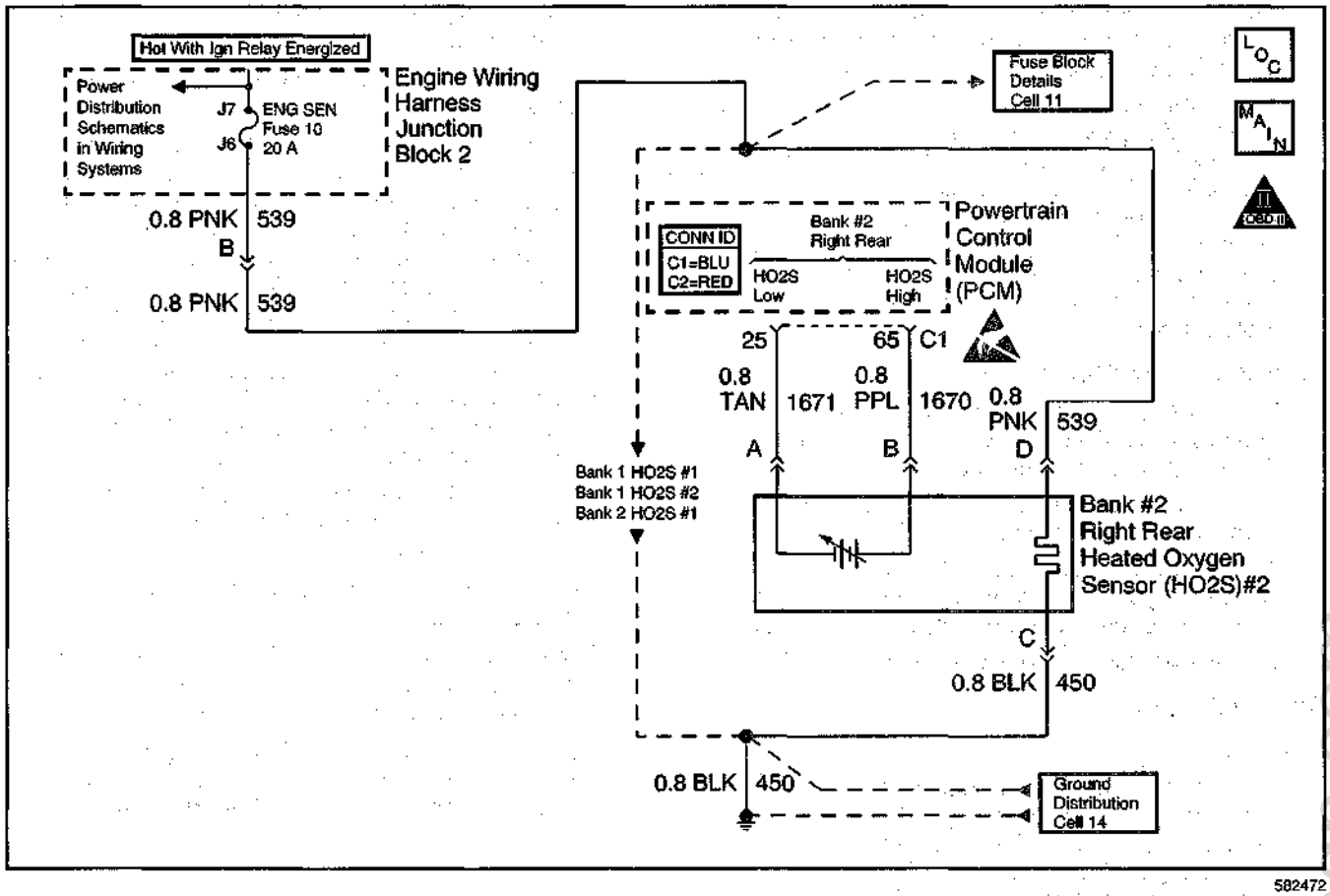
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DTC P0158 HO2S Circuit High Voltage Bank 2 Sensor 2 (cont'd)

Step	Action	Value(s)	Yes	No
7	**Important:** Disconnecting the PCM may eliminate the short to voltage if the signal circuit is shorted to another C1 circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Disconnect the HO2S. 4. Turn ON the ignition. 5. Test for a voltage on the HO2S sensor signal circuit at the PCM harness connector using the DMM. Is a voltage present?	—	*Go to Step 8*	*Go to Step 9*
8	Repair the short to voltage in the HO2S signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 11*	—
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 11*	—
10	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2.* Is the action complete?	—	*Go to Step 11*	—
11	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 12*	*Go to Step 2*
12	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0160 HO2S Circuit Insufficient Activity Bank 2 Sensor 2



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Circuit Description

The PCM supplies a voltage of about 450 mV between the HO2S high and low signal circuits. The oxygen sensor varies the voltage over a range from about 1,000 mV when the exhaust is rich, down through about 10 mV when the exhaust is lean.

The PCM monitors and stores the heated oxygen sensor (HO2S) voltage information. The PCM evaluates the HO2S voltage samples in order to determine the amount of time the HO2S voltage was out of range. The PCM compares the stored HO2S voltage samples taken within each sample period and determines if majority of the samples are out of the operating range.

The PCM monitors the HO2S voltage and detects if the voltage goes out of the bias range. If the PCM does not detect the voltage went out of the bias range, this DTC sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258, not set.
- The engine run time is more than 70 seconds.
- The fuel system is operating in Closed Loop.
- System voltage is greater than 9.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.

Conditions for Setting the DTC

- The HO2S signal voltage is steady between 409 mV and 489 mV.
- All conditions present for 2 minutes and 30 seconds.

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An oxygen supply inside the HO2S is necessary for proper operation. This supply of oxygen is provided through the HO2S wires. All HO2S wires and connections should be inspected for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The engine must be at the normal operating temperature before performing this test.
3. Using the Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you can not 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 be used to 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 the PCM recorded. This isolates when the DTC failed.
4. If the scan tool indicates the HO2S voltage goes below 200 mV, this indicates the HO2S circuits and PCM are OK.
5. This step verifies whether the signal circuit from the PCM is OK.
6. This step verifies whether the low signal circuit from the PCM is OK. A voltage indicates the PCM and wiring are OK.
7. Disconnecting the PCM allows using a DMM in order to test the continuity of the circuits. This aids in locating an open or shorted circuit.

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DTC P0160 HO2S Circuit Insufficient Activity Bank 2 Sensor 2

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	**Important:** Inspect the HO2S for being secure before proceeding with this DTC. A sensor that is loose could cause this DTC to set. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the engine above 1200 RPM for 2 minutes. 4. Monitor the HO2S voltage display on the Engine 1 Data List using the scan tool. Does the scan tool indicate the HO2S voltage varying outside the specified range?	350–550 mV	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn ON the ignition leaving the engine OFF. 2. Disconnect the HO2S. 3. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 4. Monitor the HO2S voltage using the scan tool. Is the HO2S voltage below the specified value?	200 mV	*Go to Step 8*	*Go to Step 5*
5	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM. Does the DMM indicate near the specified value?	5 Volts	*Go to Step 6*	*Go to Step 7*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the continuity of the HO2S high circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. 4. Repair the open circuit if no continuity is indicated on the DMM. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the HO2S high circuit condition?	—	*Go to Step 12*	*Go to Step 10*

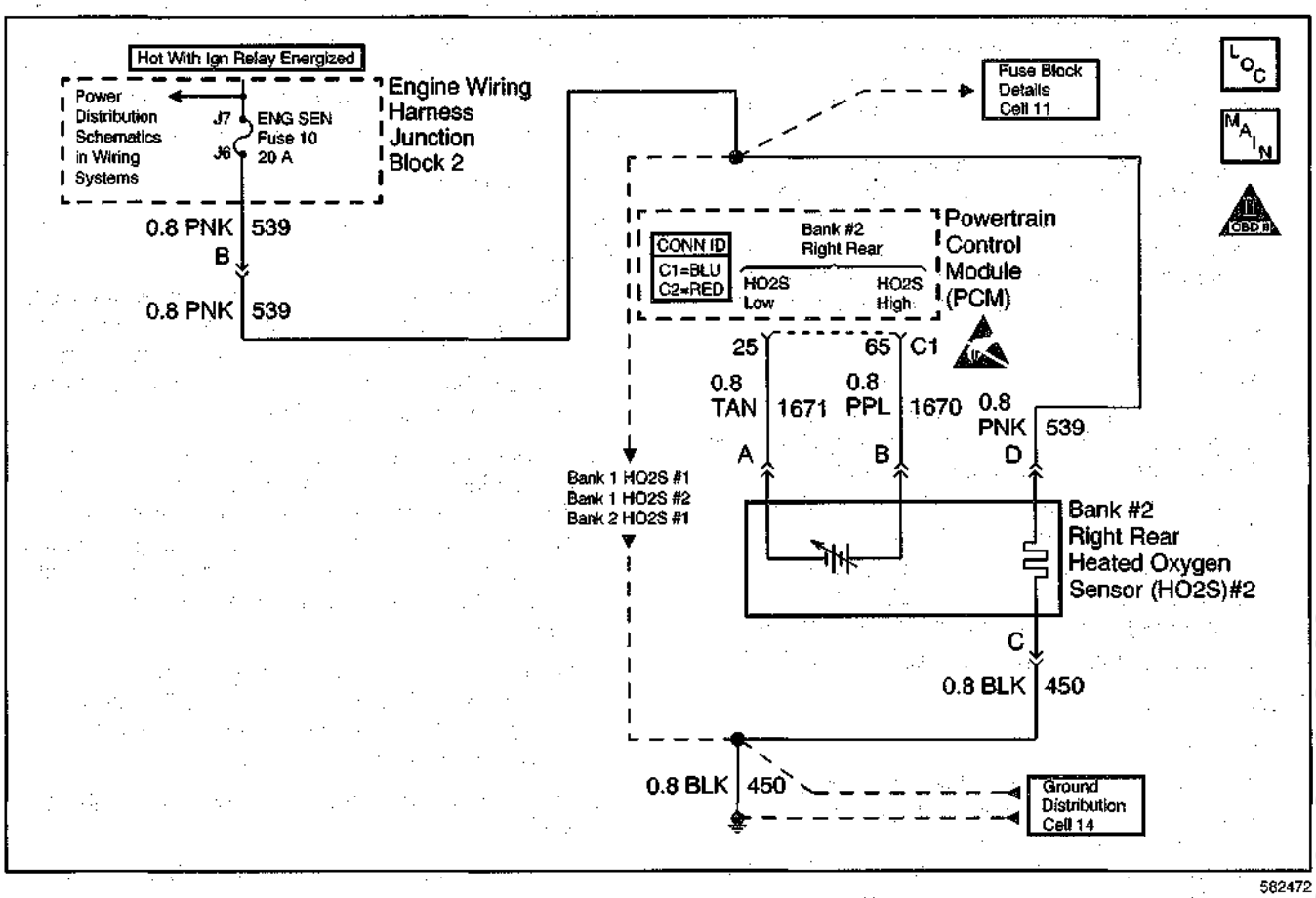
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DTC P0160 HO2S Circuit Insufficient Activity Bank 2 Sensor 2 (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity of the HO2S low circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. 4. Repair the open or the poor connection if no continuity is indicated on the DMM. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 10*
8	1. Inspect for a poor connection at the HO2S. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 9*
9	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2.* Is the action complete?	—	*Go to Step 12*	—
10	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 11*
11	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0161 HO2S Heater Performance Bank 2 Sensor 2



Circuit Description

The PCM supplies a bias voltage (approximately 450 mV) on the Heated Oxygen Sensor (HO2S) signal high and low circuits. When you turn the ignition to the ON position, battery voltage is supplied to the HO2S heater. As the heater reaches the operating temperature, the HO2S voltage responds by changing from a bias voltage range to the normal operation. Typically, as the HO2S reaches the operating temperature, the HO2S voltage goes from a bias voltage to a voltage below 300 mV. Depending on the exhaust gas content, it is possible for the HO2S voltage to go above 450 mV.

The PCM runs the heater test only on a cold start (depends on the cumulative air flow) and only once an ignition cycle. When you start the engine the PCM monitors the HO2S voltage. When the HO2S voltage goes above or below the bias range threshold, the PCM determines how much time it took. If the PCM detects that the process took too much time for the HO2S to enter into normal operating range, this DTC sets. The time the process takes the HO2S to reach operating temperature is based on the amount of air that flows into the engine.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The intake air temperature and the engine coolant temperature are less than 50°C (122°F) and are within 8°C (14.5°F) of each other at engine start-up.
- The ignition voltage is between 10.0 volts and 18.0 volts.
- The AIR, EGR, and the Catalyst diagnostics are not active.

Conditions for Setting the DTC

The HO2S voltage remains between 300 mV and 700 mV for a predetermined amount of time (depends on engine coolant temperature and air flow).

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The heater diagnostic only runs on a cold start and runs once per ignition cycle.

An oxygen supply inside the HO2S is necessary for proper operation. The HO2S wires provide the supply of oxygen. Inspect the HO2S wires and connections for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring System.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The engine must be allowed to cool, as the HO2S may be at operating temperature and no drop or rise in HO2S voltage would occur. If the HO2S voltage stays between 300–700 mV indicates the HO2S heater is inoperative.
3. If more than one HO2S heater DTC is set, this is a good indication that the HO2S fuse is open. Test all the related circuits going to all of the heated oxygen sensors for a short to ground. If all wiring is OK, it may be necessary to disconnect each HO2S one at a time to locate a shorted sensor.
4. Lower the exhaust system to gain sufficient access to the HO2S and/or the HO2S connector if necessary. This step verifies whether the B+ supply is available at the sensor.
5. This step verifies whether a ground is available at the sensor.
6. This step tests whether the HO2S heater element is internally open.
7. Inspect the ignition feed circuits at the Underhood Electrical Center for poor connections.
8. Test the ground circuits for an open if more then one heater DTC sets.

DTC P0161 HO2S Heater Performance Bank 2 Sensor 2

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	**Important:** If you have been operating the engine, allow the engine to cool for about one half hour before proceeding. 1. Turn OFF the ignition. 2. Install the scan tool. 3. Turn ON the ignition leaving the engine OFF. 4. Monitor the HO2S voltage display on the Engine 1 Data List of the scan tool. Does the HO2S voltage go from a bias voltage to above or below the specified values?	300–700 mV	Go to Diagnostic Aids	*Go to Step 3*

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DTC P0161 HO2S Heater Performance Bank 2 Sensor 2 (cont'd)

Step	Action	Value(s)	Yes	No
3	Inspect the fuse for the HO2S ignition feed. Is the HO2S fuse open?	—	*Go to Step 11*	*Go to Step 4*
4	1. Raise the vehicle. Go to *Lifting and Jacking the Vehicle* in General Information. 2. Disconnect the HO2S electrical connector. 3. Probe the ignition feed circuit at the HO2S electrical connector (PCM side) using the *J 34142-B* test lamp connected to a known good ground. Do not use the HO2S heater ground or the HO2S low circuit. Is the test lamp illuminated?	—	*Go to Step 5*	*Go to Step 7*
5	Connect the *J 34142-B* test lamp between the HO2S ignition feed and the HO2S heater ground. Is the test lamp illuminated?	—	*Go to Step 6*	*Go to Step 8*
6	Measure the resistance between the HO2S ignition feed and the HO2S heater ground at the HO2S pigtail using the DMM. Is the HO2S resistance within the specified values?	3.5–14.0Ω	*Go to Step 9*	*Go to Step 10*
7	Repair the open in the HO2S ignition feed circuit to the HO2S. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
8	Repair the open in the HO2S heater ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
9	1. Inspect for a poor connection at the HO2S. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 10*
10	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2.* Is the action complete?	—	*Go to Step 12*	—
11	1. Repair the short to ground in the HO2S ignition feed circuit. 2. Replace the faulty fuse. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0171 Fuel Trim System Lean Bank 1

Circuit Description

The PCM controls a Closed Loop air/fuel metering system in order to provide the best possible combination of driveability, fuel economy, and emission control. The PCM monitors the heated oxygen sensor signal voltage and adjusts the fuel delivery based on the signal voltage while in Closed Loop. A change made to the fuel delivery changes the Long and Short Term Fuel Trim values. The Short Term Fuel Trim values change rapidly in response to the HO2S signal voltages. These changes fine tune the engine fueling. The Long Term Fuel Trim values change in response to trends in Short Term Fuel Trim. The Long Term Fuel Trim makes coarse adjustments to fueling in order to re-center and restore control to Short Term Fuel Trim. You can use a scan tool in order to monitor the Short and Long Term Fuel Trim. The ideal fuel trim values are around 0 percent. A positive Fuel Trim value indicates that the PCM is adding fuel in order to compensate for a lean condition. A negative Fuel Trim value indicates that the PCM is reducing the amount of fuel in order to compensate for a rich condition. If the PCM detects an excessively Rich or Lean condition, the PCM sets a DTC. The long term fuel trim diagnostic parameter is an average of several of the long term speed load learn cells which the PCM selects based on the engine speed and the engine load.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0300, P0335, P0336, P0351–P0358, P0405, P0410, P0412, P0418, P0443, P0500, P0502, P0503, P1258, P1404, P1415, P1416 not set.
- The engine coolant temperature is between 50°C (122°F) and 115°C (239°F).
- The barometric pressure is more than 74 kPa.
- The mass air flow is between 5.0 g/s and 90 g/s.
- The manifold absolute pressure is between 26 kPa and 90 kPa.
- The intake air temperature is between –20°C (–4°F) and 90°C (194°F).
- The engine speed is between 400 RPM and 3,000 RPM.
- The TP sensor angle is less than 90 percent.
- The vehicle speed is less than 137 km/h (85 mph).
- The fuel level is more than 10 percent.

Conditions for Setting the DTC

- The average Long Term Fuel Trim cell values are above a predetermined threshold.
- All the above conditions are present for 6 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the Malfunction Indicator Lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails, if the diagnostic fails under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed.
- The first time the diagnostic fails, the PCM records the operating conditions in Failure Records.
- The second consecutive ignition cycle that this diagnostic fails [under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed], the PCM stores this information in Freeze Frame. The PCM copies any data previously stored in Freeze Frame and copies the data into the Failure Records. The PCM then overwrites the Freeze Frame. The only exception to this is if a Misfire DTC was already recorded in Freeze Frame. In this case, the Misfire data stays in Freeze Frame and the PCM updates the Fuel Trim data in the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the MIL OFF after three consecutive ignition cycles that the diagnostic runs and does not fail within the same conditions that the DTC last failed.

Important: If the last failure was during a non-typical driving condition, the MIL may remain ON longer than the three ignition cycles. Review the Freeze Frame/Failure Records for the last failure conditions.

- A History DTC clears after forty consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- A last test failed (Current DTC) clears when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems for procedures.

This DTC sets if the engine runs out of fuel.

A fuel delivery malfunction causes this DTC to set. Thoroughly inspect all items that cause a lean condition.

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*.

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.
4. If DTC 174 is also set indicates 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. Inspect that the engine oil dip stick is fully seated.

DTC P0171 Fuel Trim System Lean Bank 1

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	**Important:** If any DTCs are set, except P0171 and P0174, refer to those DTCs before proceeding with this diagnostic. 1. Install the scan tool. 2. Idle the engine at the normal operating temperature. 3. Fuel system in Closed Loop. 4. Monitor the LT FT Bn 1 display on the Fuel Trim Data List using the scan tool. Is the LT FT less than the specified value indicated?	24% LT	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids

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DTC P0171 Fuel Trim System Lean Bank 1 (cont'd)

Step	Action	Value(s)	Yes	No
4	Is DTC P0174 also set?	—	*Go to Step 5*	*Go to Step 6*
5	1. Visually/physically inspect the following items: • Vacuum hoses for splits, kinks, and proper connections. Refer to *Emission Hose Routing Diagram.* • Crankcase ventilation valve and/or system for leaks. Refer to *Crankcase Ventilation System Description.* • Contaminated fuel. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.* • PCM and sensor grounds are clean, tight and in the proper locations. • Air induction system after MAF sensor for vacuum leaks. • Engine mechanical failure. Refer to Engine Mechanical. 2. If you find a condition repair the condition as necessary. Did you find any problems in any of the above areas?	—	*Go to Step 7*	Go to *Fuel System Diagnosis*
6	Visually/physically inspect the following items: • Bank 1 exhaust leaks, missing or loose exhaust hardware. • Bank 1 HO2S 1 is installed securely and the electrical connector not contacting exhaust system or ignition wires. • Engine mechanical failure. Refer to Engine Mechanical. • Vacuum leaks that will only affect bank 1, such as the intake manifold, the injector O rings, etc. Did you find and repair the condition?	—	*Go to Step 7*	Go to *Fuel System Diagnosis*
7	Repair or replace any faulty items found. Is the action complete?	—	*Go to Step 8*	—
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0172 Fuel Trim System Rich Bank 1

Circuit Description

The PCM controls a Closed Loop air/fuel metering system in order to provide the best possible combination of driveability, fuel economy, and emission control. The PCM monitors the heated oxygen sensor signal voltage and adjusts the fuel delivery based on the signal voltage while in Closed Loop. A change made to the fuel delivery changes the Long and Short Term Fuel Trim values. The Short Term Fuel Trim values change rapidly in response to the HO2S signal voltages. These changes fine tune the engine fueling. The Long Term Fuel Trim values change in response to trends in Short Term Fuel Trim. The Long Term Fuel Trim makes coarse adjustments to fueling in order to re-center and restore control to Short Term Fuel Trim. You can use a scan tool in order to monitor the Short and Long Term Fuel Trim. The ideal fuel trim values are around 0 percent. A positive Fuel Trim value indicates that the PCM is adding fuel in order to compensate for a lean condition. A negative Fuel Trim value indicates that the PCM is reducing the amount of fuel in order to compensate for a rich condition. If the PCM detects an excessively Rich or Lean condition, the PCM sets a DTC. The long term fuel trim diagnostic parameter is an average of several of the long term speed load learn cells which the PCM selects based on the engine speed and the engine load.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0300, P0335, P0336, P0351–P0358, P0405, P0410, P0412, P0418, P0443, P0500, P0502, P0503, P1258, P1404, P1415, P1416 not set.
- The engine coolant temperature is between 50°C (122°F) and 115°C (239°F).
- The barometric pressure is more than 74 kPa.
- The mass air flow is between 5.0 g/s and 90 g/s.
- The manifold absolute pressure is between 26 kPa and 90 kPa.
- The intake air temperature is between –20°C (–4°F) and 90°C (194°F).
- The engine speed is between 400 RPM and 3,000 RPM.
- The TP sensor angle is less than 90 percent.
- The vehicle speed is less than 137 km/h (85 mph).

Conditions for Setting the DTC

- The average Long Term Fuel Trim cell values are below a predetermined threshold.
- All the above conditions are present for 40 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the Malfunction Indicator Lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails, if the diagnostic fails under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed.
- The first time the diagnostic fails, the PCM records the operating conditions in Failure Records.
- The second consecutive ignition cycle that this diagnostic fails [under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed], the PCM stores this information in Freeze Frame. The PCM copies any data previously stored in Freeze Frame and copies the data into the Failure Records. The PCM then overwrites the Freeze Frame. The only exception to this is if a Misfire DTC was already recorded in Freeze Frame. In this case, the Misfire data stays in Freeze Frame and the PCM updates the Fuel Trim data in the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the MIL OFF after three consecutive ignition cycles that the diagnostic runs and does not fail within the same conditions that the DTC last failed.

Important: If the last failure was during a non-typical driving condition, the MIL may remain ON longer than the three ignition cycles. Review the Freeze Frame/Failure Records for the last failure conditions.

- A History DTC clears after forty consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- A last test failed (Current DTC) clears when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems for procedures.

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*.

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 isolates when the DTC failed.
4. If DTC 175 is also set, then 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 with a suitable stopper. If the long term and short term fuel trim values increase, indicates there is fuel in the oil.

DTC P0172 Fuel Trim System Rich Bank 1

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	**Important:** If any DTCs are set, except P0172 and P0175, refer to those DTCs before proceeding with this diagnostic. 1. Install the scan tool. 2. Idle the engine at the normal operating temperature. 3. Fuel system in Closed Loop. 4. Monitor the LT FT Bn 1 display on the Fuel Trim Data List using the scan tool. Is the LT FT more than the specified value indicated? Example: More than would equal –12, –11 etc.	–13% LT	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids

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DTC P0172 Fuel Trim System Rich Bank 1 (cont'd)

Step	Action	Value(s)	Yes	No
4	Is DTC P0175 also set?	—	*Go to Step 5*	*Go to Step 6*
5	Visually/physically inspect the following items: • Collapsed air intake duct. • The air filter element for being restricted. Refer to *Air Cleaner Element Replacement.* • MAF sensor for being installed in the proper direction and for foreign objects blocking the inlet screen. Refer to *MAF Sensor Replacement.* • For excessive fuel in the crankcase. Change oil as necessary. Refer to *Engine Oil and Oil Filter Change* in Engine Mechanical 5.7L. Did you find and repair the condition?	—	*Go to Step 7*	Go to *Fuel System Diagnosis*
6	**Important:** When the fuel system test is finished, return to this table. Inspect the Bank 1 injectors for leaking, refer to *Fuel System Diagnosis.* Are any injectors leaking?	—	*Go to Step 9*	*Go to Step 8*
7	Repair or replace any faulty items found. Is the action complete?	—	*Go to Step 9*	—
8	Replace the faulty HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1* or *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2.* Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0174 Fuel Trim System Lean Bank 2

Circuit Description

The PCM controls a Closed Loop air/fuel metering system in order to provide the best possible combination of driveability, fuel economy, and emission control. The PCM monitors the heated oxygen sensor signal voltage and adjusts the fuel delivery based on the signal voltage while in Closed Loop. A change made to the fuel delivery changes the Long and Short Term Fuel Trim values. The Short Term Fuel Trim values change rapidly in response to the HO2S signal voltages. These changes fine tune the engine fueling. The Long Term Fuel Trim values change in response to trends in Short Term Fuel Trim. The Long Term Fuel Trim makes coarse adjustments to fueling in order to re-center and restore control to Short Term Fuel Trim. You can use a scan tool in order to monitor the Short and Long Term Fuel Trim. The ideal fuel trim values are around 0 percent. A positive Fuel Trim value indicates that the PCM is adding fuel in order to compensate for a lean condition. A negative Fuel Trim value indicates that the PCM is reducing the amount of fuel in order to compensate for a rich condition. If the PCM detects an excessively Rich or Lean condition, the PCM sets a DTC. The long term fuel trim diagnostic parameter is an average of several of the long term speed load learn cells which the PCM selects based on the engine speed and the engine load.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0300, P0335, P0336, P0351–P0358, P0405, P0410, P0412, P0418, P0443, P0500, P0502, P0503, P1258, P1404, P1415, P1416 not set.
- The engine coolant temperature is between 50°C (122°F) and 115°C (239°F).
- The barometric pressure is more than 74 kPa.
- The mass air flow is between 5.0 g/s and 90 g/s.
- The manifold absolute pressure is between 26 kPa and 90 kPa.
- The intake air temperature is between –20°C (–4°F) and 90°C (194°F).
- The engine speed is between 400 RPM and 3,000 RPM.
- The TP sensor angle is less than 90 percent.
- The vehicle speed is less than 137 km/h (85 mph).
- The fuel level is more than 10 percent.

Conditions for Setting the DTC

- The average Long Term Fuel Trim cell values are above a predetermined threshold.
- All the above conditions are present for 6 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the Malfunction Indicator Lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails, if the diagnostic fails under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed.
- The first time the diagnostic fails, the PCM records the operating conditions in Failure Records.
- The second consecutive ignition cycle that this diagnostic fails [under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed], the PCM stores this information in Freeze Frame. The PCM copies any data previously stored in Freeze Frame and copies the data into the Failure Records. The PCM then overwrites the Freeze Frame. The only exception to this is if a Misfire DTC was already recorded in Freeze Frame. In this case, the Misfire data stays in Freeze Frame and the PCM updates the Fuel Trim data in the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the MIL OFF after three consecutive ignition cycles that the diagnostic runs and does not fail within the same conditions that the DTC last failed.

Important: If the last failure was during a non-typical driving condition, the MIL may remain ON longer than the three ignition cycles. Review the Freeze Frame/Failure Records for the last failure conditions.

- A History DTC clears after forty consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- A last test failed (Current DTC) clears when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems for procedures.

This DTC sets if the engine runs out of fuel.

A fuel delivery malfunction causes this DTC to set. Thoroughly inspect all items that cause a lean condition.

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*.

Test Description

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

2. This test 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.
4. If DTC 171 is also set indicates both banks of the engine are operating lean. Inspect items that would cause both banks to operate lean.
5. A vacuum leak will cause DTCs P0171 and P0174 to set at the same time. Inspect all areas of the engine for a vacuum leak. Also inspect 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. Inspect that the engine oil dip stick is fully seated.

DTC P0174 Fuel Trim System Lean Bank 2

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	**Important:** If any DTCs are set, except P0171 and P0174, refer to those DTCs before proceeding with this diagnostic. 1. Install the scan tool. 2. Idle the engine at the normal operating temperature. 3. Fuel system in Closed Loop. 4. Monitor the LT FT Bn 2 display on the Fuel Trim Data List using the scan tool. Is the LT FT less than the specified value indicated?	24% LT	*Go to Step 3*	*Go to Step 4*

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DTC P0174 Fuel Trim System Lean Bank 2 (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	Is DTC P0171 also set?	—	*Go to Step 5*	*Go to Step 6*
5	Visually/physically inspect the following items: • Vacuum hoses for splits, kinks and proper connections. Refer to *Emission Hose Routing Diagram*. • Crankcase ventilation valve and/or system for leaks. Refer to *Crankcase Ventilation System Description*. • Contaminated fuel. Refer to *Fuel System Diagnosis*. • The PCM and sensor grounds are clean, tight and in proper locations. • Air induction system after MAF sensor for vacuum leaks. • Engine mechanical failure. Did you find and repair the condition?	—	*Go to Step 7*	Go to *Fuel System Diagnosis*
6	Visually/physically inspect the following items: • Bank 2 exhaust leaks, missing or loose exhaust hardware. • Bank 2 HO2S #1 is installed securely and electrical connector not contacting exhaust system or ignition wires. • Engine mechanical failure. • Vacuum leaks that will only affect bank 1 such as the intake manifold, the injector O-rings, etc. Did you find and repair the condition?	—	*Go to Step 7*	Go to *Fuel System Diagnosis*
7	Repair or replace any faulty items found. Is the action complete?	—	*Go to Step 8*	—
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0175 Fuel Trim System Rich Bank 2

Circuit Description

The PCM controls a Closed Loop air/fuel metering system in order to provide the best possible combination of driveability, fuel economy, and emission control. The PCM monitors the heated oxygen sensor signal voltage and adjusts the fuel delivery based on the signal voltage while in Closed Loop. A change made to the fuel delivery changes the Long and Short Term Fuel Trim values. The Short Term Fuel Trim values change rapidly in response to the HO2S signal voltages. These changes fine tune the engine fueling. The Long Term Fuel Trim values change in response to trends in Short Term Fuel Trim. The Long Term Fuel Trim makes coarse adjustments to fueling in order to re-center and restore control to Short Term Fuel Trim. You can use a scan tool in order to monitor the Short and Long Term Fuel Trim. The ideal fuel trim values are around 0 percent. A positive Fuel Trim value indicates that the PCM is adding fuel in order to compensate for a lean condition. A negative Fuel Trim value indicates that the PCM is reducing the amount of fuel in order to compensate for a rich condition. If the PCM detects an excessively Rich or Lean condition, the PCM sets a DTC. The long term fuel trim diagnostic parameter is an average of several of the long term speed load learn cells which the PCM selects based on the engine speed and the engine load.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0300, P0335, P0336, P0351–P0358, P0405, P0410, P0412, P0418, P0443, P0500, P0502, P0503, P1258, P1404, P1415, P1416 not set.
- The engine coolant temperature is between 50°C (122°F) and 115°C (239°F).
- The barometric pressure is more than 74 kPa.
- The mass air flow is between 5.0 g/s and 90 g/s.
- The manifold absolute pressure is between 26 kPa and 90 kPa.
- The intake air temperature is between –20°C (–4°F) and 90°C (194°F).
- The engine speed is between 400 RPM and 3,000 RPM.
- The TP sensor angle is less than 90 percent.
- The vehicle speed is less than 137 km/h (85 mph).

Conditions for Setting the DTC

- The average Long Term Fuel Trim cell values are below a predetermined threshold.
- All the above conditions are present for 40 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the Malfunction Indicator Lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails, if the diagnostic fails under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed.
- The first time the diagnostic fails, the PCM records the operating conditions in Failure Records.
- The second consecutive ignition cycle that this diagnostic fails [under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed], the PCM stores this information in Freeze Frame. The PCM copies any data previously stored in Freeze Frame and copies the data into the Failure Records. The PCM then overwrites the Freeze Frame. The only exception to this is if a Misfire DTC was already recorded in Freeze Frame. In this case, the Misfire data stays in Freeze Frame and the PCM updates the Fuel Trim data in the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the MIL OFF after three consecutive ignition cycles that the diagnostic runs and does not fail within the same conditions that the DTC last failed.

Important: If the last failure was during a non-typical driving condition, the MIL may remain ON longer than the three ignition cycles. Review the Freeze Frame/Failure Records for the last failure conditions.

- A History DTC clears after forty consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- A last test failed (Current DTC) clears when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems for procedures.

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*.

Test Description

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

2. This test 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 isolates when the DTC failed.
4. If DTC 172 is also set, then 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 with a suitable stopper. If the long term and short term fuel trim values increase, indicates there is fuel in the oil.

DTC P0175 Fuel Trim System Rich Bank 2

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	**Important:** If any DTCs are set, except P0172 and P0175, refer to those DTCs before proceeding with this diagnostic. 1. Install the scan tool. 2. Idle the engine at the normal operating temperature. 3. Fuel system in Closed Loop. 4. Monitor the LT FT Bn 2 display on the Fuel Trim Data List using the scan tool. Is the LT FT more than the specified values indicated? Example; More than would equal –12, –11 etc.	–13% LT	*Go to Step 3*	*Go to Step 4*

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DTC P0175 Fuel Trim System Rich Bank 2 (cont'd)

Step	Action	Value(s)	Yes	No
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	Is DTC P0172 also set?	—	*Go to Step 5*	*Go to Step 6*
5	Visually/physically inspect the following items: • Collapsed air intake duct. • The air filter element for being restricted. Refer to *Air Cleaner Element Replacement*. • The MAF sensor for being installed in the proper direction and for foreign objects blocking the inlet screen. Refer to *MAF Sensor Replacement*. • For excessive fuel in the crankcase. Change oil as necessary. Refer to *Engine Oil and Oil Filter Change* in Engine Mechanical–5.7L. Did you find and repair the condition?	—	*Go to Step 7*	Go to *Fuel System Diagnosis*
6	**Important:** When the fuel system test is finished, return to this table. Inspect the Bank 2 injectors for leaking, refer to *Fuel System Diagnosis*. Are any injectors leaking?	—	*Go to Step 9*	*Go to Step 8*
7	Repair or replace any faulty items found. Is the action complete?	—	*Go to Step 9*	—
8	Replace the faulty HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1* or *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2*. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0200 Injector Control Circuit

Refer to Engine Controls Schematics, *Fuel Injectors* for complete circuit details.

Circuit Description

The PCM enables an injector on the intake stroke of each cylinder. Individual cylinder fuel control is referred to as Sequential Multi-port Fuel Injection (SFI).

Ignition voltage is supplied directly to the fuel injectors. The PCM controls each injector by grounding the control circuit via an internal switch called a driver. The primary function of the driver is to supply the ground for the component being controlled. Each driver or control circuit is equipped with a fault line which is monitored by the PCM. When the PCM is commanding an injector ON, the voltage of the control circuit should be low. When the PCM is commanding the injector OFF, the voltage potential of the control circuit should be high. If the PCM detects the injector control circuit voltage other than what is expected, the PCM sets a DTC.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is more than 6.0 volts but less than 18.0 volts.

Conditions for Setting the DTC

The PCM detects the wrong voltage potential on any injector driver circuit for 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

A misfire may not be apparent at idle. The misfire may only occur above idle under a load. Road test the vehicle and monitor the misfire current counters.

Observe, if more than one cylinder is mis-firing, the scan tool may only display one cylinder mis-firing. This will not be apparent until the repair is completed. Also, if an injector fuse is open for one side of the engine, the scan tool may only display 2 or 3 cylinders mis-firing.

When the injector driver is disabled, an engine misfire will be apparent and a misfire DTC sets.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step determines if a malfunction is present.

   The Misfire Current Counters will not increment if certain DTCs set at the same time or after DTC P0300 sets. Refer to conditions for running DTC P0300 for applicable DTC list.

   If more than one cylinder is misfiring, the Misfire Current Counters may increment for only one cylinder. Example: Cylinders 1 and 8 are both misfiring, yet only cylinder 8 increments on the Misfire Current Counter.

   If one injector fuse open, only two or three Misfire current counters may increment for the corresponding side of the engine.

3. There are two ways to isolate a malfunctioning injector circuit:
   - DTC P0300 indicates a misfire is present. So use the Misfire Current Counters to locate the cylinder that is misfiring.
   - If no misfire DTC is present, Start and idle the engine while monitoring Misfire Current Counters. If a misfire is present, the Misfire Current Counters will increase for a cylinder that has a misfire.

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4. The injector fuses also feed the ignition coil/modules. Thoroughly inspect the circuits going to the ignition coil/modules for a short to ground. A shorted ignition coil/module may also cause a fuse to open.
7. Inspect the injector connections before replacing the injector. A faulty connection causes an inoperative injector.
11. Disconnecting the PCM allows testing the continuity of the circuits with the DMM. This aids in locating an open or shorted circuit. Tests for an ignition feed circuit that is shorted to ground.
13. Tests for an ignition feed circuit that is shorted to ground.
14. The injector fuses also feed the ignition coil/modules. Thoroughly inspect the circuits going to the ignition coil/modules for a short to ground. A shorted ignition coil/module may also cause a fuse to open.

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DTC P0200 Injector Control Circuit

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	1. Install the scan tool. 2. Start the engine. 3. Monitor all the Misfire Current Counters on the Misfire Data List (There are a total of 8 counters. One counter per cylinder) with a scan tool. Are any of the Misfire Current Counters incrementing?	—	*Go to Step 4*	*Go to Step 3*
3	Monitor the Misfire History Counters on the Misfire Data List (There are a total of 8 counters. One counter per cylinder) with a scan tool. Do any of the Misfire History Counters indicate a number other than 0.0 counts?	—	*Go to Step 18*	Go to Diagnostic Aids
4	Are the injector fuses OK?	—	*Go to Step 5*	*Go to Step 8*
5	1. Turn OFF the ignition. 2. Disconnect the injector(s) harness that the Misfire Current Counter is incrementing for. 3. Turn ON the ignition, with the engine OFF. 4. Probe the injector harness ignition feed circuit with the test lamp *J 34142-B* connected to ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 6*	*Go to Step 10*
6	1. Turn OFF the ignition. 2. Connect the injector test lamp *J 34730-2C* to the isolated injector harness. 3. Start and idle the engine. Does the injector test lamp blink?	—	*Go to Step 7*	*Go to Step 11*
7	1. Inspect the injector harness terminals for poor connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 19*	*Go to Step 9*
8	1. Turn OFF the ignition. 2. Disconnect the four injector harness connectors related to the fuse that was open. 3. Probe the injector ignition feed circuits of one of the injector harnesses that are disconnected with the test lamp *J 34142-B* connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 13*	*Go to Step 9*
9	**Important:** Return to this Diagnostic after performing the Fuel Injector Coil Test. Perform the Fuel Injector Coil Test. Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F).* Did the Fuel Injector Coil Test isolate an injector condition?	—	*Go to Step 15*	*Go to Step 14*
10	Repair the injector ignition feed circuit to the isolated injector. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—

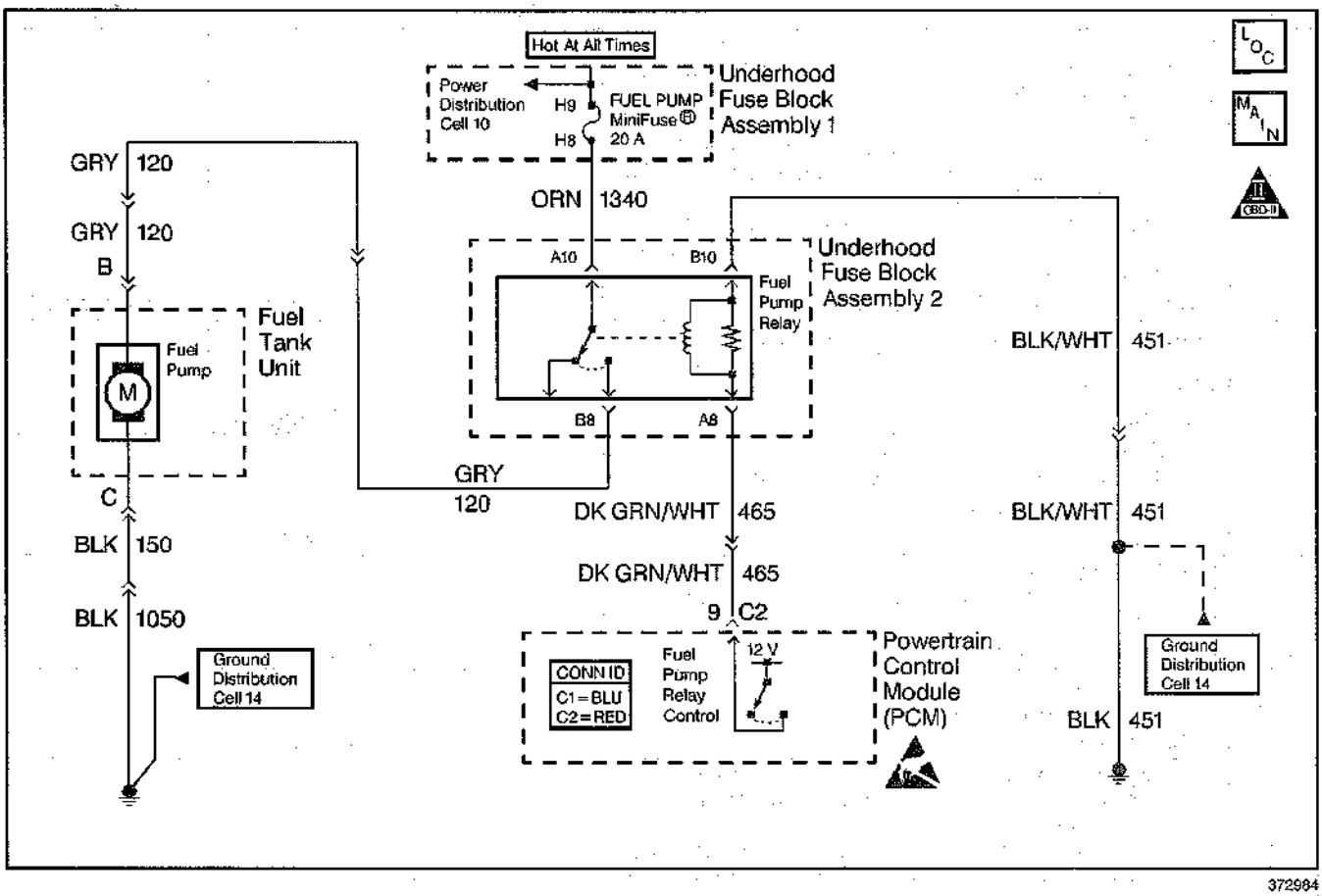
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DTC P0200 Injector Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
11	**Important:** Disconnecting the PCM may eliminate the short to ground, or short to voltage if the injector circuit is shorted to another PCM circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the injector control circuit for an open, short to ground or a short to voltage. Refer to *Circuit Testing* in Wiring Systems. Is the injector control circuit open or shorted?	—	*Go to Step 12*	*Go to Step 16*
12	Repair the injector control circuit for an open, short to ground, or a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—
13	1. Repair the grounded ignition feed circuit to the injectors. Refer to *Wiring Repairs* in Wiring Systems. 2. Replace the open fuse. Is the action complete?	—	*Go to Step 19*	—
14	Repair the intermittent short to ground in the injector ignition feed circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—
15	Replace the faulty injector(s) that was isolated. Refer to *Fuel Injector Replacement.* Is the action complete?	—	*Go to Step 19*	—
16	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 19*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 19*	—
18	1. Inspect the appropriate injector circuit for the following: • Poor connections at the injector and the PCM terminal. • Intermittent shorts to ground. • Intermittent opens. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If a condition is found, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 19*	Go to *Symptoms*
19	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option with the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number with the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 20*	*Go to Step 2*
20	Select the Capture Info option and the Review Info option with the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0230 Fuel Pump Relay Control Circuit



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Circuit Description

When you turn the ignition switch to the on position, the PCM activates the in-tank fuel pump. The fuel pump remains on as long as the PCM receives reference pulses from the electronic ignition system. If there are no reference pulses, the PCM turns the fuel pump off after about 2–3 seconds. The PCM controls the fuel pump relay by applying B+ to the control circuit via an internal switch called a driver. The primary function of the driver is to supply a voltage to the fuel pump relay. The driver has a fault line which the PCM monitors. When the PCM commands the fuel pump on, the voltage of the control circuit should be high (near battery voltage). When the PCM commands the control circuit to the fuel pump OFF, the voltage potential of the circuit should be low (near 0 volts). This DTC sets when the PCM detects the fuel pump control circuit is shorted to ground.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- All the above conditions present for a minimum of 2.5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

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 the OFF states. Repeat the commands as necessary.
4. This step tests the ground circuit for the fuel pump relay.
5. This step verifies that the PCM is providing B+ to the fuel pump relay.
6. This step tests if B+ is constantly being applied to the fuel pump relay.

DTC P0230 Fuel Pump Relay Control Circuit

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	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, command the fuel pump relay ON and OFF. Does the fuel pump relay turn ON and OFF with each command?	—	*Go to Step 3*	*Go to Step 4*
3	1. Review the Freeze Frame and/or Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the same Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure Records data that you observed. Does the DTC reset?	—	*Go to Step 4*	Go to *Intermittent Conditions*
4	1. Turn OFF the ignition. 2. Disconnect the fuel pump relay from the underhood electrical center. 3. Turn ON the ignition, with the engine OFF. 4. Probe the coil side ground circuit of the fuel pump relay with a test lamp that is connected to B+. Is the test lamp illuminated?	—	*Go to Step 5*	*Go to Step 11*
5	1. Connect a test lamp between the control circuit of the fuel pump relay and the coil side ground circuit of the fuel pump relay. 2. With a scan tool, command the fuel pump relay ON and OFF. Does the test lamp turn ON and OFF with each command?	—	*Go to Step 9*	*Go to Step 6*
6	Does the test lamp remain illuminated with each command?	—	*Go to Step 8*	*Go to Step 7*
7	1. Test the control circuit of the fuel pump relay for an open, or short to ground. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 10*

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DTC P0230 Fuel Pump Relay Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Test the control circuit of the fuel pump relay for a short to voltage. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
9	1. Inspect for poor connections at the fuel pump relay. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 12*
10	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
11	Repair the relay coil side ground circuit for an open. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	—
12	Replace the fuel pump relay. Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 14*	—
14	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	—	*Go to Step 2*	*Go to Step 15*
15	With a scan tool, review the Stored Information (capture info). Does the scan tool display any DTCs that you have not diagnosed?	—	Go to *Diagnostic Trouble Code (DTC) List/Type*	System OK

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DTC P0300 Engine Misfire Detected

Circuit Description

The Crankshaft Position sensor is mounted through the side of the engine block at the rear of Bank 2 behind the starter assembly. The Crankshaft Position sensor works in conjunction with a 24X reluctor wheel on the crankshaft. The reluctor wheel is inside the engine immediately in front of the rear main bearing. The PCM provides a 12 volt power supply to the CKP sensor as well as a ground and a signal circuit.

A misfire causes a change in crankshaft speed. The PCM times the interval between each pulse and compares each new time interval with the previous one in order to determine when an excessive change in crankshaft speed has occurred. You can expect a certain amount of acceleration/deceleration between each firing stroke, but if the crankshaft speed changes are greater than an expected amount, the PCM interprets this as a misfire.

The PCM uses the Crankshaft Position sensor for both spark and fueling. As the crankshaft rotates, the reluctor wheel teeth interrupt a magnetic field produced by a magnet within the sensor. The sensors internal circuitry detects this and produces a signal which the PCM reads. The PCM uses this 24X signal in combination with the Camshaft Position sensor 1X signal in order to accurately determine crankshaft position. The PCM also calculates a 4X signal from this information. The PCM uses the 4X signal for internal calculations. The 4X signal also provides a tach signal for any device which requires one.

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

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0341, P0342, P0343, P0500, P0502, P0503, P1258 not set.
- The engine speed is between 450 RPM and 3,001 RPM.
- The ignition voltage is between 10.0 volts and 18.0 volts.
- The engine coolant temperature is between –7°C (19°F) and 130°C (266°F).
- Fuel level is more than 10 percent.
- The TP sensor angle is steady within 1 percent.
- The ABS and Traction Control systems are not active.
- The transmission is not changing gears.
- The AIR diagnostic test is not in progress.
- The A/C clutch is not changing states.
- The PCM is not in fuel shut-off or decel fuel cut-off mode.
- The ABS signals not exceeding rough road thresholds.

Conditions for Setting the DTC

- The PCM determines that an emission type Misfire is present.
- The PCM determines that a catalyst damaging Misfire is present.

Action Taken When the DTC Sets

The PCM illuminates the Malfunction Indicator Lamp (MIL) under the following conditions:

- The PCM illuminates the Malfunction Indicator Lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails, if the diagnostic fails under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed.
- The first time the diagnostic fails, the PCM records the operating conditions in Failure Records.
- The PCM determines the percent of misfire over a 1,000 revolution period is high enough to cause excessive tail pipe emissions. The PCM illuminates the Malfunction Indicator lamp the next consecutive ignition cycle that the diagnostic runs and fails, if the diagnostic fails under the same conditions (load, RPM, temperature, etc.) as the previous ignition cycle that the test ran and failed.

  Or

- The PCM flashes the Malfunction Indicator Lamp (MIL) when the diagnostic runs and fails a catalyst damaging misfire.

Conditions for Clearing the MIL/DTC

Important: If the last failure was during a non-typical driving condition, the MIL may remain ON longer than the three ignition cycles. Review the Freeze Frame/Failure Records for the last failure conditions.

- The PCM turns the MIL OFF after three consecutive ignition cycles that the diagnostic runs and does not fail within the same conditions that the DTC last failed.
- A History DTC clears after forty consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- A last test failed (Current DTC) clears when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The following may cause a misfire:

- Running the vehicle out of fuel causes sufficient misfire to set DTC P0300. A vehicle that is out of fuel may have DTC P0461 also set.
- A restricted fuel filter can cause sufficient misfire to set DTC P0300. Refer to *Fuel System Diagnosis*.
- A misfire may not be apparent at idle. The misfire may only occur above idle under a load. Road test the vehicle and monitor the misfire current counters.
- Observe, if more than one cylinder is mis-firing, the scan tool may only display one cylinder mis-firing. This will not be apparent until the repair is completed. Also, if an ignition coil/module ground circuit is open for one side of the engine, the scan tool may only display 2 or 3 cylinders mis-firing. Inspect the ground circuit for the ignition coil/modules on the cylinder bank of the engine that has more then one cylinder mis-firing.
- Excessive vibration from sources other than the engine could cause a misfire DTC. The following are possible sources of vibration:
  - Variable thickness brake rotor
  - Drive shaft not balanced
  - Certain rough road conditions

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. A misfire may not be apparent at idle. The misfire may only occur above idle or under a load. Road test the vehicle and monitor the Misfire Current Counters.

   The Misfire Current Counters will not increment if certain DTCs set at the same time or after DTC P0300 sets. Refer to conditions for running DTC P0300 for applicable DTC list.

   If more than one cylinder is misfiring, the Misfire Current Counters may increment for only one cylinder. Example: Cylinders 1 and 8 are both misfiring, yet only cylinder 8 increments on the Misfire Current Counter.

   If one injector fuse open, only two or three Misfire Current Counters may increment for the corresponding side of the engine.

   Wetting down the secondary ignition system with water from a spray bottle may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as you apply the water.

   If the Misfire Current Counters are incrementing and there is no apparent misfire, an erratic CKP sensor signal could be the cause. Perform the diagnostic table for DTC P0335 first if this condition is suspected.

   If a misfire is present and you suspect a fuel control condition, force the fuel system into Open Loop using the scan tool and allow the engine to run for a few minutes. If this eliminates the misfire, refer to any fuel control related DTCs which are set. If no other DTCs are set, refer to the Engine Scan Tool Data List.

4. The cylinder with the more significant misfire may cause another cylinders counter to increment only by a small amount.

10. If the engine misfire moves with the spark plug, this is good indication that you should replace the spark plug.

12. If you cannot locate a fuel system condition, refer to Engine Mechanical–5.7L. An engine mechanical condition can cause a spark plug to gas foul. Inspect for loose rockers, collapsed lifters or worn camshaft lobes.

17. If the customers concern is the MIL is flashing, this indicates that a Catalyst Misfire has occurred. Drive the vehicle in the conditions to run the catalyst diagnostic.

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DTC P0300 Engine Misfire Detected

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	**Important:** • You must perform the CKP System Variation Learn Procedure before proceeding with this diagnostic table. Refer to *CKP System Variation Learn Procedure.* • Ensure that the ABS and Traction Control systems are functioning properly before proceeding with this diagnostic. • If any DTCs are set, refer to those DTCs before proceeding with this diagnostic. Monitor all the Misfire Current Counters on the misfire data list (There are a total of 8 counters, one counter per cylinder) using the scan tool. Are any of the Misfire Current Counters incrementing?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	Is only one Misfire Counter incrementing?	—	*Go to Step 6*	*Go to Step 5*

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DTC P0300 Engine Misfire Detected (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Visually/physically inspect the following items: • Accessory drive belt and pulleys for damage or misalignment. Refer to *Symptoms - Drive Belt* in Engine Mechanical 5.7L. • Vacuum hoses for splits, kinks and proper connections. Refer to *Emission Hose Routing Diagram*. • Throttle body and intake manifold for vacuum leaks • Crankcase ventilation valve and/or system for vacuum leaks. Refer to *Crankcase Ventilation System Description*. • PCM grounds for being clean and secure. Refer to *Ground Distribution Schematics* in Wiring Systems. • Verify that all injector harness connectors are connected to the proper injector/cylinder. • Inspect the injector and Ignition Control fuses for being open. If you find an open fuse, locate and repair the shorted circuit. Refer to *Wiring Repairs* in Wiring Systems. • Test for low fuel pressure or restricted fuel flow. Refer to *Fuel System Diagnosis*. • Inspect for a restricted exhaust. Refer to *Restricted Exhaust* in Engine Exhaust. • Fuel contamination. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. 2. If you find a condition, repair as necessary. Did any of the above tests isolate a condition requiring a repair?	—	*Go to Step 17*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the injector that corresponds to the Misfire Current Counter(s) that was incrementing. 3. Connect the *J 34730-2C* injector test lamp to the injector electrical connector. 4. Idle the engine. Is the injector test lamp flashing?	—	*Go to Step 7*	Go to *DTC P0200 Injector Control Circuit*
7	1. Turn OFF the ignition. 2. Reconnect the injector harness electrical connector. 3. Disconnect the ignition wire(s) from the spark plug that corresponds to the Misfire Current Counter(s) that was incrementing. 4. Install *J 26792* spark tester to ground. 5. Start the engine. Does the spark jump the tester gap and is the spark consistent?	—	*Go to Step 9*	*Go to Step 8*
8	1. Remove the ignition wire for the cylinder that is misfiring. 2. Measure the resistance of the ignition wire using the DMM. Is the ignition wire resistance less than the specified resistance?	700Ω	Go to *Electronic Ignition (EI) System Diagnosis*	*Go to Step 16*
9	1. Remove the spark plug(s) from the cylinder that indicated a misfire. Refer to *Spark Plug Replacement* in Engine Electrical. 2. Visually inspect the spark plug(s). Refer to *Spark Plug Visual Diagnosis* in Engine Electrical. Does the spark plug appear to be OK?	—	*Go to Step 10*	*Go to Step 11*

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DTC P0300 Engine Misfire Detected (cont'd)

Step	Action	Value(s)	Yes	No
10	**Important:** If the Injector Coil Test Procedure does not isolate the condition, refer to *Base Engine Misfire Diagnosis* in Engine Mechanical–5.7L. 1. Swap the suspected spark plug with another cylinder that is operating properly. 2. Operate the vehicle under the same conditions that the misfire occurred. Did the misfire move with the spark plug?	—	*Go to Step 15*	Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)*
11	Are the spark plugs oil or coolant fouled.	—	Go to *Base Engine Misfire Diagnosis* in Engine Mechanical–5.7L	*Go to Step 12*
12	**Important:** If the Fuel System is OK, refer to *Base Engine Misfire Diagnosis* in Engine Mechanical–5.7L. Are the spark plugs gas fouled?	—	Go to *Fuel System Diagnosis*	*Go to Step 13*
13	**Important:** If the Injector Coil Test Procedure does not isolate the condition, refer to *Base Engine Misfire Diagnosis* in Engine Mechanical–5.7L. Do the spark plugs show any signs of being cracked, worn, or improperly gapped?	—	*Go to Step 14*	Go to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)*
14	1. Replace or re-gap spark plugs. 2. If improper gap is found, be sure to re-gap spark plugs using a wire type gauge. Is the action complete?	—	*Go to Step 17*	—
15	Replace the faulty spark plug(s). Refer to *Spark Plug Replacement* in Engine Electrical. Is the action complete?	—	*Go to Step 17*	—
16	Replace the faulty ignition wire(s). Refer to *Spark Plug Wire Harness Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 17*	—
17	Was the customers concern that the MIL was flashing?	—	Go to *DTC P0420 Catalyst System Low Efficiency Bank 1* or *DTC P0430 Catalyst System Low Efficiency Bank 2*	*Go to Step 18*
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0325 Knock Sensor Module Performance

Circuit Description

The KS system monitors both knock sensors in order to determine if pre-detonation is present. If the KS system determines that excessive knock (pre-detonation) is present, the PCM retards the spark timing based on the signals from the KS system. When knock is present, the KS system voltage input signal to the PCM goes low. The PCM then retards timing until no knock is present. When the KS system is malfunctioning, the KS circuit voltage going to the PCM goes low. The PCM interprets this low signal as spark knock.

Conditions for Running the DTC

- The engine speed is between 1,650 RPM and 3,000 RPM.
- The MAP is more than 49 kPa.
- The engine coolant temperature is more than 60°C (135°F).
- The throttle angle is more than 0.5 percent.
- The engine run time is more than 20 seconds.

Conditions for Setting the DTC

- A malfunction with the KS system or circuits within the PCM are faulty.
- All above conditions present for 3.0 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the diagnostic test does not run, review the Conditions for Running the DTC.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This DTC indicates an internal PCM fault.

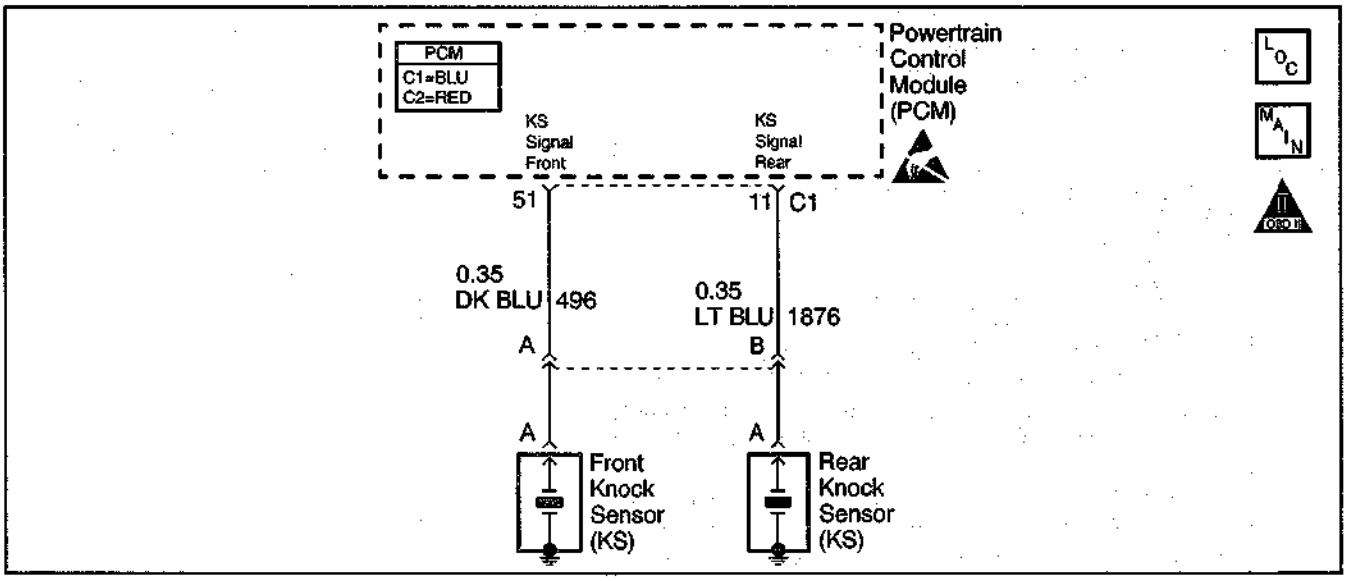
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DTC P0325 Knock Sensor Module Performance

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	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 3*	—
3	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 4*	*Go to Step 2*
4	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0327 Knock Sensor (KS) 1 Circuit



Circuit Description

The Knock Sensor (KS) system detects engine pre-detonation. The PCM retards the spark timing based on the signals from the knock sensors. The knock sensors produce an AC voltage when specific frequencies are detected. The knock sensor voltages are an input to the PCM. The amount of AC voltage produced is proportional to the intensity of the knock.

An operating engine produces a normal amount of engine mechanical vibration (noise). The knock sensors produce an AC voltage signal from this noise. When an engine operates, the PCM learns the minimum and maximum frequency of the noise the engine produces. When the PCM determines that this frequency is less than or greater than the expected amount, a knock sensor DTC will set.

Conditions for Running the DTC

- The engine speed is between 1,650 RPM and 3,000 RPM.
- The MAP is more than 49 kPa.
- The engine coolant temperature is more than 60°C (135°F).
- The throttle angle is greater than 0.5 percent.
- The engine run time is more than 20 seconds.

Conditions for Setting the DTC

The PCM determines that this frequency is less than or more than the expected amount for less than 3 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Inspect the knock sensor for proper installation. A knock sensor that is loose or over torqued may cause the DTC P0327 to set.

For an intermittent, refer to *Symptoms*.

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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 display 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, inspect the KS system wiring connections. When testing 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 isolates the Knock Sensor from the rest of the circuit.
4. Tap on the engine block near the appropriate knock sensor. Do not tap on plastic engine components.

DTC P0327 Knock Sensor (KS) 1 Circuit

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	**Important:** If an engine knock can be heard, repair the engine mechanical condition before proceeding with this diagnostic. Refer to *Engine Noise Diagnosis* in Engine Mechanical. 1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. 6. Monitor the Diagnostic Trouble Code (DTC) information using a scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	1. Disconnect the knock sensor electrical connector located behind the intake manifold. 2. Measure the resistance between the appropriate knock sensor signal circuit (sensor side of harness) and the battery ground using the DMM. 3. Set the DMM to the 400K ohm scale. Is the resistance of the knock sensor within the specified range?	93–107KΩ	*Go to Step 4*	*Go to Step 6*
4	1. Connect the DMM between the appropriate knock sensor signal circuit (sensor side of harness) and the engine block. 2. Set the DMM to the AC voltage scale. **Important:** Do not tap on plastic engine components. 3. Tap on the engine near the appropriate knock sensor while observing the signal indicated on the DMM. Is any signal indicated on the DMM while tapping on the engine near the appropriate Knock Sensor?	—	*Go to Step 5*	*Go to Step 7*

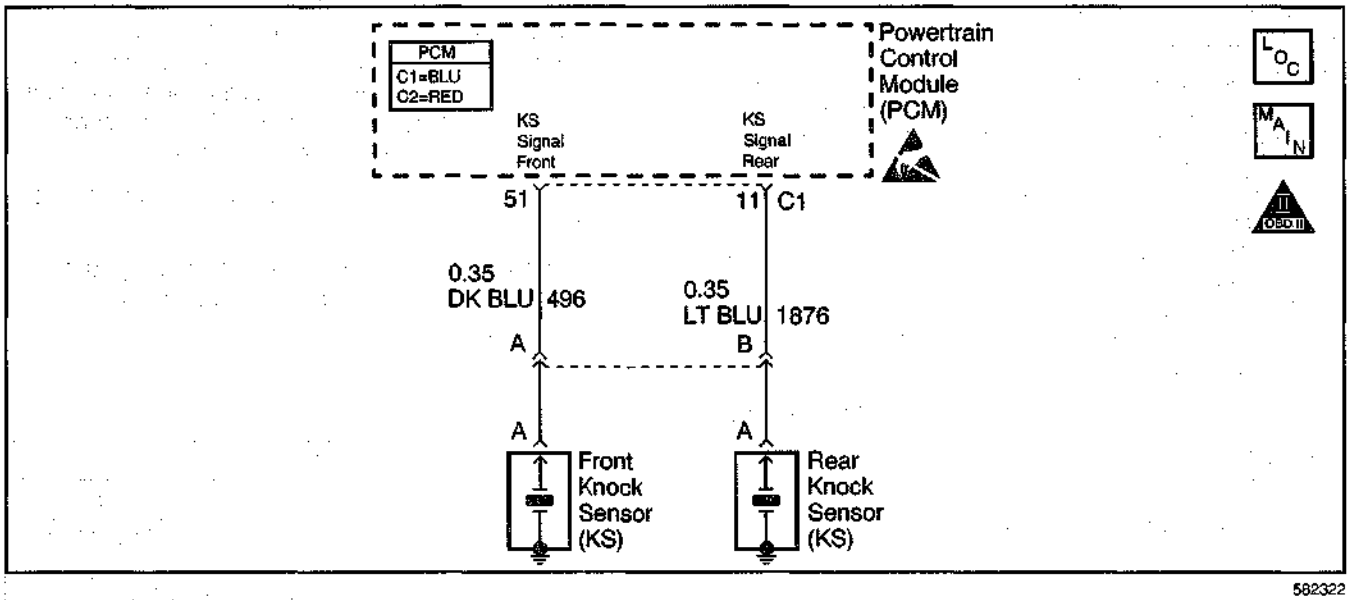
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DTC P0327 Knock Sensor (KS) 1 Circuit (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 2. Test the KS signal circuit between the PCM and the knock sensor connector for the following: • An open • A short to voltage • A short to ground 3. If you find a condition repair the condition as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 8*
6	1. Remove the intake manifold. Refer to *Intake Manifold Replacement* in Engine Mechanical–5.7L. 2. Test for an open or a short to ground in the signal circuit between the knock sensor jumper harness connector, located at the back of the intake manifold, and the knock sensor connector. Refer to *Circuit Testing* in Wiring Systems. 3. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 7*
7	Replace the appropriate Knock Sensor. Refer to *Knock Sensor (KS) Replacement*. Is the action complete?	—	*Go to Step 10*	—
8	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 10*	*Go to Step 9*
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 10*	—
10	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 11*	*Go to Step 2*
11	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0332 Knock Sensor (KS) 2 Circuit



Circuit Description

The Knock Sensor (KS) system detects engine pre-detonation. The PCM retards the spark timing based on the signals from the knock sensors. The knock sensors produce an AC voltage when specific frequencies are detected. The knock sensor voltages are an input to the PCM. The amount of AC voltage produced is proportional to the intensity of the knock.

An operating engine produces a normal amount of engine mechanical vibration (noise). The knock sensors produce an AC voltage signal from this noise. When an engine operates, the PCM learns the minimum and maximum frequency of the noise the engine produces. When the PCM determines that this frequency is less than or greater than the expected amount, a knock sensor DTC will set.

Conditions for Running the DTC

- The engine speed is between 1,650 RPM and 3,000 RPM.
- The MAP is more than 48 kPa.
- The engine coolant temperature is more than 60°C (135°F).
- The throttle angle is more than 0.5 percent.
- The engine run time is more than 20 seconds.

Conditions for Setting the DTC

The PCM determines that this frequency is less than or more than the expected amount for less than 3 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.
- Inspect the knock sensor for proper installation. A knock sensor that is loose or over torqued may cause the DTC P0332 to set.
- For an intermittent, refer to *Symptoms*.

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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 display 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, inspect the KS system wiring connections. When testing 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 isolates the Knock Sensor from the rest of the circuit.
4. Tap on the engine block near the appropriate knock sensor. Do not tap on plastic engine components.

DTC P0332 Knock Sensor (KS) 2 Circuit

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	**Important:** If an engine knock can be heard, repair the engine mechanical condition before proceeding with this diagnostic. Refer to *Engine Noise Diagnosis* in Engine Mechanical. 1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. 6. Monitor the Diagnostic Trouble Code (DTC) information using a scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	1. Disconnect the knock sensor electrical connector located behind the intake manifold. 2. Measure the resistance between the appropriate knock sensor signal circuit (sensor side of harness) and the battery ground using the DMM. 3. Set the DMM to the 400K ohm scale. Is the resistance of the knock sensor within the specified range?	93–107KΩ	*Go to Step 4*	*Go to Step 6*
4	1. Connect the DMM between the appropriate knock sensor signal circuit (sensor side of harness) and the engine block. 2. Set the DMM to the AC voltage scale. **Important:** Do not tap on plastic engine components. 3. Tap on the engine near the appropriate knock sensor while observing the signal indicated on the DMM. Is any signal indicated on the DMM while tapping on the engine near the appropriate Knock Sensor?	—	*Go to Step 5*	*Go to Step 7*

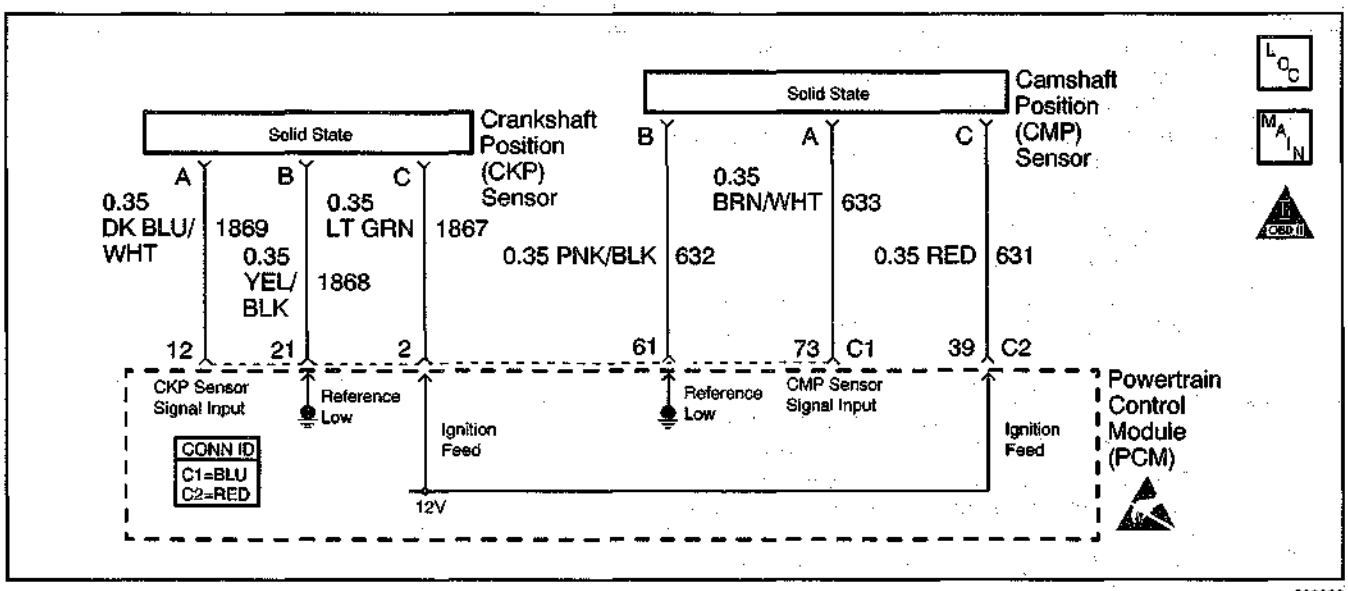
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DTC P0332 Knock Sensor (KS) 2 Circuit (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 2. Test the KS signal circuit between the PCM and the knock sensor connector for the following: • An open • A short to voltage • A short to ground 3. If you find a condition repair the condition as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 8*
6	1. Remove the intake manifold. Refer to *Intake Manifold Replacement* in Engine Mechanical–5.7L. 2. Test for an open or a short to ground in the signal circuit between the knock sensor jumper harness connector, located at the back of the intake manifold, and the knock sensor connector. Refer to *Circuit Testing* in Wiring Systems. 3. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 7*
7	Replace the appropriate Knock Sensor. Refer to *Knock Sensor (KS) Replacement*. Is the action complete?	—	*Go to Step 10*	—
8	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 10*	*Go to Step 9*
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 10*	—
10	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 11*	*Go to Step 2*
11	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0335 Crankshaft Position (CKP) Sensor Circuit



582388

Circuit Description

The Crankshaft Position Sensor CKP is mounted in the right rear of the engine block behind the starter. The CKP sensor works in conjunction with a 24X reluctor wheel mounted on the rear of the crankshaft. The CKP sensor has a B+ power supply, a ground, and a signal circuit.

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

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0341, P0342, P0343 are not set.
- The CMP sensor is transitioning.
- The MAF is more than 3 g/s.
- The ignition switch in the crank mode.

Conditions for Setting the DTC

The PCM determines no signal from the CKP sensor for less than 8 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The following conditions may cause this DTC to set:

- Poor connections/terminal tension at the sensor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
- Crankshaft reluctor wheel damage or improper installation.
- The sensor coming in contact with the reluctor wheel.
- The engine running out of fuel.

Excess crankshaft end play causes the CKP sensor reluctor wheel to move out of alignment with the CKP sensor. This could result in any one of the following:

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

For an intermittent, refer to *Symptoms.*

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Test Description

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

3. This step determines if the fault is present.
6. This step simulates a CKP sensor signal to the PCM. If the PCM receives the signal, the fuel pump will operate for about two seconds. If the fuel pump operates, the condition is either terminal contact at the CKP sensor, the CKP sensor or, the CKP sensor reluctor wheel.
7. This test determines if the CKP sensor signal circuit or if the PCM is faulty.
11. The CKP System Variation Learn Procedure must be performed anytime the relationship between the CKP sensor and the CKP reluctor wheel is changed.
12. To inspect the reluctor wheel, remove the starter and rotate the crankshaft while viewing the reluctor wheel through the CKP sensor hole. If you cannot determine if the reluctor wheel is damaged, the oil pan may have to be removed.
14. The CKP System Variation Learn Procedure must be performed anytime the relationship between the CKP sensor and the CKP reluctor wheel is changed.
15. Before replacing the PCM, inspect the PCM harness connections.
16. The repair is not complete if the scan tool indicates that the diagnostic ran and failed.

DTC P0335 Crankshaft Position (CKP) Sensor Circuit

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	Does the engine start and continue to run?	—	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and record or document the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Specific DTC option under the Diagnostic Trouble Code (DTC) option using a scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	***Caution: Before proceeding, remove the fuses for the ignition coil and fuel injector feed circuits in order to prevent personal injury from engine rotation, sparks, and excessive engine fueling.*** 1. Turn ON the ignition leaving the engine OFF. 2. Lift the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information. 3. Disconnect the Crankshaft Position (CKP) sensor. 4. Measure the voltage from the CKP ignition feed circuit using the DMM *J 39200*. Does the DMM display the specified value?	B+	*Go to Step 5*	*Go to Step 8*
5	Measure the voltage between the CKP sensor ignition feed circuit and the CKP sensor ground circuit using the DMM *J 39200*. Does the DMM display the specified value?	B+	*Go to Step 6*	*Go to Step 9*

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DTC P0335 Crankshaft Position (CKP) Sensor Circuit (cont'd)

Step	Action	Value(s)	Yes	No
6	Momentarily connect the test lamp *J 34142-B* between the CKP sensor signal circuit and the CKP sensor ignition feed circuit. Does the fuel pump operate when ignition voltage was applied to the CKP sensor signal circuit?	—	*Go to Step 11*	*Go to Step 7*
7	**Important:** Use the connector test adapter kit *J 35616-A* when probing the PCM connectors. Refer to *Using Connector Test Adapters* in Wiring Systems. 1. Re-connect the CKP sensor. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Jumper the CKP B+ supply circuit at the PCM harness connector to the battery positive voltage terminal using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. 4. Jumper the CKP ground circuit at the PCM harness connector to the battery ground terminal. 5. Probe the CKP sensor signal circuit with the DMM *J 39200* set to the 40V AC scale. 6. Crank the engine. Is the voltage within the specified range?	4.0–6.0V	*Go to Step 15*	*Go to Step 10*
8	1. Test for an open or a short to ground in the CKP ignition feed circuit. Refer to *Circuit Testing* in Wiring Systems. 2. If you find an open or a short to ground, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 16*	*Go to Step 15*
9	1. Test for an open or a poor connection in the CKP ground circuit. Refer to *Testing for Continuity* or *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find an open or poor connection, repair the condition as necessary. Refer to *Wiring Repairs* or *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 16*	*Go to Step 15*
10	1. Test the CKP sensor signal circuit for the following: • An open • A short to ground • A short to voltage 2. If you find a concern with the signal circuit, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 16*	*Go to Step 11*

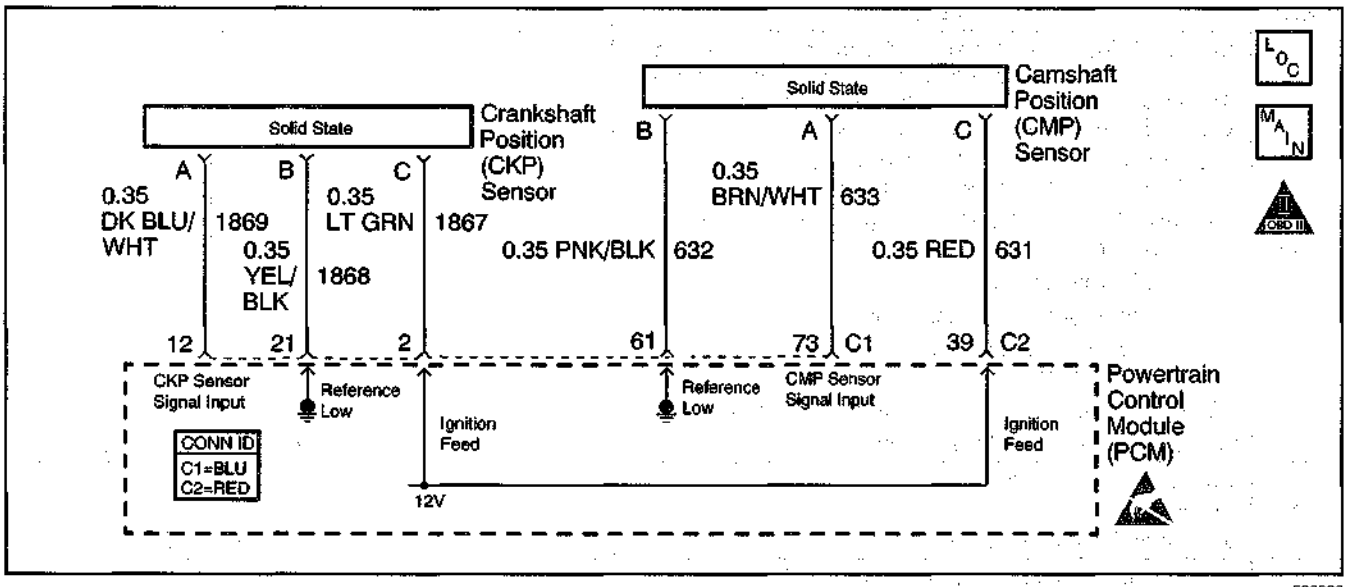
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DTC P0335 Crankshaft Position (CKP) Sensor Circuit (cont'd)

Step	Action	Value(s)	Yes	No
11	**Important:** The CKP System Variation Learn Procedure must be performed anytime the relationship between the CKP sensor and the CKP reluctor wheel is changed. Refer to *CKP System Variation Learn Procedure*. 1. Remove the CKP sensor. Refer to *Crankshaft Position (CKP) Sensor Replacement*. 2. Visually inspect the CKP Sensor for the following conditions: • Physical damage • Loose or improper installation • Wiring routed too closely to secondary ignition components 3. If a condition is located, repair as necessary. Did you find and correct the condition?	—	*Go to Step 16*	*Go to Step 12*
12	Visually inspect the CKP sensor reluctor wheel for damage. Did you find and correct the condition?	—	*Go to Step 16*	*Go to Step 13*
13	1. Inspect for poor connections at the CKP sensor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 16*	*Go to Step 14*
14	1. Replace the CKP Sensor. Refer to *Crankshaft Position (CKP) Sensor Replacement*. 2. Perform the CKP System Variation Learn Procedure. Refer to *CKP System Variation Learn Procedure*. Is the action complete?	—	*Go to Step 16*	—
15	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 16*	—
16	1. Select the Diagnostic Trouble Codes (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Specific DTC option under the Diagnostic Trouble Code (DTC) option using a scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test passed?	—	*Go to Step 17*	*Go to Step 2*
17	Select the Capture Info option and the Review Info option using the scan tool. Are any DTCs displayed that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0336 Crankshaft Position (CKP) Sensor Performance



Circuit Description

The Crankshaft Position Sensor is mounted in the right rear of the engine block behind the starter. The CKP sensor works in conjunction with a 24X reluctor wheel mounted on the rear of the crankshaft. The CKP sensor has a B+ power supply, a ground, and a signal circuit.

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

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

The PCM determines that the CKP sensor signal is out of range for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The following conditions may cause this DTC to set:

- Poor connections: Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
- Crankshaft reluctor wheel damage or improper installation.
- The sensor coming in contact with the reluctor wheel.
- The engine running out of fuel.
- If the crankshaft rotates backwards, this DTC will set. This condition is only with vehicles equipped with a manual transmission. This condition can occur when a vehicle is on an incline and the clutch is released and an engine stall occurs.

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Excess crankshaft end play causes the CKP sensor reluctor wheel to move out of alignment with the CKP sensor. This could result in any one of the following:

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

For an intermittent, refer to *Symptoms*.

Test Description

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

2. This step verifies that the malfunction is present.
3. This step tests for EMI (Electro Magnetic Interference) on the CKP sensor circuits.
6. Vertical lines across the face of the sensor could indicate foreign material passing between the CKP sensor and the reluctor wheel. Non vertical lines across the face of the sensor may indicate a crack in the CKP sensor. Either of these conditions causes this DTC to set.
7. Damage to the reluctor wheel would affect the CKP sensor output. To inspect the reluctor wheel, remove the starter and rotate the crankshaft while viewing the reluctor wheel through the CKP sensor hole. If you cannot determine if the reluctor wheel is damaged, the oil pan may have to be removed. If this condition exist, refer to Engine Mechanical for crankshaft replacement.

DTC P0336 Crankshaft Position (CKP) Sensor Performance

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	**Important:** If DTC P0335 is also set, diagnose DTC P0335 before proceeding with this DTC. 1. Install a scan tool. 2. Idle the engine for 2 minutes. Does the scan tool indicate that DTC P0336 failed this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	1. Visually/physically inspect all circuits going to the Crankshaft Position sensor for the following: • Routed too close to secondary ignition wires or components • Routed too close to after-market add on electrical equipment • Routed too close to solenoids, relays and motors. 2. If you find incorrect routing, correct the harness routing. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 4*
4	1. Inspect for a poor connection at the CKP sensor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 5*
5	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 6*

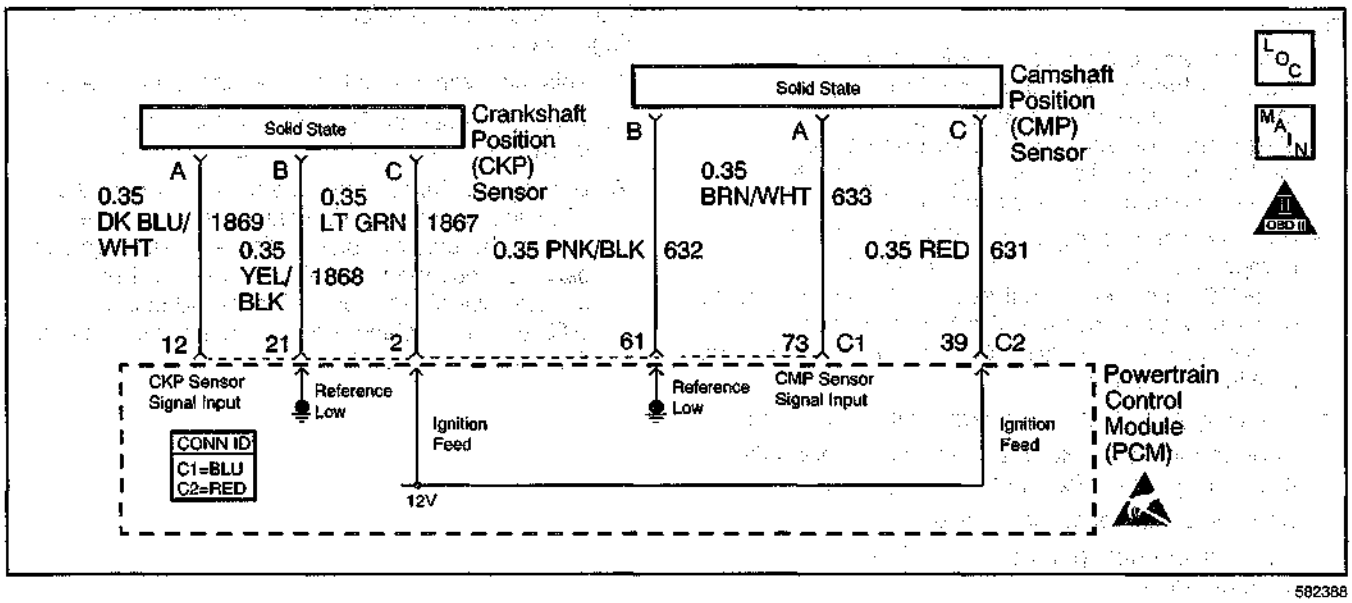
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DTC P0336 Crankshaft Position (CKP) Sensor Performance (cont'd)

Step	Action	Value(s)	Yes	No
6	**Important:** The CKP System Variation Learn Procedure must be preformed anytime the relationship between the CKP sensor and the CKP reluctor wheel is changed. Refer to *CKP System Variation Learn Procedure.* 1. Remove the CKP sensor. Refer to *Crankshaft Position (CKP) Sensor Replacement.* 2. Inspect the CKP sensor for signs of damage. Is the CKP sensor damaged?	—	Go to *Crankshaft and Bearings Removal* in Engine Mechanical–5.7L	*Go to Step 7*
7	Inspect the crankshaft reluctor wheel for damage. Is the reluctor wheel damaged?	—	Go to *Crankshaft and Bearings Removal* in Engine Mechanical–5.7L	*Go to Step 8*
8	1. Replace the CKP Sensor. Refer to *Crankshaft Position (CKP) Sensor Replacement.* 2. Perform the *CKP System Variation Learn Procedure.* Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0341 Camshaft Position (CMP) Sensor Performance



Circuit Description

The Camshaft Position (CMP) sensor is mounted through the top of the engine block at the rear of the valley cover. The CMP sensor works in conjunction with a 1X reluctor wheel on the camshaft. The reluctor wheel is inside the engine immediately in front of the rear cam bearing. The PCM provides a 12 volt power supply to the CMP sensor as well as a ground and a signal circuit.

The CMP sensor determines whether a cylinder is on a firing stroke or on an exhaust stroke. As the camshaft rotates, the reluctor wheel interrupts a magnetic field produced by a magnet within the sensor. The sensors internal circuitry detects this and produces a signal which the PCM reads. The PCM uses this 1X signal in combination with the Crankshaft Position (CKP) sensor 24X signal in order to determine crankshaft position and stroke. This diagnostic monitors for a loss of Camshaft Position sensor signal.

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

Conditions for Running the DTC

The engine speed is less than 4,000 RPM.

Conditions for Setting the DTC

The PCM detects that a CMP to CKP mis-match has occurred for 10 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The following conditions may cause this DTC to set:

- Poor connections: Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
- Camshaft reluctor wheel damage.
- The sensor coming in contact with the reluctor wheel.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. This step verifies that the malfunction is present.
3. This step tests for EMI (Electro Magnetic Interference) on the CMP sensor circuits.
6. Damage to the reluctor wheel would affect the CMP sensor output. Vertical lines across the face of the sensor could indicate foreign material passing between the CMP sensor and the reluctor wheel. This condition would cause this DTC to set. Replace the CMP sensor if damage to the sensor is evident.

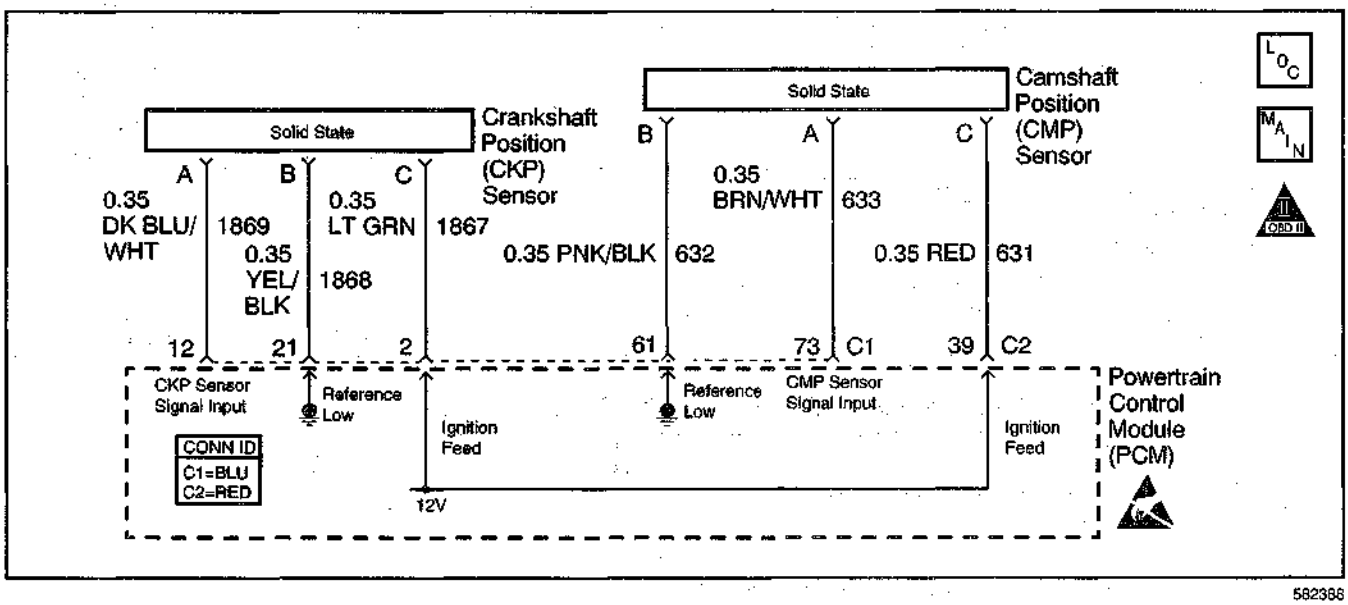
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DTC P0341 Camshaft Position (CMP) Sensor Performance

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	**Important:** If there are any other CMP DTCs set, diagnose those DTCs first. 1. Install a scan tool. 2. Idle the engine for 2 minutes. Does the scan tool indicate that DTC P0341 failed this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	1. Visually/Physically inspect all circuits going to the Camshaft Position sensor for the following: • Routed too close to secondary ignition wires or components • Routed too close to after–market add on electrical equipment • Routed too close to solenoids, relays and motors 2. If you find incorrect routing, correct the harness routing Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 4*
4	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 5*
5	1. Remove the intake manifold. Refer to *Intake Manifold Replacement* in Engine Mechanical 5.7L. 2. Inspect for a poor connection at the CMP sensor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 3. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 6*
6	1. Remove the CMP sensor. Refer to *Camshaft Position (CMP) Sensor Replacement.* 2. Inspect the CMP reluctor wheel for damage. Is the CMP reluctor wheel damaged?	—	Go to *Camshaft Replacement* in Engine Mechanical 5.7L	*Go to Step 7*
7	Replace the CMP sensor. Refer to *Camshaft Position (CMP) Sensor Replacement.* Is the action complete?	—	*Go to Step 8*	—
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0342 Camshaft Position (CMP) Sensor Circuit Low Voltage



Circuit Description

The Camshaft Position sensor is mounted through the top of the engine block at the rear of the valley cover. The CMP sensor works in conjunction with a 1X reluctor wheel on the camshaft. The reluctor wheel is inside the engine immediately in front of the rear cam bearing. The PCM provides a 12 volt power supply to the CMP sensor as well as a ground and a signal circuit.

The CMP sensor determines whether a cylinder is on a firing stroke or on an exhaust stroke. As the camshaft rotates, the reluctor wheel interrupts a magnetic field produced by a magnet within the sensor. The sensors internal circuitry detects this and produces a signal which the PCM reads. The PCM uses this 1X signal in combination with the Crankshaft Position sensor 24X signal in order to determine crankshaft position and stroke. This diagnostic monitors for a loss of Camshaft Position sensor signal.

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

Conditions for Running the DTC

The engine speed is less than 4,000 RPM.

Conditions for Setting the DTC

The PCM detects the Cam signal is stuck low when the signal should be high for 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

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The following may cause this DTC to set:

- Poor connections/terminal tension at the sensor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
- Camshaft reluctor wheel damage
- The sensor coming in contact with the reluctor wheel

For an intermittent, refer to *Symptoms*.

Test Description

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

2. This step verifies that the fault is present.
4. If the duty cycle is present at the PCM connector, the Camshaft Position sensor B+ reference and ground circuits are OK.
5. This step tests the Camshaft Position sensor B+ reference circuit.
6. This step tests the Camshaft Position sensor ground circuit.
9. This step tests for a short to B+ on the Camshaft Position sensor signal circuit.
10. This step tests for a short to ground on the Camshaft Position sensor signal circuit.

DTC P0342 Camshaft Position (CMP) Sensor Circuit Low Voltage

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	1. Install a scan tool. 2. Idle the engine. 3. Monitor the CAM signal input - High to Low transition in the Engine Data List 1 using the scan tool. Does the scan tool parameter increment?	—	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition with the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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 Setting the DTC. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Disconnect both PCM connectors. Refer to *PCM Replacement/Programming*. 2. Jumper the Camshaft Position sensor ground circuit at the PCM connector C1 (sensor side) to a known good ground. 3. Jumper the Camshaft Position sensor ignition feed circuit at the PCM connector C2 (sensor side) to B+ using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. 4. Measure the duty cycle from the Camshaft Position sensor signal circuit with the *J 39200* DMM. 5. Crank the engine. Does the DMM display a duty cycle within the specified range while cranking the engine?	45–55%	*Go to Step 17*	*Go to Step 5*

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DTC P0342 Camshaft Position (CMP) Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Reconnect the PCM connectors. Refer to *PCM Replacement/Programming*. 3. Remove the intake manifold in order to gain access to the Camshaft Position sensor. Refer to *Intake Manifold Replacement* in Engine Mechanical 5.7L. 4. Disconnect the Camshaft Position sensor electrical connector. 5. Turn ON the ignition with the engine OFF. 6. Measure the voltage from the Camshaft Position sensor B+ supply circuit to the battery ground with the DMM. Does the DMM display the specified voltage?	B+	*Go to Step 6*	*Go to Step 8*
6	Measure the voltage from the Camshaft Position sensor B+ supply circuit to the Camshaft Position sensor ground circuit with the DMM. Does the DMM display the specified voltage?	B+	*Go to Step 9*	*Go to Step 7*
7	Test for an open in the Camshaft Position sensor ground circuit. Refer to *Testing for Continuity* in Wiring Systems. Did you find an open ground circuit?	—	*Go to Step 13*	*Go to Step 17*
8	Test for an open or a short to ground in the Camshaft Position sensor B+ reference circuit. Refer to *Circuit Testing* in Wiring Systems. Did you find the circuit open or shorted to a ground?	—	*Go to Step 12*	*Go to Step 17*
9	1. Turn ON the ignition with the engine OFF. 2. Measure the voltage at the Camshaft Position sensor signal circuit to ground with the DMM. Is the voltage less than the specified value?	1V	*Go to Step 10*	*Go to Step 14*
10	Probe the CMP signal circuit with the test lamp *J 34142-B* connected to battery voltage. Does the test lamp illuminate?	—	*Go to Step 15*	*Go to Step 11*
11	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the continuity of the Camshaft Position sensor signal circuit with the DMM. Refer to *Testing for Continuity* in Wiring Systems. Is the resistance less than the specified value?	2Ω	*Go to Step 18*	*Go to Step 16*
12	Repair the open or short to ground in the Camshaft Position sensor B+ reference circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
13	Repair the open in the Camshaft Position sensor ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
14	Repair the short to voltage in the Camshaft Position sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
15	Repair the short to ground in the Camshaft Position sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
16	Repair the open in the Camshaft Position sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—

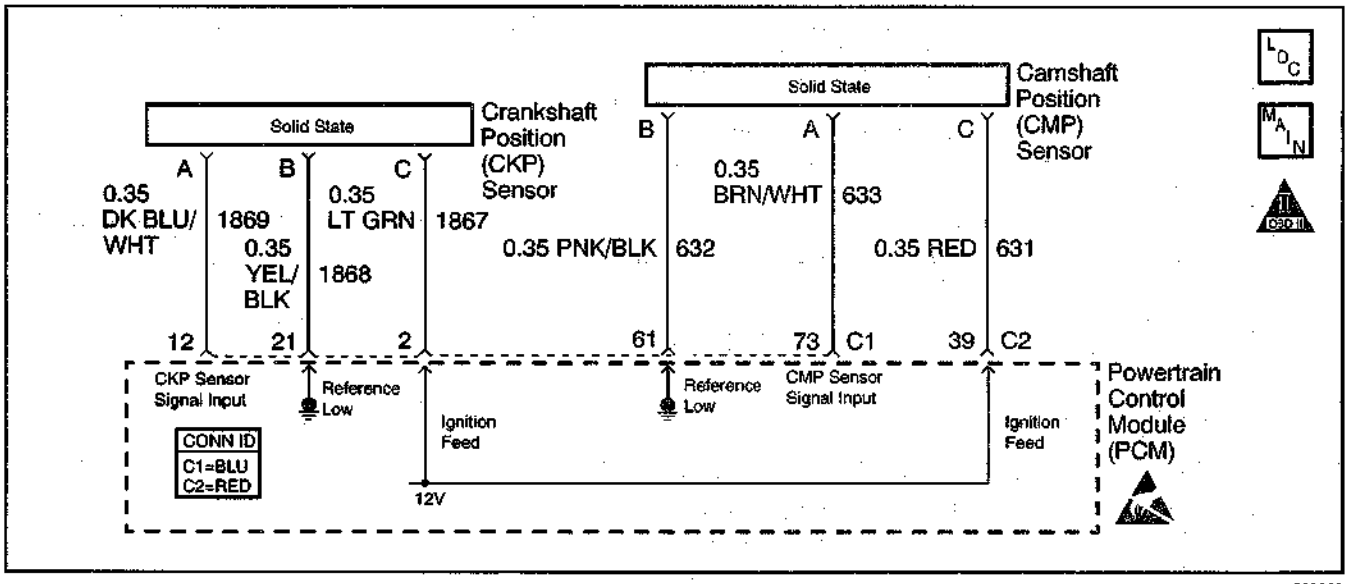
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DTC P0342 Camshaft Position (CMP) Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
17	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 20*	*Go to Step 19*
18	Replace the Camshaft Position sensor. Refer to *Camshaft Position (CMP) Sensor Replacement.* Is the action complete?	—	*Go to Step 20*	—
19	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 20*	—
20	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 21*	*Go to Step 2*
21	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC Table	System OK

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DTC P0343 Camshaft Position (CMP) Sensor Circuit High Voltage



582388

Circuit Description

The Camshaft Position sensor is mounted through the top of the engine block at the rear of the valley cover. The CMP sensor works in conjunction with a 1X reluctor wheel on the camshaft. The reluctor wheel is inside the engine immediately in front of the rear cam bearing. The PCM provides a 12 volt power supply to the CMP sensor as well as a ground and a signal circuit.

The CMP sensor determines whether a cylinder is on a firing stroke or on an exhaust stroke. As the camshaft rotates, the reluctor wheel interrupts a magnetic field produced by a magnet within the sensor. The sensors internal circuitry detects this and produces a signal which the PCM reads. The PCM uses this 1X signal in combination with the Crankshaft Position sensor 24X signal in order to determine crankshaft position and stroke. This diagnostic monitors for a loss of Camshaft Position sensor signal.

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

Conditions for Running the DTC

The engine speed is less than 4,000 RPM.

Conditions for Setting the DTC

The PCM detects the Cam signal is stuck high when the signal should be low for 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

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The following conditions may cause this DTC to set:

- Poor connections/terminal tension at the sensor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
- Camshaft reluctor wheel damage
- The sensor coming in contact with the reluctor wheel

For an intermittent, refer to *Symptoms.*

Test Description

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

2. This step verifies that the fault is present.
4. If the duty cycle is present at the PCM connector, the Camshaft Position sensor B+ reference and ground circuits are OK.
5. This step tests the Camshaft Position sensor B+ reference circuit.
6. This step tests the Camshaft Position sensor ground circuit.
9. This step tests for a short to B+ on the Camshaft Position sensor signal circuit.
10. This step tests for a short to ground on the Camshaft Position sensor signal circuit.

DTC P0343 Camshaft Position (CMP) Sensor Circuit High Voltage

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	1. Install a scan tool. 2. Idle the engine. 3. Monitor the CAM signal input - High to Low transition in the Engine Data List 1 using the scan tool. Does the scan tool parameter increment?	—	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition with the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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 Setting the DTC. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Disconnect both PCM connectors. Refer to *PCM Replacement/Programming.* 2. Jumper the Camshaft Position sensor ground circuit at the PCM connector C1 (sensor side) to a known good ground. 3. Jumper the Camshaft Position sensor ignition feed circuit at the PCM connector C2 (sensor side) to B+ using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. 4. Measure the duty cycle from the Camshaft Position sensor signal circuit with the *J 39200* DMM. 5. Crank the engine. Does the DMM display a duty cycle within the specified range while cranking the engine?	45–55%	*Go to Step 17*	*Go to Step 5*

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DTC P0343 Camshaft Position (CMP) Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Reconnect the PCM connectors. Refer to *PCM Replacement/Programming*. 3. Remove the intake manifold in order to gain access to the Camshaft Position sensor. Refer to *Intake Manifold Replacement* in Engine Mechanical 5.7L. 4. Disconnect the Camshaft Position sensor electrical connector. 5. Turn ON the ignition with the engine OFF. 6. Measure the voltage from the Camshaft Position sensor B+ supply circuit to the battery ground with the DMM. Does the DMM display the specified voltage?	B+	*Go to Step 6*	*Go to Step 8*
6	Measure the voltage from the Camshaft Position sensor B+ supply circuit to the Camshaft Position sensor ground circuit with the DMM. Does the DMM display the specified voltage?	B+	*Go to Step 9*	*Go to Step 7*
7	Test for an open in the Camshaft Position sensor ground circuit. Refer to *Testing for Continuity* in Wiring Systems. Did you find an open ground circuit?	—	*Go to Step 13*	*Go to Step 17*
8	Test for an open or a short to ground in the Camshaft Position sensor B+ reference circuit. Refer to *Circuit Testing* in Wiring Systems. Did you find the circuit open or shorted to a ground?	—	*Go to Step 12*	*Go to Step 17*
9	1. Turn ON the ignition with the engine OFF. 2. Measure the voltage at the Camshaft Position sensor signal circuit to ground with the DMM. Is the voltage less than the specified value?	1V	*Go to Step 10*	*Go to Step 14*
10	Probe the CMP signal circuit with the test lamp *J 34142-B* connected to battery voltage. Does the test lamp illuminate?	—	*Go to Step 15*	*Go to Step 11*
11	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the continuity of the Camshaft Position sensor signal circuit with the DMM. Refer to *Testing for Continuity* in Wiring Systems. Is the resistance less than the specified value?	2Ω	*Go to Step 18*	*Go to Step 16*
12	Repair the open or short to ground in the Camshaft Position sensor B+ reference circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
13	Repair the open in the Camshaft Position sensor ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
14	Repair the short to voltage in the Camshaft Position sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
15	Repair the short to ground in the Camshaft Position sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
16	Repair the open in the Camshaft Position sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—

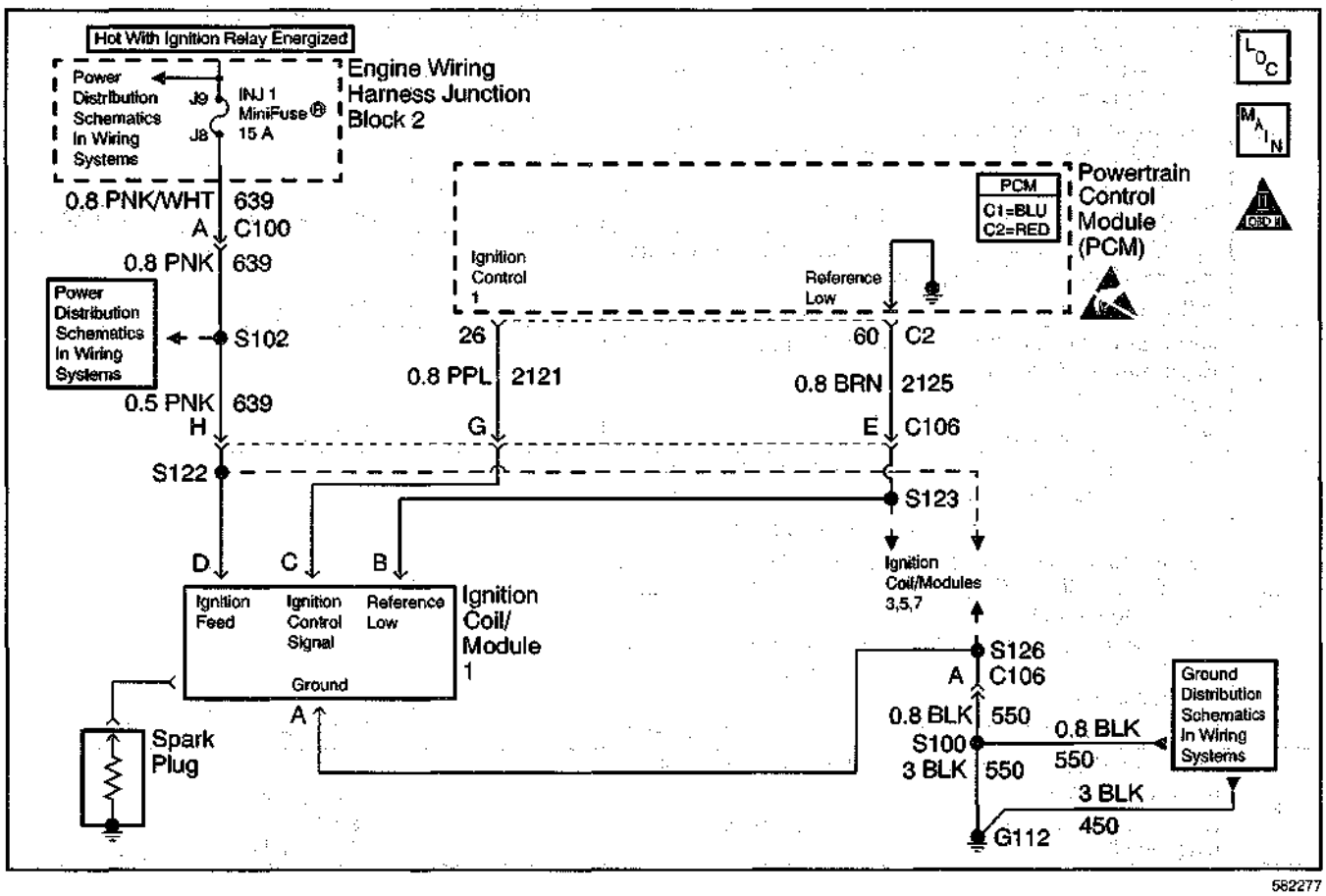
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DTC P0343 Camshaft Position (CMP) Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
17	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 20*	*Go to Step 19*
18	Replace the Camshaft Position sensor. Refer to *Camshaft Position (CMP) Sensor Replacement.* Is the action complete?	—	*Go to Step 20*	—
19	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 20*	—
20	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 21*	*Go to Step 2*
21	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC Table	System OK

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DTC P0351 Ignition Coil 1 Control Circuit



582277

Circuit Description

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

- A power feed
- A ground circuit
- An ignition control (IC) circuit
- A reference low circuit

Sequencing and timing are PCM controlled. This DTC sets when the IC circuit is out of range.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

- The PCM detects the ignition control circuit is grounded, open or shorted to a voltage.
- All conditions met for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step verifies that the fault is present.
4. This step verifies the integrity of the ignition control circuit and the PCM output.
5. This step tests for a short to ground on the ignition control circuit.

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DTC P0351 Ignition Coil 1 Control Circuit

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	**Important:** If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits or the B+ circuits for an open. 1. Install a scan tool. 2. Idle the engine. 3. Monitor the (IC) Ignition Control status for the cylinder with the ignition control DTC using the scan tool in the Misfire Data List. Does the scan tool indicate Fault?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the engine. 2. Disconnect the ignition coil/module electrical connector. 3. Measure the frequency at the ignition control signal circuit using the DMM on the DC Hertz setting. Refer to *Measuring Frequency* in Wiring Systems. 4. Idle the engine. Is the frequency within the specified range?	3.0–20 Hz	*Go to Step 8*	*Go to Step 5*
5	Measure the voltage at the ignition control signal circuit using the DMM. Is the voltage greater than the specified value?	1V	*Go to Step 14*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity from the IC circuit (at the ignition coil/module electrical connector) to the PCM connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 15*
7	Test the resistance from the IC circuit (at the ignition coil/module electrical connector) to ground using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate OL?	—	*Go to Step 16*	*Go to Step 15*

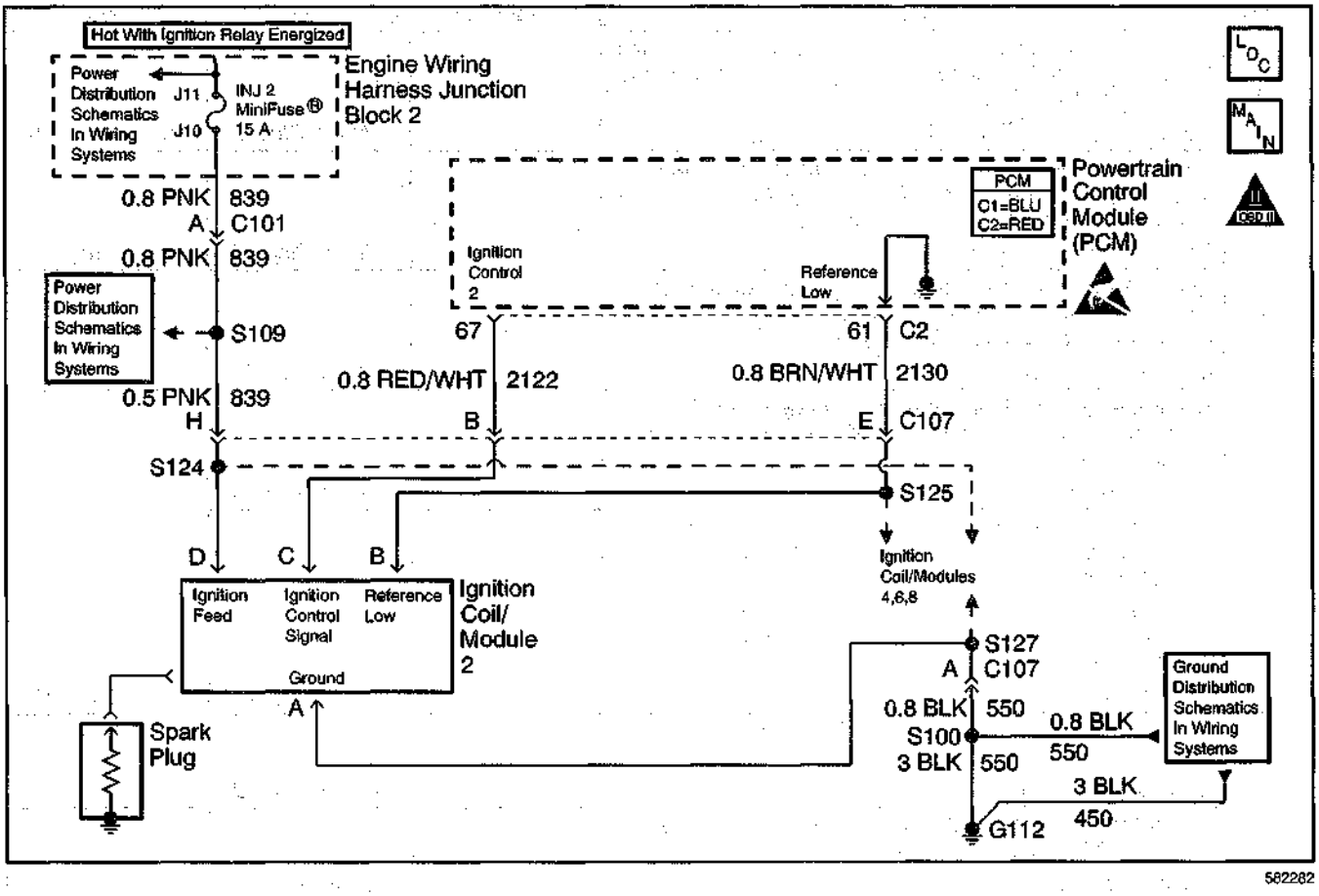
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DTC P0351 Ignition Coil 1 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	Probe the Ignition feed circuit for the coil/module using the test lamp *J 34142-B* connected to battery ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 10*
9	Probe the ground circuit for the coil/module using the test lamp *J 34142-B* connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 12*	*Go to Step 11*
10	Repair the Ignition feed circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
11	Repair the ground circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	1. Inspect for a poor connection at the coil/module. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 13*
13	Replace the ignition coil/module. Refer to *Ignition Coil Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 18*	—
14	Repair the Ignition Control circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the Ignition Control circuit for an open or grounded circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0352 Ignition Coil 2 Control Circuit



582282

Circuit Description

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

- A power feed
- A ground circuit
- An ignition control (IC) circuit
- A reference low circuit

Sequencing and timing are PCM controlled. This DTC sets when the IC circuit is out of range.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

- The PCM detects the ignition control circuit is grounded, open or shorted to a voltage.
- All conditions met for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step verifies that the fault is present.
4. This step verifies the integrity of the ignition control circuit and the PCM output.
5. This step tests for a short to ground on the ignition control circuit.

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DTC P0352 Ignition Coil 2 Control Circuit

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	**Important:** If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits or the B+ circuits for an open. 1. Install a scan tool. 2. Idle the engine. 3. Monitor the (IC) Ignition Control status for the cylinder with the ignition control DTC using the scan tool in the Misfire Data List. Does the scan tool indicate Fault?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the engine. 2. Disconnect the ignition coil/module electrical connector. 3. Measure the frequency at the ignition control signal circuit using the DMM on the DC Hertz setting. Refer to *Measuring Frequency* in Wiring Systems. 4. Idle the engine. Is the frequency within the specified range?	3.0–20 Hz	*Go to Step 8*	*Go to Step 5*
5	Measure the voltage at the ignition control signal circuit using the DMM. Is the voltage greater than the specified value?	1V	*Go to Step 14*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity from the IC circuit (at the ignition coil/module electrical connector) to the PCM connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 15*
7	Test the resistance from the IC circuit (at the ignition coil/module electrical connector) to ground using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate OL?	—	*Go to Step 16*	*Go to Step 15*

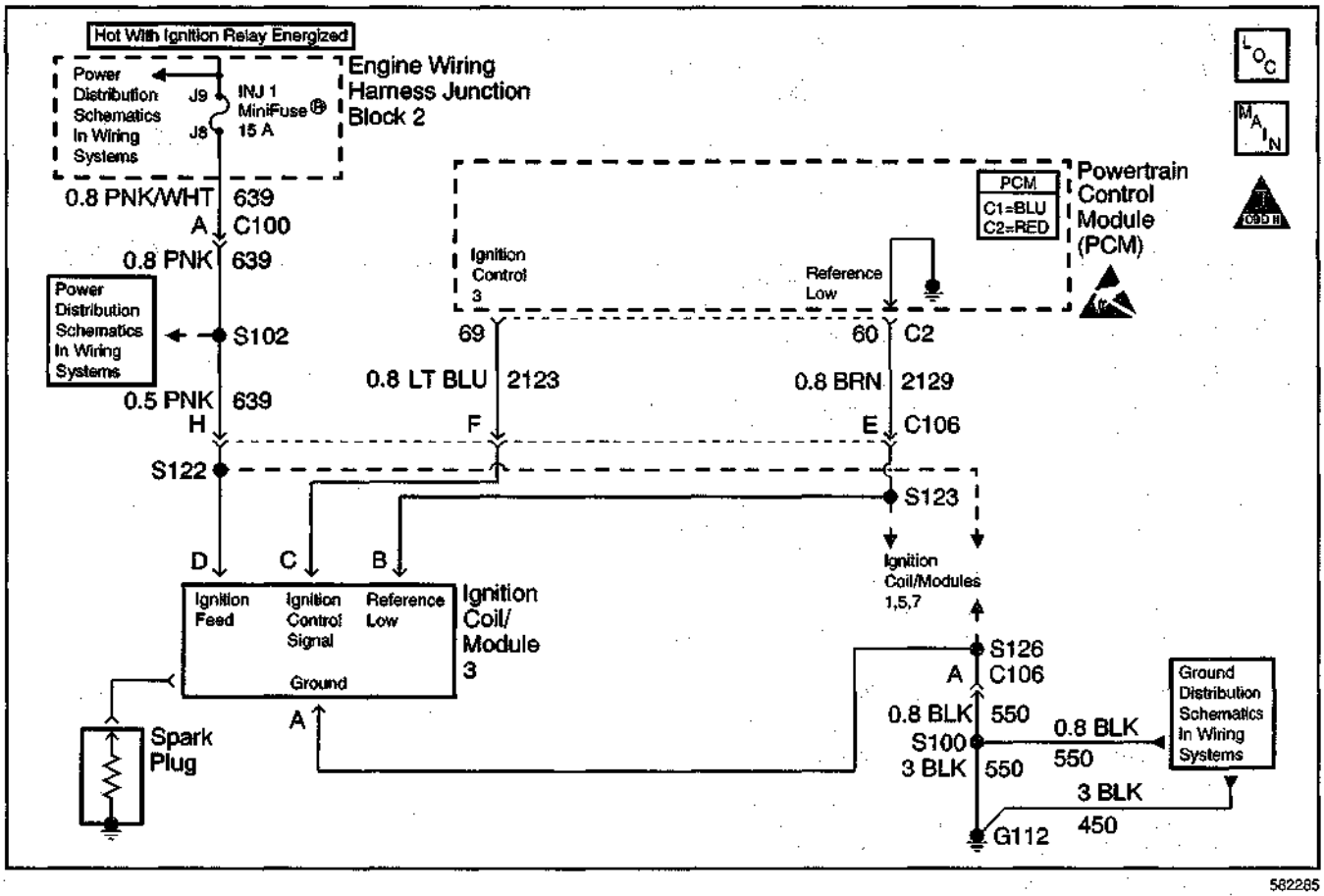
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DTC P0352 Ignition Coil 2 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	Probe the Ignition feed circuit for the coil/module using the test lamp *J 34142-B* connected to battery ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 10*
9	Probe the ground circuit for the coil/module using the test lamp *J 34142-B* connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 12*	*Go to Step 11*
10	Repair the Ignition feed circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
11	Repair the ground circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	1. Inspect for a poor connection at the coil/module. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 13*
13	Replace the ignition coil/module. Refer to *Ignition Coil Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 18*	—
14	Repair the Ignition Control circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the Ignition Control circuit for an open or grounded circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0353 Ignition Coil 3 Control Circuit



582285

Circuit Description

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

- A power feed
- A ground circuit
- An ignition control (IC) circuit
- A reference low circuit

Sequencing and timing are PCM controlled. This DTC sets when the IC circuit is out of range.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

- The PCM detects the ignition control circuit is grounded, open or shorted to a voltage.
- All conditions met for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step verifies that the fault is present.
4. This step verifies the integrity of the ignition control circuit and the PCM output.
5. This step tests for a short to ground on the ignition control circuit.

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DTC P0353 Ignition Coil 3 Control Circuit

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	**Important:** If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits or the B+ circuits for an open. 1. Install a scan tool. 2. Idle the engine. 3. Monitor the (IC) Ignition Control status for the cylinder with the ignition control DTC using the scan tool in the Misfire Data List. Does the scan tool indicate Fault?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the engine. 2. Disconnect the ignition coil/module electrical connector. 3. Measure the frequency at the ignition control signal circuit using the DMM on the DC Hertz setting. Refer to *Measuring Frequency* in Wiring Systems. 4. Idle the engine. Is the frequency within the specified range?	3.0–20 Hz	*Go to Step 8*	*Go to Step 5*
5	Measure the voltage at the ignition control signal circuit using the DMM. Is the voltage greater than the specified value?	1V	*Go to Step 14*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity from the IC circuit (at the ignition coil/module electrical connector) to the PCM connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 15*
7	Test the resistance from the IC circuit (at the ignition coil/module electrical connector) to ground using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate OL?	—	*Go to Step 16*	*Go to Step 15*

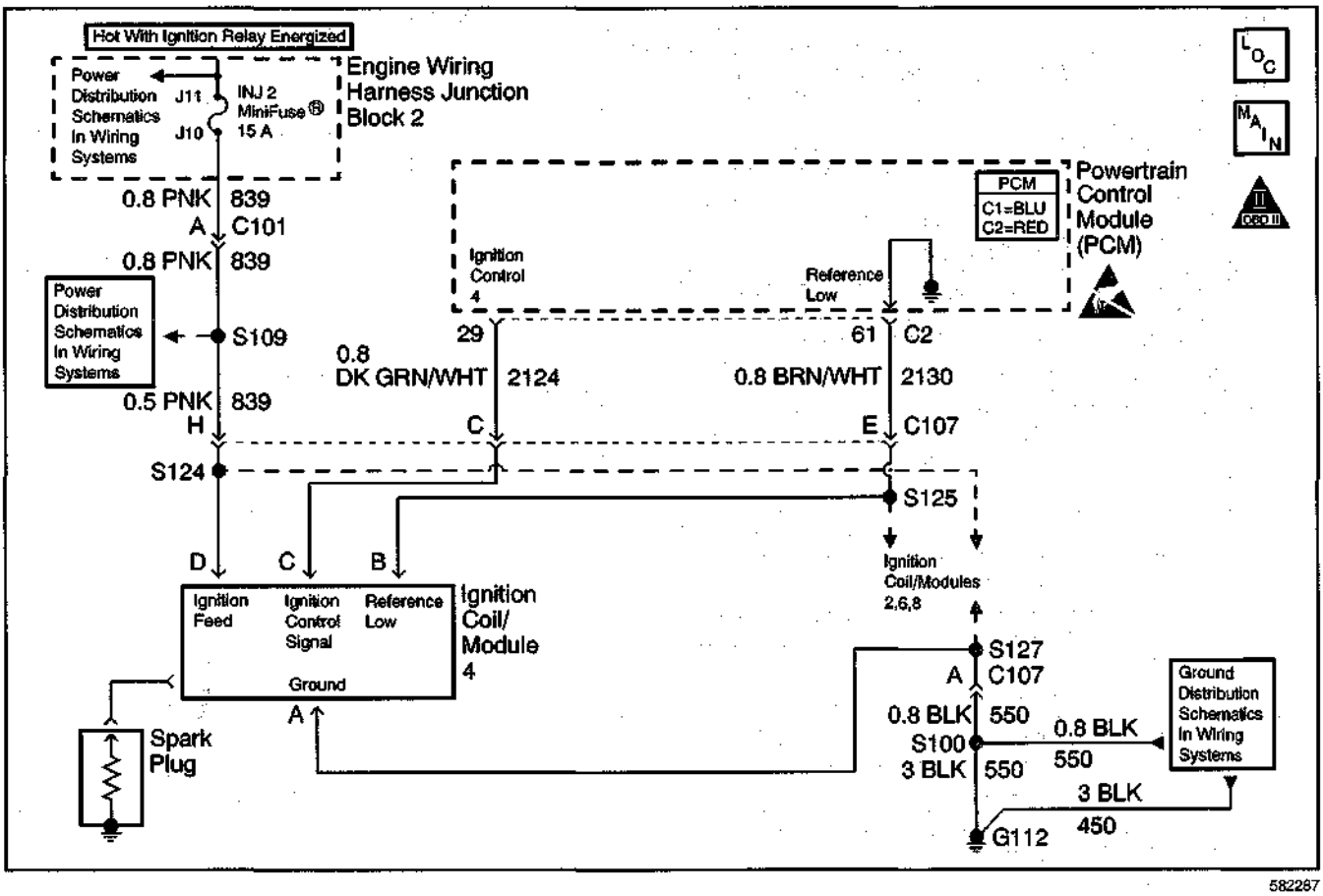
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DTC P0353 Ignition Coil 3 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	Probe the Ignition feed circuit for the coil/module using the test lamp *J 34142-B* connected to battery ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 10*
9	Probe the ground circuit for the coil/module using the test lamp *J 34142-B* connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 12*	*Go to Step 11*
10	Repair the Ignition feed circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
11	Repair the ground circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	1. Inspect for a poor connection at the coil/module. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 13*
13	Replace the ignition coil/module. Refer to *Ignition Coil Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 18*	—
14	Repair the Ignition Control circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the Ignition Control circuit for an open or grounded circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0354 Ignition Coil 4 Control Circuit



582287

Circuit Description

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

- A power feed
- A ground circuit
- An ignition control (IC) circuit
- A reference low circuit

Sequencing and timing are PCM controlled. This DTC sets when the IC circuit is out of range.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

- The PCM detects the ignition control circuit is grounded, open or shorted to a voltage.
- All conditions met for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step verifies that the fault is present.
4. This step verifies the integrity of the ignition control circuit and the PCM output.
5. This step tests for a short to ground on the ignition control circuit.

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DTC P0354 Ignition Coil 4 Control Circuit

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	**Important:** If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits or the B+ circuits for an open. 1. Install a scan tool. 2. Idle the engine. 3. Monitor the (IC) Ignition Control status for the cylinder with the ignition control DTC using the scan tool in the Misfire Data List. Does the scan tool indicate Fault?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the engine. 2. Disconnect the ignition coil/module electrical connector. 3. Measure the frequency at the ignition control signal circuit using the DMM on the DC Hertz setting. Refer to *Measuring Frequency* in Wiring Systems. 4. Idle the engine. Is the frequency within the specified range?	3.0–20 Hz	*Go to Step 8*	*Go to Step 5*
5	Measure the voltage at the ignition control signal circuit using the DMM. Is the voltage greater than the specified value?	1V	*Go to Step 14*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity from the IC circuit (at the ignition coil/module electrical connector) to the PCM connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 15*
7	Test the resistance from the IC circuit (at the ignition coil/module electrical connector) to ground using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate OL?	—	*Go to Step 16*	*Go to Step 15*

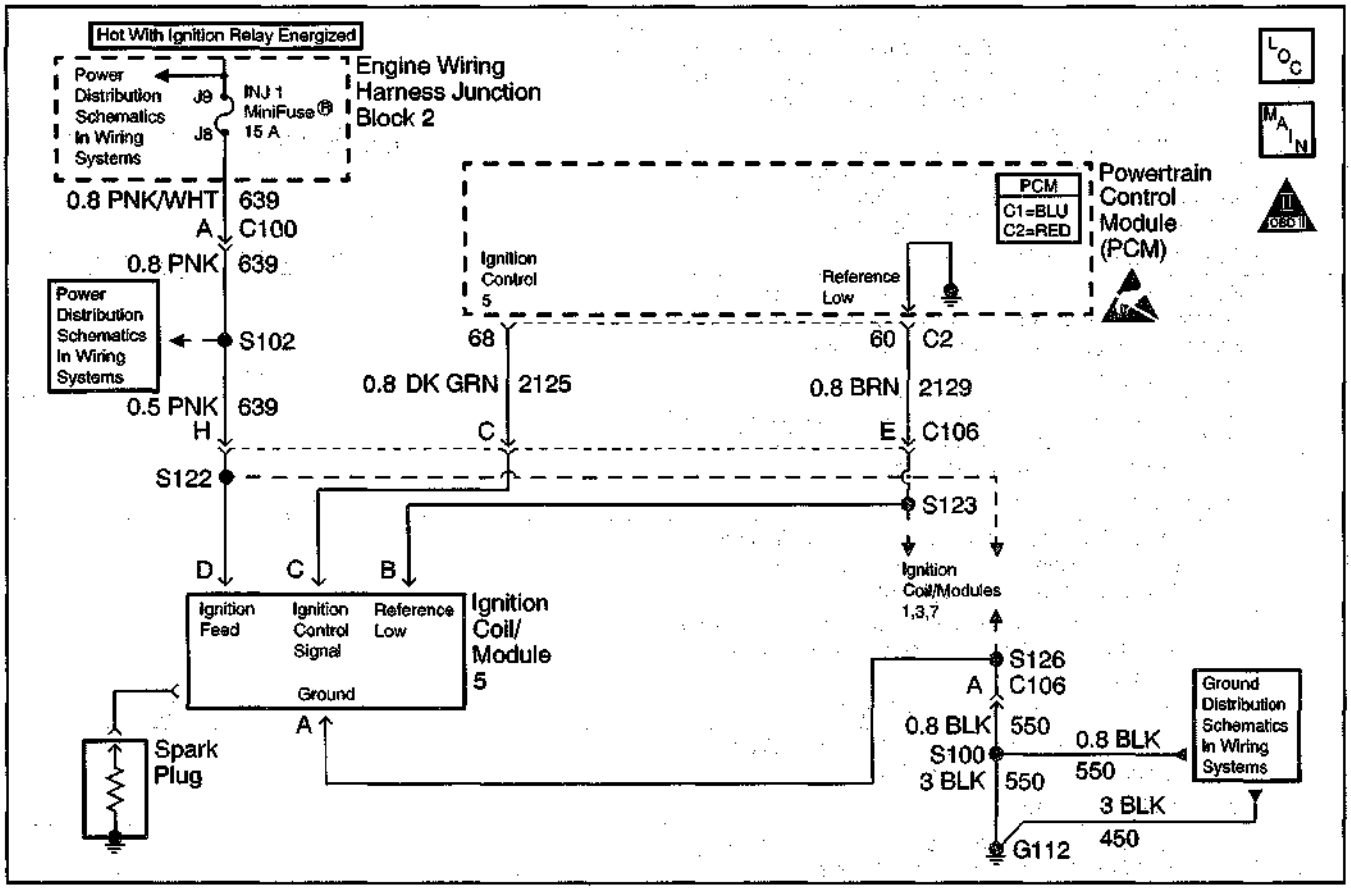
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DTC P0354 Ignition Coil 4 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	Probe the Ignition feed circuit for the coil/module using the test lamp *J 34142-B* connected to battery ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 10*
9	Probe the ground circuit for the coil/module using the test lamp *J 34142-B* connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 12*	*Go to Step 11*
10	Repair the Ignition feed circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
11	Repair the ground circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	1. Inspect for a poor connection at the coil/module. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 13*
13	Replace the ignition coil/module. Refer to *Ignition Coil Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 18*	—
14	Repair the Ignition Control circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the Ignition Control circuit for an open or grounded circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0355 Ignition Coil 5 Control Circuit



Circuit Description

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

- A power feed
- A ground circuit
- An ignition control (IC) circuit
- A reference low circuit

Sequencing and timing are PCM controlled. This DTC sets when the IC circuit is out of range.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

- The PCM detects the ignition control circuit is grounded, open or shorted to a voltage.
- All conditions met for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step verifies that the fault is present.
4. This step verifies the integrity of the ignition control circuit and the PCM output.
5. This step tests for a short to ground on the ignition control circuit.

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DTC P0355 Ignition Coil 5 Control Circuit

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	**Important:** If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits or the B+ circuits for an open. 1. Install a scan tool. 2. Idle the engine. 3. Monitor the (IC) Ignition Control status for the cylinder with the ignition control DTC using the scan tool in the Misfire Data List. Does the scan tool indicate Fault?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the engine. 2. Disconnect the ignition coil/module electrical connector. 3. Measure the frequency at the ignition control signal circuit using the DMM on the DC Hertz setting. Refer to *Measuring Frequency* in Wiring Systems. 4. Idle the engine. Is the frequency within the specified range?	3.0–20 Hz	*Go to Step 8*	*Go to Step 5*
5	Measure the voltage at the ignition control signal circuit using the DMM. Is the voltage greater than the specified value?	1V	*Go to Step 14*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity from the IC circuit (at the ignition coil/module electrical connector) to the PCM connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 15*
7	Test the resistance from the IC circuit (at the ignition coil/module electrical connector) to ground using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate OL?	—	*Go to Step 16*	*Go to Step 15*

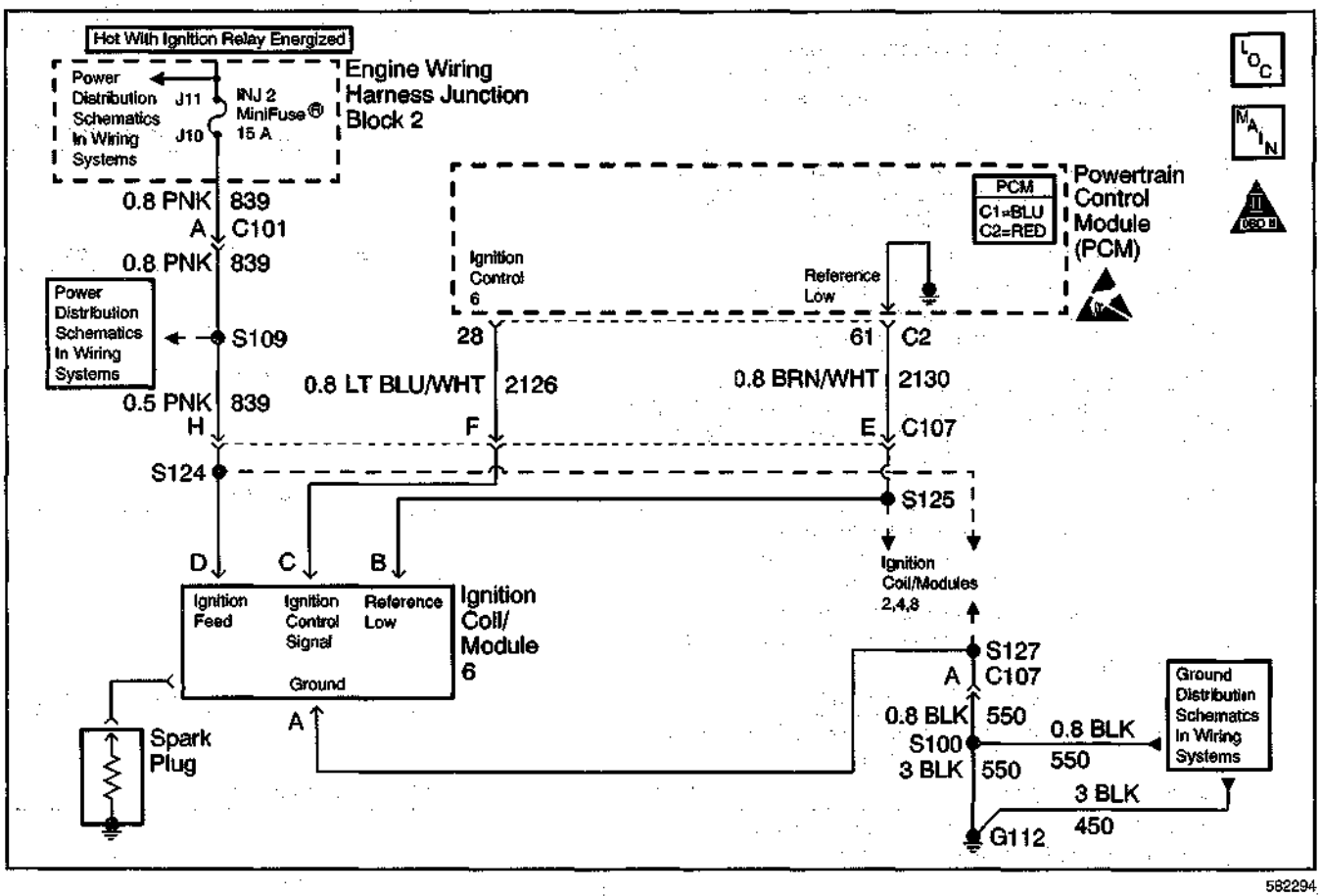
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DTC P0355 Ignition Coil 5 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	Probe the Ignition feed circuit for the coil/module using the test lamp *J 34142-B* connected to battery ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 10*
9	Probe the ground circuit for the coil/module using the test lamp *J 34142-B* connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 12*	*Go to Step 11*
10	Repair the Ignition feed circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
11	Repair the ground circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	1. Inspect for a poor connection at the coil/module. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 13*
13	Replace the ignition coil/module. Refer to *Ignition Coil Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 18*	—
14	Repair the Ignition Control circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the Ignition Control circuit for an open or grounded circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0356 Ignition Coil 6 Control Circuit



582294

Circuit Description

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

- A power feed
- A ground circuit
- An ignition control (IC) circuit
- A reference low circuit

Sequencing and timing are PCM controlled. This DTC sets when the IC circuit is out of range.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

- The PCM detects the ignition control circuit is grounded, open or shorted to a voltage.
- All conditions met for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step verifies that the fault is present.
4. This step verifies the integrity of the ignition control circuit and the PCM output.
5. This step tests for a short to ground on the ignition control circuit.

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DTC P0356 Ignition Coil 6 Control Circuit

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	**Important: If** all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits or the B+ circuits for an open. 1. Install a scan tool. 2. Idle the engine. 3. Monitor the (IC) Ignition Control status for the cylinder with the ignition control DTC using the scan tool in the Misfire Data List. Does the scan tool indicate Fault?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the engine. 2. Disconnect the ignition coil/module electrical connector. 3. Measure the frequency at the ignition control signal circuit using the DMM on the DC Hertz setting. Refer to *Measuring Frequency* in Wiring Systems. 4. Idle the engine. Is the frequency within the specified range?	3.0–20 Hz	*Go to Step 8*	*Go to Step 5*
5	Measure the voltage at the ignition control signal circuit using the DMM. Is the voltage greater than the specified value?	1V	*Go to Step 14*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity from the IC circuit (at the ignition coil/module electrical connector) to the PCM connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 15*
7	Test the resistance from the IC circuit (at the ignition coil/module electrical connector) to ground using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate OL?	—	*Go to Step 16*	*Go to Step 15*

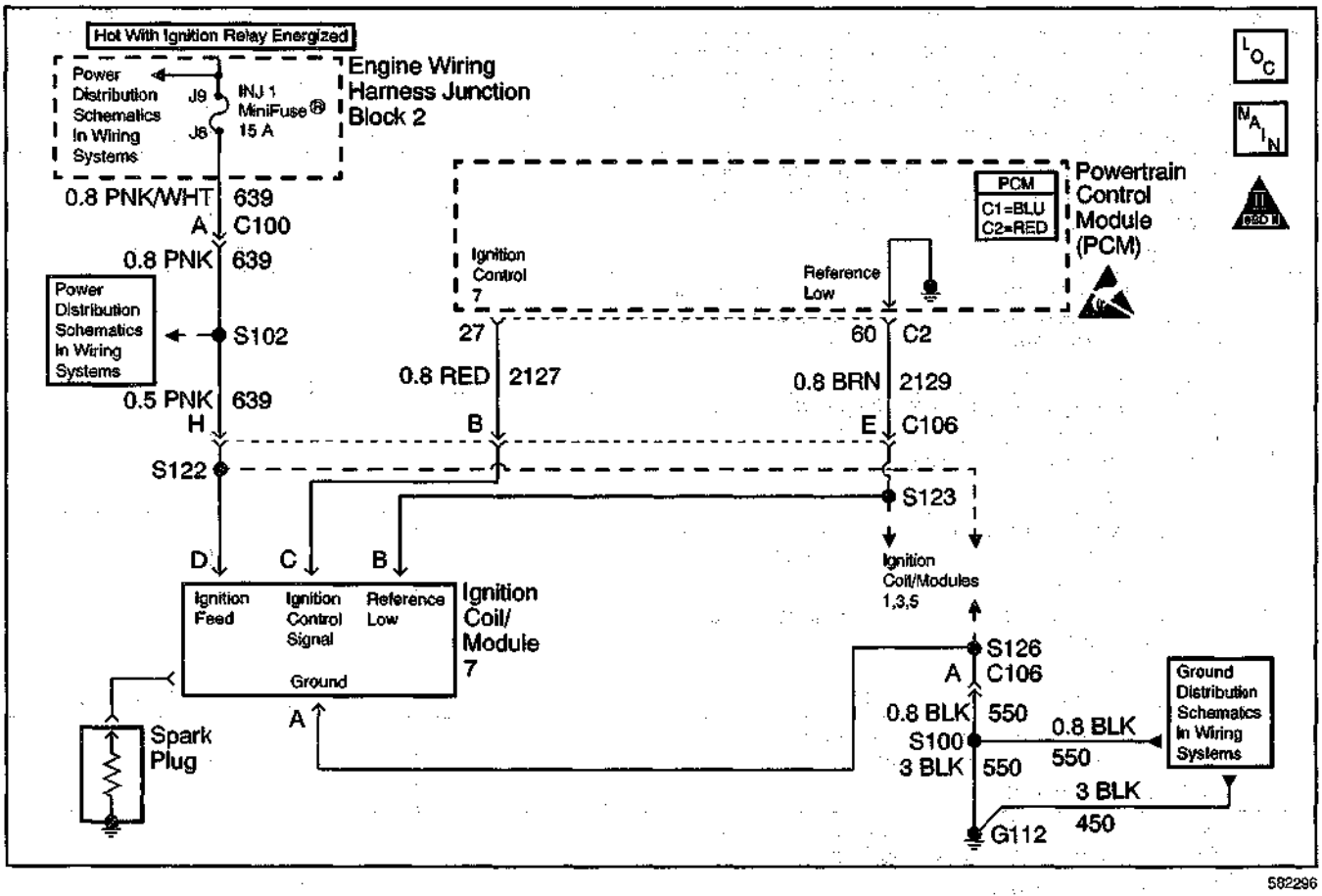
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DTC P0356 Ignition Coil 6 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	Probe the Ignition feed circuit for the coil/module using the test lamp *J 34142-B* connected to battery ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 10*
9	Probe the ground circuit for the coil/module using the test lamp *J 34142-B* connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 12*	*Go to Step 11*
10	Repair the Ignition feed circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
11	Repair the ground circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	1. Inspect for a poor connection at the coil/module. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 13*
13	Replace the ignition coil/module. Refer to *Ignition Coil Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 18*	—
14	Repair the Ignition Control circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the Ignition Control circuit for an open or grounded circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0357 Ignition Coil 7 Control Circuit



582296

Circuit Description

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

- A power feed
- A ground circuit
- An ignition control (IC) circuit
- A reference low circuit

Sequencing and timing are PCM controlled. This DTC sets when the IC circuit is out of range.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

- The PCM detects the ignition control circuit is grounded, open or shorted to a voltage.
- All conditions met for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step verifies that the fault is present.
4. This step verifies the integrity of the ignition control circuit and the PCM output.
5. This step tests for a short to ground on the ignition control circuit.

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DTC P0357 Ignition Coil 7 Control Circuit

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	**Important:** If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits or the B+ circuits for an open. 1. Install a scan tool. 2. Idle the engine. 3. Monitor the (IC) Ignition Control status for the cylinder with the ignition control DTC using the scan tool in the Misfire Data List. Does the scan tool indicate Fault?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the engine. 2. Disconnect the ignition coil/module electrical connector. 3. Measure the frequency at the ignition control signal circuit using the DMM on the DC Hertz setting. Refer to *Measuring Frequency* in Wiring Systems. 4. Idle the engine. Is the frequency within the specified range?	3.0–20 Hz	*Go to Step 8*	*Go to Step 5*
5	Measure the voltage at the ignition control signal circuit using the DMM. Is the voltage greater than the specified value?	1V	*Go to Step 14*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity from the IC circuit (at the ignition coil/module electrical connector) to the PCM connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 15*
7	Test the resistance from the IC circuit (at the ignition coil/module electrical connector) to ground using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate OL?	—	*Go to Step 16*	*Go to Step 15*

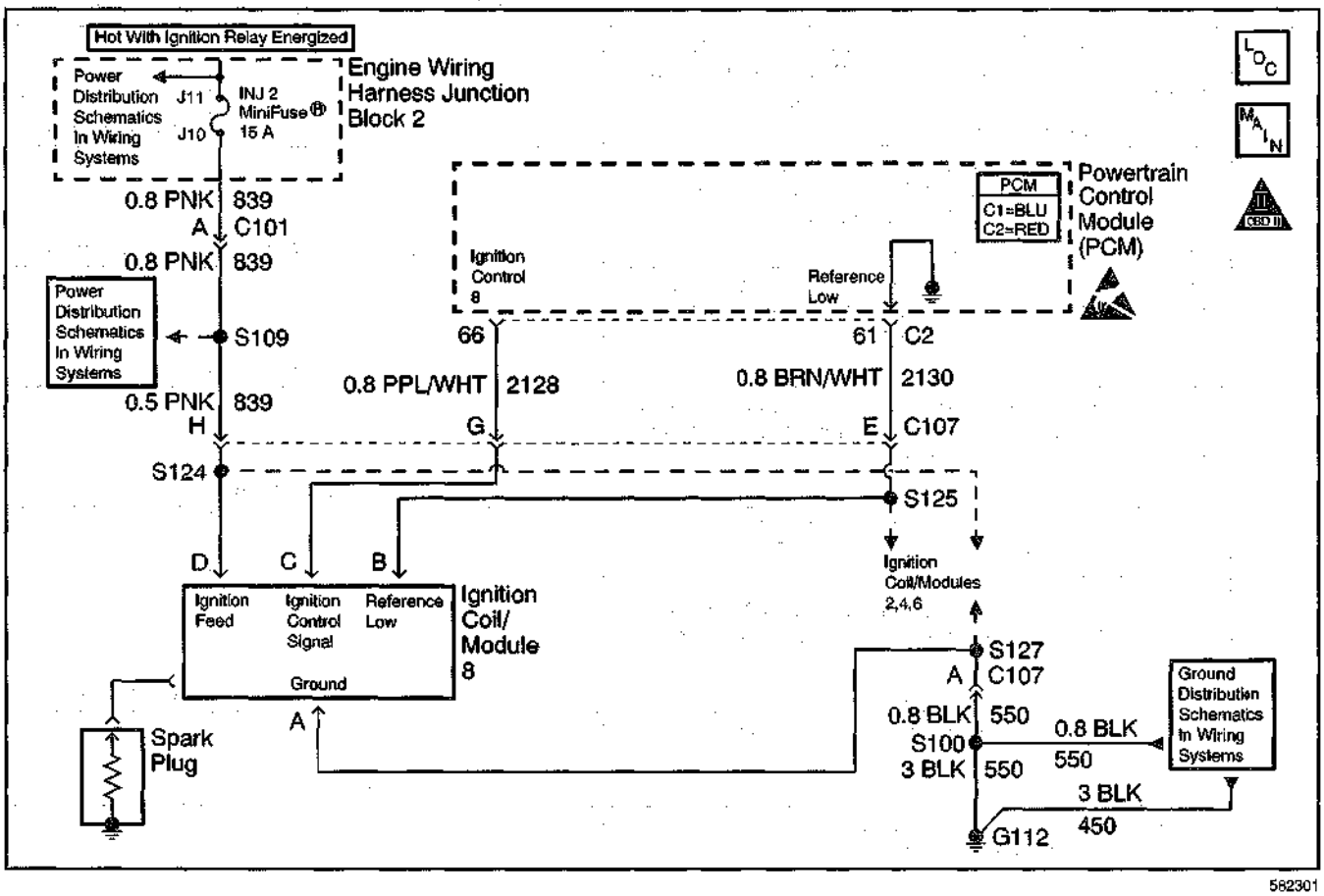
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DTC P0357 Ignition Coil 7 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	Probe the Ignition feed circuit for the coil/module using the test lamp *J 34142-B* connected to battery ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 10*
9	Probe the ground circuit for the coil/module using the test lamp *J 34142-B* connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 12*	*Go to Step 11*
10	Repair the Ignition feed circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
11	Repair the ground circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	1. Inspect for a poor connection at the coil/module. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 13*
13	Replace the ignition coil/module. Refer to *Ignition Coil Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 18*	—
14	Repair the Ignition Control circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the Ignition Control circuit for an open or grounded circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0358 Ignition Coil 8 Control Circuit



582301

Circuit Description

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

- A power feed
- A ground circuit
- An ignition control (IC) circuit
- A reference low circuit

Sequencing and timing are PCM controlled. This DTC sets when the IC circuit is out of range.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

- The PCM detects the ignition control circuit is grounded, open or shorted to a voltage.
- All conditions met for less than 1 second.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms.*

Test Description

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

2. This step verifies that the fault is present.
4. This step verifies the integrity of the ignition control circuit and the PCM output.
5. This step tests for a short to ground on the ignition control circuit.

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DTC P0358 Ignition Coil 8 Control Circuit

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	**Important:** If all the Ignition Control (IC) DTCs are set at the same time, inspect the IC ground circuits or the B+ circuits for an open. 1. Install a scan tool. 2. Idle the engine. 3. Monitor the (IC) Ignition Control status for the cylinder with the ignition control DTC using the scan tool in the Misfire Data List. Does the scan tool indicate Fault?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the engine. 2. Disconnect the ignition coil/module electrical connector. 3. Measure the frequency at the ignition control signal circuit using the DMM on the DC Hertz setting. Refer to *Measuring Frequency* in Wiring Systems. 4. Idle the engine. Is the frequency within the specified range?	3.0–20 Hz	*Go to Step 8*	*Go to Step 5*
5	Measure the voltage at the ignition control signal circuit using the DMM. Is the voltage greater than the specified value?	1V	*Go to Step 14*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity from the IC circuit (at the ignition coil/module electrical connector) to the PCM connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 15*
7	Test the resistance from the IC circuit (at the ignition coil/module electrical connector) to ground using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate OL?	—	*Go to Step 16*	*Go to Step 15*

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DTC P0358 Ignition Coil 8 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	Probe the Ignition feed circuit for the coil/module using the test lamp *J 34142-B* connected to battery ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 10*
9	Probe the ground circuit for the coil/module using the test lamp *J 34142-B* connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 12*	*Go to Step 11*
10	Repair the Ignition feed circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
11	Repair the ground circuit for an open between the ignition coil/module electrical connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	1. Inspect for a poor connection at the coil/module. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 13*
13	Replace the ignition coil/module. Refer to *Ignition Coil Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 18*	—
14	Repair the Ignition Control circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
15	Repair the Ignition Control circuit for an open or grounded circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	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. The pressure in the intake manifold increases when the EGR valve is open. The PCM monitors the Manifold Absolute Pressure (MAP) sensor signal during the EGR system diagnostic in order to determine the amount of EGR flow. The PCM calculates an error based on the difference between the actual MAP increase and a predetermined value. The PCM records the error and adjusts an internal fail counter towards the fail threshold if the error is too great. The PCM sets a DTC P0401 when the fail counter exceeds the fail threshold. The number of test samples required to exceed the fail threshold varies according to the magnitude of the detected flow errors.

The PCM allows only one EGR flow test sample to be taken during an ignition cycle. Following a scan tool Clear Info or a battery disconnect the PCM allows twelve test samples during the first ignition cycle in order to aid in verifying a repair.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0405, P0500, P0502, P0503, P0562, P0563, P1404 are not set.
- The ignition voltage is between 11.7 and 18 volts.
- The BARO is more than 70 kPa.
- The ECT is between 60°C (140°F) and 117°C (243°F).
- The IAT is less than 65°C (140°F).
- The TP sensor angle is less than 1.1 percent.
- The engine speed is between 800 RPM and 2,000 RPM.
- The engine vacuum (BARO minus MAP) is between 60 kPa (9 psi) and 83 kPa (12 psi).
- The IAC position is steady.
- The vehicle speed is between 42 km/h (26 mph) and 113 km/h (70 mph).
- The change in VSS is less 6 km/h (4 mph).
- The change in MAP is less than 0.5 kPa.
- The A/C clutch status is steady.
- Not in fuel deceleration cut-off.

Conditions for Setting the DTC

- The change in the MAP is less than a predetermined value during the EGR flow test.
- All conditions present for 2 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

1. Use a scan tool in order to clear info. Run the EGR flow test in order to verify a repair. Keep the following items in mind when running the EGR flow test:
   - The PCM runs the EGR flow test during a gradual deceleration.
   - The PCM runs the EGR flow test during a closed throttle condition.
   - The PCM runs the EGR flow test at vehicle speeds between 42 km/h (26 MPH) and 113 km/h (70 MPH).
   - Several deceleration cycles will be necessary to run a sufficient number of EGR flow test samples (9–12).
2. Inspect for the following conditions:
   - 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.
   - An engine that is running poorly may cause this DTC to set.
   - Poor connections or a damaged harness.
   - If the harness appears to be OK, observe the Actual EGR Position display on the scan tool while moving connectors and wiring harnesses related to the EGR valve. A change in the display indicates the location of the malfunction.
3. For an intermittent, refer to *Symptoms*.

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Test Description

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

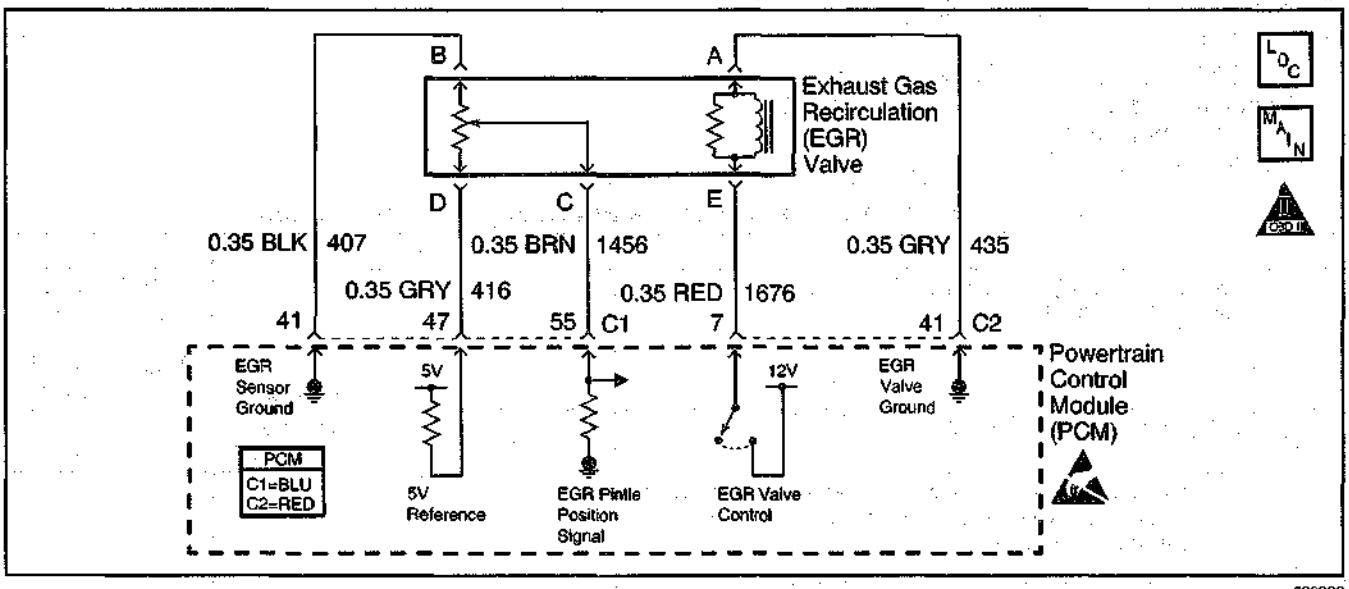
2. This DTC is set when the PCM does not detect a predetermined change in MAP when the EGR valve is commanded. A malfunctioning MAP sensor may cause this DTC to set.

DTC P0401 Exhaust Gas Recirculation (EGR) Flow Insufficient

Step	Action	Value(s)	Yes	No
1	Did you perform the Powertrain On-Board Diagnostic (OBD) System Check?	—	*Go to Step 2*	Go to the *A Powertrain On Board Diagnostic (OBD) System Check*
2	Is there any MAP DTC's set?	—	Go to the applicable DTC	*Go to Step 3*
3	1. Inspect the exhaust system for modification of original installed parts or leaks. Refer to *Exhaust System Inspection* in Engine Exhaust. 2. Repair the exhaust system as necessary if you locate a problem. Did you find and correct the condition?	—	*Go to Step 7*	*Go to Step 4*
4	1. Inspect the EGR valve gasket and pipes for leaks. 2. If you locate a problem, clean or replace the EGR system components as necessary. Refer to *EGR System Cleaning.* Did you find and correct the condition?	—	*Go to Step 7*	*Go to Step 5*
5	1. Remove the EGR valve. Refer to *EGR Valve Replacement.* 2. Visually and physically inspect the following items for a leak and/or a restriction: • The EGR pintle • The EGR valve passages Did you find and correct the condition?	—	*Go to Step 7*	*Go to Step 6*
6	1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold. 2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage. 3. Correct the condition as necessary if a condition is found. Refer to *EGR System Cleaning.* Did you find and correct the condition?	—	*Go to Step 7*	Go to Diagnostic Aids
7	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate vehicle within the Conditions for Running this DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test failed?	—	*Go to Step 8*	*Go to Step 2*
8	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0404 Exhaust Gas Recirculation (EGR) Open Position Performance



Circuit Description

The ability of the PCM to control the EGR valve is verified with this test. The PCM calculates an error based on the difference between the actual EGR position and the desired EGR position. The PCM sets this DTC if the error is too great.

Conditions for Running the DTC

- The ignition voltage is more than 11.7 volts.
- The desired EGR position is more than 0 percent.

Conditions for Setting the DTC

- The difference between the desired EGR position and the actual EGR position is more than 20 percent.
- The failure counter is more than a predetermined value.

Action Taken When the DTC Sets

- The PCM disables the EGR for the ignition cycle.
- The PCM illuminates the Malfunction Indicator Lamp (MIL) on the second consecutive drive cycle the diagnostic runs and fails.
- The PCM records the operating conditions the first time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent, refer to *Symptoms*.

Test Description

The numbers below refer to the step numbers on the Diagnostic Table.

2. This step determines if the EGR valve can be commanded open.
3. Excessive resistance in the EGR control circuit or the EGR ground circuit will result in the EGR not responding correctly to the commanded EGR position.
4. This step tests the EGR Valve control circuit.
5. This step tests the EGR Valve ground circuit.
6. Excessive resistance in the control circuit or the ground circuit will cause this DTC to set. With the EGR commanded to 100% the test lamp should light with full intensity. Connect the test lamp across the battery terminals and compare the test lamp intensity to the EGR control circuit intensity.

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DTC P0404 Exhaust Gas Recirculation (EGR) Open Position Performance

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	1. Idle the engine. 2. Command the EGR valve to 50% using the scan tool. Does the engine run rough or stall?	—	*Go to Step 3*	*Go to Step 6*
3	1. Idle the engine. 2. Command the EGR valve to 50% using the scan tool. 3. Monitor the Actual EGR position on the scan tool. Is the Actual EGR Position within the specified range?	48–52%	Go to Diagnostic Aids	*Go to Step 4*
4	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2. Refer to *PCM Replacement/Programming.* 3. Disconnect the EGR valve electrical connector. 4. Test the continuity of the EGR valve control circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Is the resistance within the specified range?	0–2Ω	*Go to Step 5*	*Go to Step 14*
5	Test the continuity of the EGR valve ground circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Is the resistance within the specified range?	0–2Ω	*Go to Step 16*	*Go to Step 15*
6	1. Turn OFF the ignition. 2. Disconnect the EGR valve electrical connector. 3. Probe the EGR control circuit using the *J 34142-B* test lamp connected to ground. Refer to *Probing Electrical Connectors* in Wiring Systems. 4. Turn ON the ignition. 5. Command the EGR to the specified value using the scan tool. Is the test lamp illuminated?	100%	*Go to Step 7*	*Go to Step 8*
7	Probe the EGR ground circuit using the *J 34142-B* test lamp connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Is the test lamp illuminated?	—	*Go to Step 16*	*Go to Step 11*
8	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2. Refer to *PCM Replacement/Programming.* 3. Test the continuity of the EGR valve control circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	—	*Go to Step 9*	*Go to Step 12*
9	Test the continuity of the EGR valve control circuit using the DMM connected to ground. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	—	*Go to Step 12*	*Go to Step 10*
10	Test for continuity from the EGR control circuit to all other circuits in the PCM harness connector. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity to any other circuit in the PCM harness connector?	—	*Go to Step 12*	*Go to Step 18*

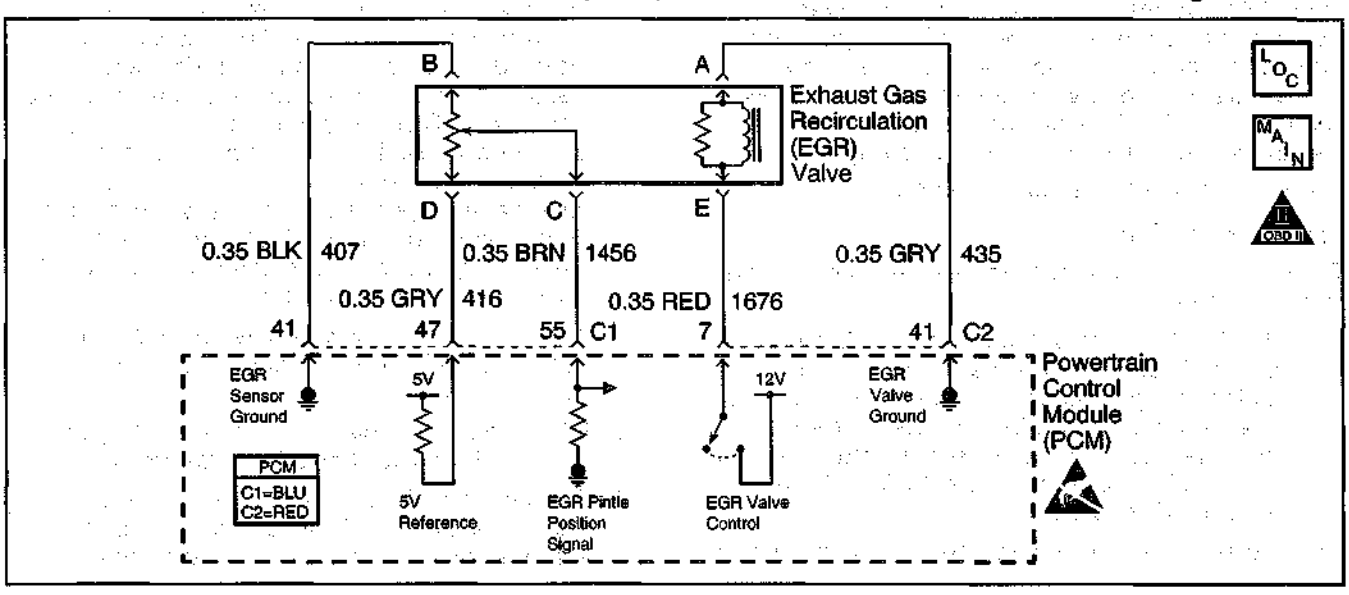
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DTC P0404 Exhaust Gas Recirculation (EGR) Open Position Performance (cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2. Refer to *PCM Replacement/Programming.* 3. Test the continuity of the EGR valve ground circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	—	*Go to Step 18*	*Go to Step 13*
12	Repair the EGR valve control circuit for an open, short to ground or short to another circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
13	Repair the open in the EGR valve ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
14	Repair the high resistance in the EGR valve control circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
15	Repair the high resistance in the EGR valve ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 20*	—
16	1. Inspect for poor connections at the EGR valve electrical connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 20*	*Go to Step 17*
17	Replace the EGR valve. Refer to *EGR Valve Replacement.* Is the replacement complete?	—	*Go to Step 20*	—
18	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did find and correct the condition?	—	*Go to Step 20*	*Go to Step 19*
19	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 20*	—
20	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate vehicle within the Conditions for Running this DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test passed?	—	*Go to Step 21*	*Go to Step 2*
21	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0405 Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage



Circuit Description

An Exhaust Gas Recirculation (EGR) system is used in order to lower Oxides of Nitrogen (NOx) emission levels. The EGR system accomplishes this by feeding small amounts of exhaust gas back into the combustion chamber. High combustion temperatures cause NOx. Combustion temperatures are reduced when the air/fuel mixture is diluted with the exhaust gases.

The EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The EGR valve controls the exhaust flow into the intake manifold from the exhaust manifold through an orifice with a PCM controlled pintle. The PCM controls the pintle position using inputs from the Throttle Position (TP) sensor, the Manifold Absolute Pressure (MAP) sensor and, the Engine Coolant Temperature sensor. The PCM commands the EGR valve in order to supply the correct amount of exhaust gas recirculation for the current engine operating conditions. This can be monitored on a scan tool as the Desired EGR Position.

The PCM monitors the position of the EGR valve through a feedback signal. The PCM supplies a 5.0 volt reference and a ground to the EGR valve. A voltage signal representing the EGR valve pintle position is sent to the PCM from the EGR valve. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

Conditions for Running the DTC

The ignition voltage is more than 11.7 volts.

Conditions for Setting the DTC

- The EGR feedback signal voltage is less than 0.14 volts.
- All conditions are present for 10 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

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Due to the moisture associated with exhaust systems, the EGR valve may freeze and stick in colder weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the concern disappears. By monitoring the Actual EGR and Desired EGR Positions on a cold engine with a scan tool, the fault can be verified easily.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. If DTC P1635 sets at the same time, this indicates that the 5 voltage reference circuit is either shorted to a ground or shorted to a voltage. The 5 volt reference circuit is internally connected within the PCM. The MAP sensor circuits may be causing this DTC to set. Refer to DTC P1635 for further diagnosis.
3. This step determines if the malfunction is present.
4. 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 isolates when the DTC failed.
5. If the scan tool displays 5 volts, the EGR pintle position signal, 5 volt reference circuit, and the PCM are OK.
6. If the scan tool displays 5 volts, the EGR pintle position signal circuit and the PCM are OK.
7. Disconnecting the PCM allows using the DMM in order to test the continuity of the circuits. This aids in locating an open or a shorted circuit.

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DTC P0405 Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage

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	1. Install a scan tool. 2. Idle the engine. 3. Monitor the Diagnostic Trouble Code (DTC) Information using the scan tool. Did DTC P1635 fail this ignition cycle?	—	Go to *DTC P1635 5 Volt Reference 1 Circuit*	*Go to Step 3*
3	Monitor the EGR pintle position voltage on Engine 1 Data List on the scan tool. Is the EGR pintle position voltage below the specified value?	0.14V	*Go to Step 5*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids
5	1. Disconnect the EGR valve electrical connector. 2. Jumper the 5 volt reference circuit and the EGR pintle signal circuit together at the EGR valve harness connector. 3. Observe the EGR pintle position voltage display on the scan tool. Is the EGR pintle position voltage near the specified value?	5 Volts	*Go to Step 11*	*Go to Step 6*
6	1. Connect the test lamp *J 34142-B* between B+ and the EGR pintle position signal circuit at the EGR valve harness connector. 2. Observe the EGR pintle position voltage display on the scan tool. Is the voltage near the specified value?	5 Volts	*Go to Step 7*	*Go to Step 9*
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the 5 volt reference circuit for the following: • an open • a short to a ground • a short to a voltage 4. If you find the 5 volt reference circuit is open or shorted, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 8*

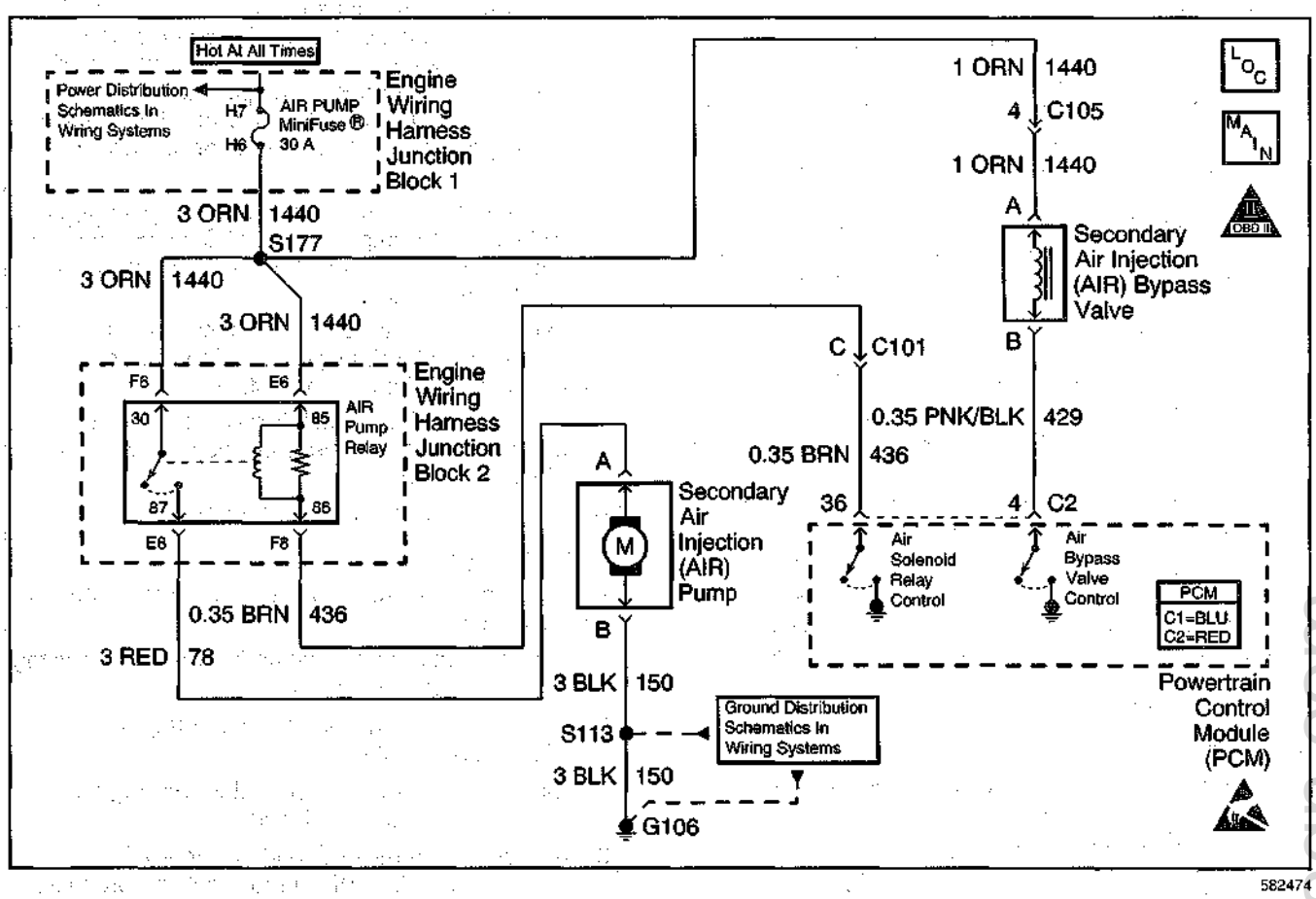
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DTC P0405 Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Inspect the 5 volt reference circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
9	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the EGR pintle position signal circuit for the following: • Open circuit • Short to a ground • Short to sensor ground circuit 4. If you find the EGR pintle position signal circuit is open or shorted to a ground, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 10*
10	1. Inspect the EGR pintle position signal circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
11	1. Inspect for poor connections at the EGR valve. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 12*
12	Replace the EGR valve. Refer to *EGR Valve Replacement.* Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 14*	—
14	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 15*	*Go to Step 2*
15	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0410 Secondary Air Injection (AIR) System



Circuit Description

An AIR pump is used on this vehicle to lower tail pipe emissions on start-up. The PCM supplies a ground to the AIR pump relay, which energizes the AIR pump.

The PCM monitors the HO2S voltages to diagnose the AIR system.

During the AIR test the PCM activates the AIR pump during closed loop operation. When the AIR is activated, the PCM monitors the HO2S voltages and short term fuel trim values for both banks of the engine. If the AIR system is operating properly, the HO2S voltages should go low and the short term fuel trim should go high.

If the PCM determines that the HO2S voltages for BOTH banks did not respond as expected during the tests, DTC P0410 sets. If only one sensor responded, the PCM sets either a DTC P1415 or P1416 to indicate on which bank the AIR system is inoperative.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0171–P0175, P0200, P0300, P0335, P0336, P0351–P0358, P0443, P0500, P0502, P0503, P1258, and HO2S DTCs not set.
- The engine operates for more than 2 seconds.
- The engine run time is more than 15 seconds after closed loop operation.
- The engine speed is more than 900 RPM.
- The maximum air flow is 22 g/s.
- The ECT is between 66°C (151°F) and 110°C (255°F).
- The IAT is more than –10°C (14°F).
- The ignition voltage is more than 11.7 volts.
- The engine load is less than 42.5 percent.
- Not operating in power enrichment mode OR deceleration fuel cut-off mode.
- In short term Fuel Trim cells 1, 2, and 5.

Conditions for Setting the DTC

- HO2S voltage does not go below 222 mV for 1 second, when the AIR pump turns ON during closed loop operation.
- Short term fuel trim does not change a predetermined value, when the AIR pump turns ON during closed loop operation.

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Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.
- Excessive resistance in any circuit related to the AIR system may cause this DTC to set. Listen for an audible click as the AIR solenoid and the AIR relay are commanded ON and OFF. If either component does not operate when commanded ON and OFF, and no other DTC is set, inspect the related circuits for excessive resistance.
- The scan tool offers three modes of AIR output controls. AIR Pump Relay, AIR Solenoid, and AIR System. Select the AIR System function for all AIR diagnostics.
- If air is present at both outlet hoses when the AIR system is enabled, inspect the AIR check valves and pipes for damage or restrictions.
- For underhood fuseblock terminal identification, refer to *Electrical Center Identification Views* in Wiring Systems.

For an intermittent, refer to *Symptoms.*

Test Description

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

2. The AIR pump fuse is located in the engine wiring harness junction block #1.
3. If the AIR pump fuse is OK, then diagnose DTC P0412 or P0418 first.
5. The AIR pump relay is located in the engine wiring harness junction block #2.
13. Inspect for intermittent shorts to ground or connections, if the AIR pump functions properly.
22. Inspect the circuits for a short to ground between the AIR pump fuse and the AIR pump relay. Also inspect the circuit for a short to ground between the splice and the AIR solenoid valve.

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DTC P0410 Secondary Air Injection (AIR) System

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	Is the AIR Pump fuse OK?	—	*Go to Step 3*	*Go to Step 15*
3	Is DTC P0412 or P0418 also set?	—	Go to *DTC P0412 Secondary Air Injection (AIR) Solenoid Control Circuit* or *DTC P0418 Secondary Air Injection (AIR) Pump Relay Control Circuit*	*Go to Step 4*
4	1. Install the scan tool. 2. Turn ON the ignition with the engine OFF. 3. Enable the AIR system with a scan tool in output controls. Does the AIR pump turn ON?	—	*Go to Step 9*	*Go to Step 5*
5	**Important:** Refer to *Electrical Center Identification Views* in Wiring Systems for relay terminal identification. 1. Turn OFF the ignition. 2. Disconnect the AIR pump relay. 3. Turn ON the ignition with the engine OFF. 4. Probe the AIR pump relay B+ supply circuit terminal (switch side of relay) using the test lamp *J 34142-B* connected to a ground. Refer to *Using Connector Test Adapters* in Wiring Systems. Is the test lamp illuminated?	—	*Go to Step 6*	*Go to Step 19*
6	Jumper the B+ terminal to the AIR pump feed circuit at the relay harness connector using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the AIR pump turn ON?	—	*Go to Step 26*	*Go to Step 7*
7	1. The jumper still installed. 2. Disconnect the AIR pump electrical connector. 3. Probe terminal A of the AIR pump electrical connector using the test lamp *J 34142-B* connected to battery ground. Refer to *Using Connector Test Adapters* in Wiring Systems. Is the test lamp illuminated?	—	*Go to Step 8*	*Go to Step 20*
8	1. The jumper still installed. 2. Connect the test lamp *J 34142-B* from terminal A to terminal B of the AIR pump harness connector. Is the test lamp illuminated?	—	*Go to Step 29*	*Go to Step 21*
9	1. Disconnect the vacuum source from the AIR solenoid valve. Refer to *AIR Solenoid Valve Replacement.* 2. Connect a vacuum gauge to the vacuum source. 3. Start and idle the engine. Is an engine vacuum displayed on the vacuum gauge?	—	*Go to Step 10*	*Go to Step 25*

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DTC P0410 Secondary Air Injection (AIR) System (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn OFF the ignition. 2. Reconnect the vacuum source to the AIR solenoid valve. 3. Disconnect the vacuum hose to the AIR shut off valve at the AIR solenoid valve. 4. Connect a vacuum gauge to the AIR solenoid valve port. 5. Start and idle the engine. 6. Enable the AIR system with a scan tool in output controls. Is an engine vacuum indicated on the vacuum gauge when the AIR system is enabled?	—	*Go to Step 11*	*Go to Step 28*
11	1. Turn OFF the ignition. 2. Reconnect the vacuum hose to the AIR solenoid valve. 3. Disconnect the vacuum hose from the AIR Shut-off valve. Refer to *Secondary AIR Injection Shut Off Valve Replacement.* 4. Connect a vacuum gauge to the AIR shut off supply vacuum hose. 5. Start and idle the engine. 6. Enable the AIR system with the scan tool in output controls. Is an engine vacuum indicated on the vacuum gauge when the AIR system is enabled?	—	*Go to Step 12*	*Go to Step 25*
12	1. Turn OFF the ignition. 2. Install the vacuum hose to the AIR shut OFF valve. 3. Disconnect the AIR supply hose (from the AIR pump) at the connector (located near the left wheel well). 4. Start and idle the engine. 5. Enable the AIR system with the scan tool in output controls. Is air present at the AIR shut off valve supply hose?	—	*Go to Step 13*	*Go to Step 24*
13	1. Connect the AIR shut off valve supply hose. 2. Disconnect both AIR hoses from the AIR pipe check valves. 3. Start and idle the engine. 4. Enable the AIR system with the scan tool in output controls. Is air present at both hoses?	—	Go to Diagnostic Aids	*Go to Step 14*
14	1. Inspect the AIR hoses for restrictions or damage. 2. If you find an AIR hose restricted or damaged, repair as necessary. Did you find and correct the condition?	—	*Go to Step 31*	*Go to Step 27*
15	1. Turn OFF the ignition. 2. Remove the AIR pump relay from the underhood electrical center 2. 3. Remove the AIR pump fuse from the underhood electrical center 1. 4. Disconnect the AIR solenoid harness connector. 5. Probe the battery feed terminal for the AIR pump relay harness connector with the test lamp *J 34142-B* connected to B+. Does the test lamp illuminate?	—	*Go to Step 22*	*Go to Step 16*

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DTC P0410 Secondary Air Injection (AIR) System (cont'd)

Step	Action	Value(s)	Yes	No
16	1. Disconnect the AIR pump harness connector. 2. Probe the AIR pump electrical connector terminal A (harness side) with the test lamp *J 34142-B* connected to B+. Does the test lamp illuminate?	—	*Go to Step 23*	*Go to Step 17*
17	1. Turn OFF the ignition. 2. Re-install the following components/electrical connector: • A new AIR pump fuse • The AIR pump relay • The AIR solenoid 3. Turn ON the ignition leaving the engine OFF. 4. Enable the AIR system with the scan tool in output controls. Does the AIR pump fuse open?	—	*Go to Step 28*	*Go to Step 18*
18	1. Connect the AIR pump electrical connector. 2. Enable the AIR pump with a scan tool in output controls. Does the AIR pump fuse open?	—	*Go to Step 30*	Go to Diagnostic Aids
19	Repair the open circuit between the fuse and the relay. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 31*	—
20	Repair the open circuit between the AIR pump and the AIR relay. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 31*	—
21	Repair the faulty ground connection or the open ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 31*	—
22	Repair the short to ground in the ignition feed circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 31*	—
23	Repair the short to ground in the circuit between the AIR pump relay and the AIR pump. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 31*	—
24	1. Inspect the AIR inlet hose and AIR outlet hose from the AIR pump for restrictions or damage. 2. Repair the restriction or damage to the AIR hose. Is the action complete?	—	*Go to Step 31*	—
25	Repair the vacuum hose as necessary. Is the action complete?	—	*Go to Step 31*	—
26	Replace the AIR pump relay. Is the action complete?	—	*Go to Step 31*	—
27	Replace the AIR Shut-off valve. Refer to *Secondary AIR Injection Shut Off Valve Replacement.* Is the action complete?	—	*Go to Step 31*	—
28	Replace the AIR solenoid valve. Refer to *AIR Solenoid Valve Replacement.* Is the action complete?	—	*Go to Step 31*	—

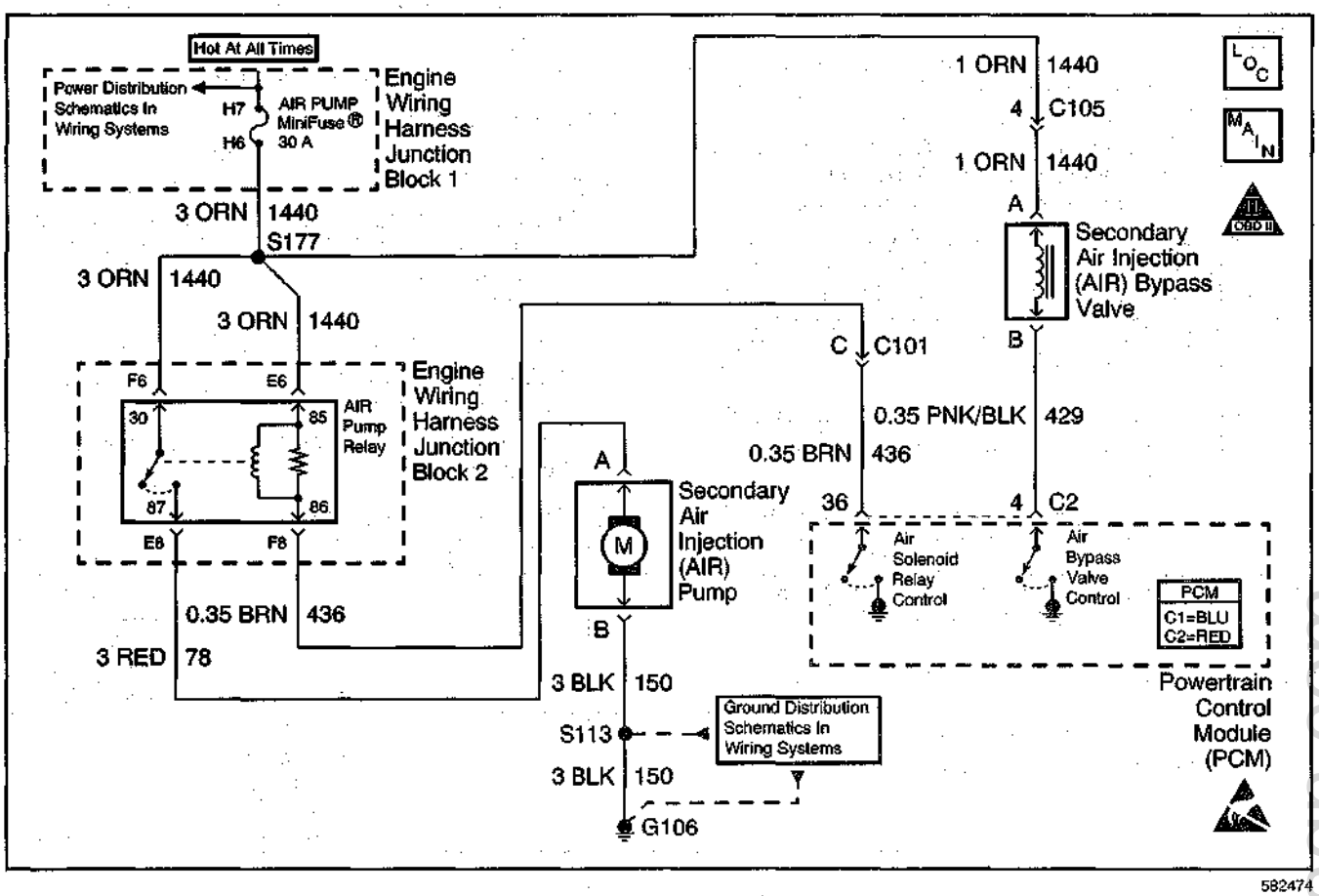
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DTC P0410 Secondary Air Injection (AIR) System (cont'd)

Step	Action	Value(s)	Yes	No
29	1. Inspect for poor connections at the AIR pump electrical connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. Repair the poor connection as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 31*	*Go to Step 30*
30	Replace the AIR pump. Refer to *Secondary AIR Injection Pump Replacement* Is the action complete?	—	*Go to Step 31*	—
31	1. Select the Diagnostic Trouble Codes (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Specific DTC option under the Diagnostic Trouble Code (DTC) option using a scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test passed?	—	*Go to Step 32*	—
32	Select the Capture Info option and the Review Info option using the scan tool. Are any DTCs displayed that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0412 Secondary Air Injection (AIR) Solenoid Control Circuit



Circuit Description

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

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- All the above conditions are present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.
- The scan tool offers three modes of AIR output controls. AIR pump relay, AIR solenoid, and AIR system.
- For underhood fuseblock terminal identification, refer to *Electrical Center Identification Views* in Wiring Systems.
- For an intermittent, refer to *Symptoms*.

Test Description

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

3. Listen for an audible click when the solenoid valve operates. Be sure that both the ON and the OFF states are commanded. Repeat the commands as necessary.
5. Tests for voltage to the AIR solenoid valve.
6. Verifies that the PCM is providing ground to the AIR solenoid valve.
7. Tests if a ground is constantly being applied to the AIR solenoid valve.

DTC P0412 Secondary Air Injection (AIR) Solenoid Control Circuit

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	Inspect the AIR pump fuse Is the AIR pump fuse open?	—	Go to *DTC P0410 Secondary Air Injection (AIR) System*	*Go to Step 3*
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, command the AIR solenoid valve ON and OFF. Does the AIR solenoid valve turn ON and OFF with each command?	—	*Go to Step 4*	*Go to Step 5*
4	1. Review the Freeze Frame and/or Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure Records data that you observe. Does the DTC reset?	—	*Go to Step 5*	Go to *Intermittent Conditions*
5	1. Turn OFF the ignition. 2. Disconnect the AIR solenoid valve electrical connector. 3. Turn ON the ignition, with the ignition OFF. 4. Probe the AIR solenoid valve B+ supply circuit with the test lamp *J 34142-B* connected to ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 6*	*Go to Step 12*
6	1. Connect a test lamp between the control circuit of the AIR solenoid valve and the B+ supply circuit of the AIR solenoid valve. 2. With a scan tool, command the AIR solenoid valve ON and OFF. Does the test lamp turn ON and OFF with each command?	—	*Go to Step 10*	*Go to Step 7*

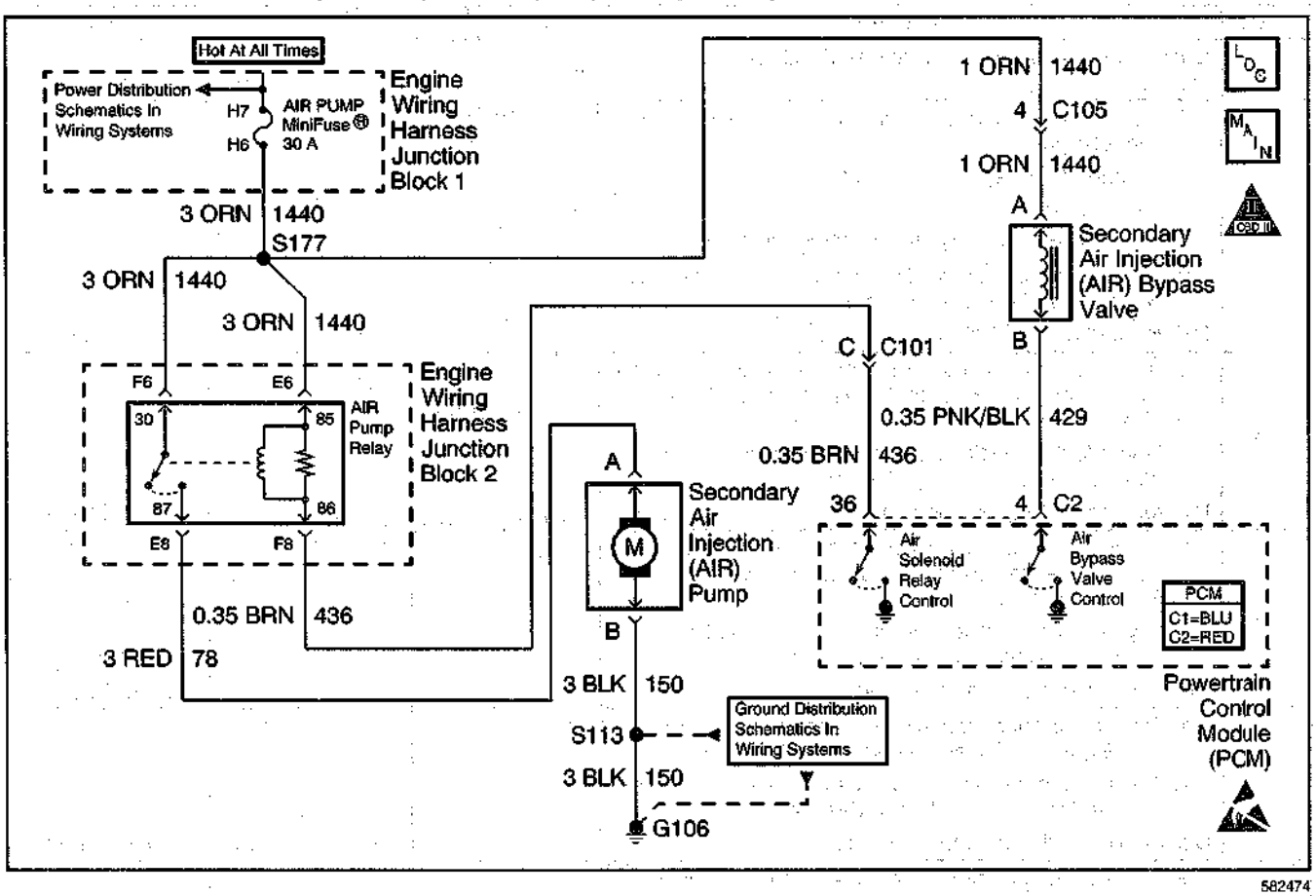
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DTC P0412 Secondary Air Injection (AIR) Solenoid Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
7	Does the test lamp remain illuminated with each command?	—	*Go to Step 9*	*Go to Step 8*
8	1. Test the control circuit of the AIR solenoid valve for the following: • short to voltage • an open Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 11*
9	1. Test the control circuit of the AIR solenoid valve for a short to ground. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 14*
10	1. Inspect for poor connections at the AIR solenoid valve. Refer to *Testing for Electrical Intermittents* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 13*
11	1. Inspect for poor connections at the PCM. Refer to *Testing for Electrical Intermittents* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 14*
12	Repair the B+ supply circuit for the AIR solenoid valve. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 15*	—
13	Replace the AIR solenoid valve. Refer to *AIR Solenoid Valve Replacement.* Is the action complete?	—	*Go to Step 15*	—
14	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 15*	—
15	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running as specified in the supporting text. Does this DTC reset?	—	*Go to Step 2*	*Go to Step 16*
16	With a scan tool, review the Stored information (Capture Info). Does the scan tool display any DTCs that you have not diagnosed?	—	Go to *Diagnostic Trouble Code (DTC) List/Type*	System OK

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DTC P0418 Secondary Air Injection (AIR) Pump Relay Control Circuit



Circuit Description

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

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

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18 volts

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- All the above conditions are present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.
- The scan tool offers three modes of AIR output controls. AIR pump relay, AIR solenoid, and AIR system.
- For underhood fuseblock terminal identification, refer to *Electrical Center Identification Views* in Wiring Systems.
- For an intermittent, refer to *Symptoms*.

Test Description

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

3. Listen for an audible click when the relay operates. Be sure that both the ON and the OFF states are commanded. Repeat the commands as necessary.
5. Tests for voltage at the coil side of the AIR pump relay.
6. Verifies that the PCM is providing ground to the AIR pump relay.
7. Tests if a ground is constantly being applied to the AIR pump relay.

DTC P0418 Secondary Air Injection (AIR) Pump Relay Control Circuit

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	Inspect the AIR pump fuse Is the AIR pump fuse open?	—	Go to *DTC P0410 Secondary Air Injection (AIR) System*	*Go to Step 3*
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, command the AIR pump relay ON and OFF. Does the AIR pump relay turn ON and OFF with each command?	—	*Go to Step 4*	*Go to Step 5*
4	1. Review the Freeze Frame and/or Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure Records data that you observe. Does the DTC reset?	—	*Go to Step 5*	Go to *Intermittent Conditions*
5	1. Turn OFF the ignition. 2. Disconnect the AIR pump relay. 3. Turn ON the ignition, with the ignition OFF. 4. Probe the AIR pump relay B+ supply circuit with the test lamp *J 34142-B* connected to ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 6*	*Go to Step 12*
6	1. Connect a test lamp between the control circuit of the AIR pump relay and the B+ supply circuit of the AIR pump relay. 2. With a scan tool, command the AIR pump relay ON and OFF. Does the test lamp turn ON and OFF with each command?	—	*Go to Step 10*	*Go to Step 7*

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DTC P0418 Secondary Air Injection (AIR) Pump Relay Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
7	Does the test lamp remain illuminated with each command?	—	*Go to Step 9*	*Go to Step 8*
8	1. Test the control circuit of the AIR pump relay for the following: • short to voltage • an open Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 11*
9	1. Test the control circuit of the AIR pump relay for a short to ground. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Circuit Testing* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 14*
10	1. Inspect for poor connections at the AIR pump relay. Refer to *Testing for Electrical Intermittents* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 13*
11	1. Inspect for poor connections at the PCM. Refer to *Testing for Electrical Intermittents* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 15*	*Go to Step 14*
12	Repair the B+ supply circuit for the AIR pump relay. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 15*	—
13	Replace the AIR pump relay. Refer to *Secondary Air Injection Pump Relay Replacement.* Is the action complete?	—	*Go to Step 15*	—
14	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 15*	—
15	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running as specified in the supporting text. Does this DTC reset?	—	*Go to Step 2*	*Go to Step 16*
16	With a scan tool, review the Stored information (Capture Info). Does the scan tool display any DTCs that you have not diagnosed?	—	Go to *Diagnostic Trouble Code (DTC) List/Type*	System OK

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DTC P0420 Catalyst System Low Efficiency Bank 1

Circuit Description

In order to maintain a reasonably low emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), the engine controls system uses a three-way catalytic converter. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas. This reaction converts them into harmless water vapor and Carbon Dioxide. The catalyst also reduces NOx, converting it to Nitrogen. The PCM monitors this process using Bank 1 HO2S #2. Bank 1 HO2S #2, located in the exhaust stream past the three-way catalytic converter, produces an output signal which indicates the oxygen storage capacity of the catalyst. This determines the catalysts ability to convert exhaust emissions effectively. If the catalyst is functioning correctly, the Bank 1 HO2S #2 signal will be far less active than that produced by Bank 1 HO2S #1. This indicates that the three-way catalytic converters oxygen storage capacity is below a threshold considered acceptable.

When the conditions for running this DTC are met, the following occurs:

- The PCM captures the current rear HO2S rich/lean status.
- The Air Fuel ratio transitions from rich to lean or lean to rich depending on the capture rear HO2S rich/lean status.
- The Air Fuel ratio transitions a second time opposite the first Air Fuel ratio transition.
- The PCM captures the response time (the time the HO2S goes from below 300 mV to above 600 mV and from 600 mV to below 300 mV) of the front and rear Heated Oxygen sensors when the Air Fuel ratio transitions occurred.
- The PCM measures the time it takes the rear HO2S voltage to cross a reference rich/lean threshold minus the time it takes the front HO2S voltage to cross the same rich/lean threshold. The time difference from the front and rear HO2S is the oxygen storage capacity of the catalyst. This DTC sets if the time exceeds a predetermined threshold.

Conditions for Running the DTC

- DTCs, P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0171, P0172, P0174, P0175, P0200, P0230, P0300, P0325, P0327, P0332, P0335, P0336, P0341, P0342, P0343, P0351-P0358, P0401, P0404, P0405, P0410, P0412, P0418, P0440, P0442, P0443, P0446, P0449, P0500, P0704, P0801, P0803, P1258, P1336, P1404, P1415, P1416, P1441 and HO2S DTCs not set.
- The engine is operating for longer than 400 seconds.
- The ECT is between 80°C (176°F) 120°C (248°F).
- The IAT is between –15°C (5°F) and 75°C (167°F).
- Engine speed is more than 900 RPM for a minimum of 22 seconds (manual transmission) or 25 seconds (Automatic Transmission) since the end of the last idle test.
- The BARO is more than 74 kPA.
- The fuel system is operating in closed loop.

Conditions for Setting the DTC

The PCM determines the oxygen storage capability of the catalytic converter has degraded below a calibrated threshold.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

If the HO2S parameter is monitored using a scan tool while this diagnostic is running, the HO2S voltages may be fixed low or high.

Test Description

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

4. Before replacing the Three-Way Catalytic Converter, correct any conditions which may have damaged the catalyst.

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DTC P0420 Catalyst System Low Efficiency Bank 1

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 other DTCs set?	—	Go to the applicable DTC table	*Go to Step 3*
3	Inspect for the following conditions: • Verify that the three-way catalytic converter is an original equipment part. • Inspect the three-way catalytic converter for damage (dents, severe discoloration caused by excessive temperature, holes, etc.). • Insure that the internal three-way catalytic converter rattle caused by damaged catalyst is not present. • Inspect the exhaust system for leaks, damage, or loose or missing hardware (area from converter to HO2S #2 primarily). Refer to *Exhaust System Inspection* in Engine Exhaust. • Insure that the HO2S #1 and the HO2S #2 are secure and that the pigtails and wiring are not damaged or contacting the exhaust. Did you find and correct the condition?	—	*Go to Step 5*	*Go to Step 4*
4	Replace the catalytic converter. Refer to *Oxidation Catalytic Converter Replacement (5.7 L Left)* in Engine Exhaust. Is the action complete?	—	*Go to Step 5*	—
5	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 6*	*Go to Step 2*
6	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0430 Catalyst System Low Efficiency Bank 2

Circuit Description

In order to maintain a reasonably low emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), the engine controls system uses a three-way catalytic converter. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas. This reaction converts them into harmless water vapor and Carbon Dioxide. The catalyst also reduces NOx, converting it to Nitrogen. The PCM monitors this process using Bank 2 HO2S #2. Bank 2 HO2S #2, located in the exhaust stream past the three-way catalytic converter, produces an output signal which indicates the oxygen storage capacity of the catalyst. This determines the catalysts ability to convert exhaust emissions effectively. If the catalyst is functioning correctly, the Bank 2 HO2S #2 signal will be far less active than that produced by Bank 2 HO2S #1. This indicates that the three-way catalytic converters oxygen storage capacity is below a threshold considered acceptable.

When the conditions for running this DTC are met, the following occurs:

- The PCM captures the current rear HO2S rich/lean status.
- The Air Fuel ratio transitions from rich to lean or lean to rich depending on the capture rear HO2S rich/lean status.
- The Air Fuel ratio transitions a second time opposite the first Air Fuel ratio transition.
- The PCM captures the response time (the time the HO2S goes from below 300 mV to above 600 mV and from 600 mV to below 300 mV) of the front and rear Heated Oxygen sensors when the Air Fuel ratio transitions occurred.
- The PCM measures the time it takes the rear HO2S voltage to cross a reference rich/lean threshold minus the time it takes the front HO2S voltage to cross the same rich/lean threshold. The time difference from the front and rear HO2S is the oxygen storage capacity of the catalyst. This DTC sets if the time exceeds a predetermined threshold.

Conditions for Running the DTC

- DTCs, P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0171, P0172, P0174, P0175, P0200, P0230, P0300, P0325, P0327, P0332, P0335, P0336, P0341, P0342, P0343, P0351-P0358, P0401, P0404, P0405, P0410, P0412, P0418, P0440, P0442, P0443, P0446, P0449, P0500, P0704, P0801, P0803, P1258, P1336, P1404, P1415, P1416, P1441 and HO2S DTCs not set.
- The engine is operating for longer than 400 seconds.
- The ECT is between 80°C (176°F) 120°C (248°F).
- The IAT is between –15°C (5°F) and 75°C (167°F).
- Engine speed is more than 900 RPM for a minimum of 22 seconds (manual transmission) or 25 seconds (Automatic Transmission) since the end of the last idle test.
- The BARO is more than 74 kPA.
- The fuel system is operating in closed loop.

Conditions for Setting the DTC

The PCM determines the oxygen storage capability of the catalytic converter has degraded below a calibrated threshold.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

If the HO2S parameter is monitored using a scan tool while this diagnostic is running, the HO2S voltages may be fixed low or high.

Test Description

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

4. Before replacing the three-way catalytic converter, make sure that any conditions which may have caused the catalyst to be damaged have been corrected.

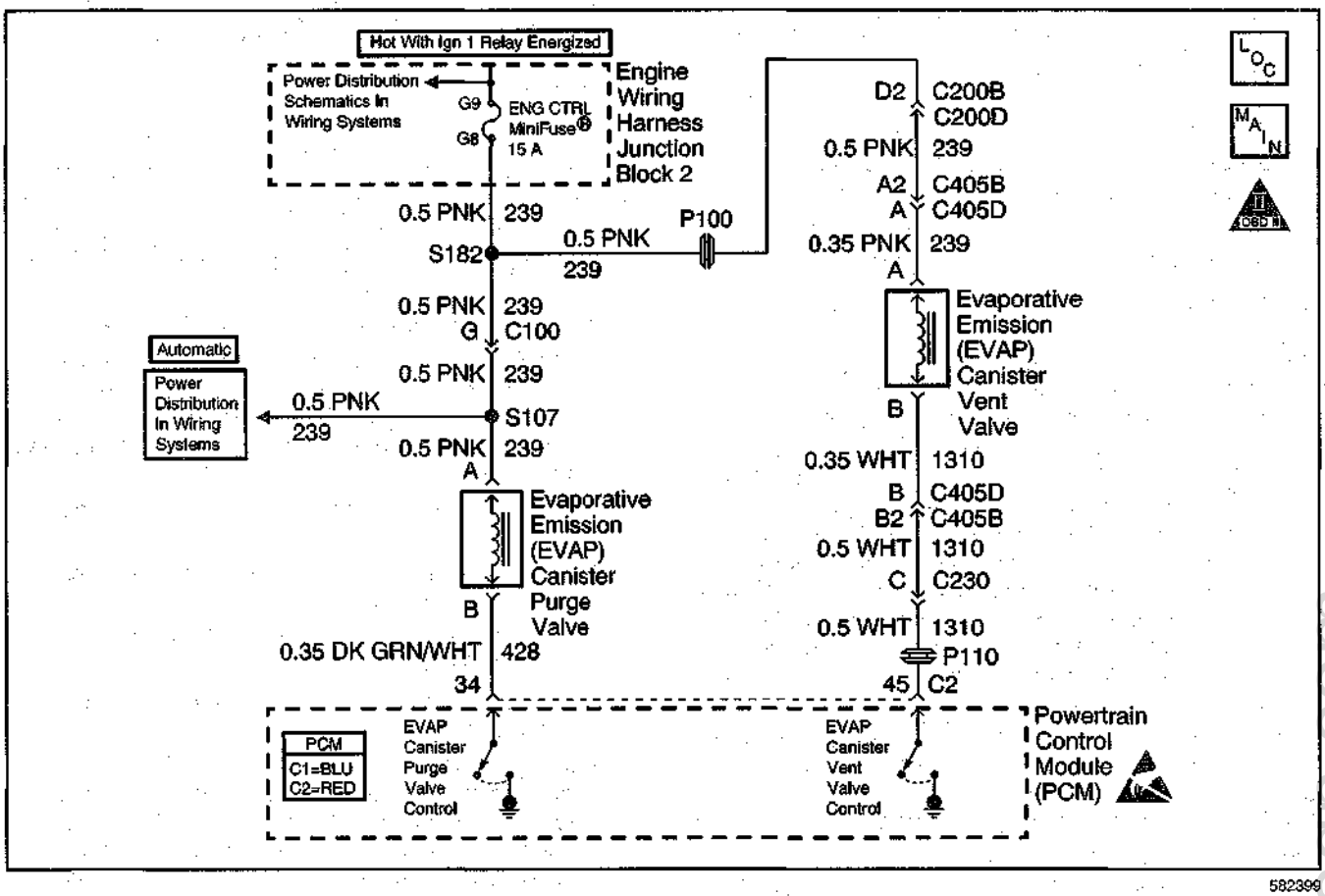
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DTC P0430 Catalyst System Low Efficiency Bank 2

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 other DTCs set?	—	Go to the applicable DTC table	*Go to Step 3*
3	Inspect for the following conditions: • Verify that the three-way catalytic converter is an original equipment part. • Inspect the three-way catalytic converter for damage such as dents, severe discoloration caused by excessive temperature, holes, etc. • Insure that internal three-way catalytic converter rattle caused by damaged catalyst is not present. • Inspect exhaust system for leaks, damage, or loose or missing hardware in the area from the converter to the HO2S #2 primarily. Refer to *Exhaust System Inspection* in Engine Exhaust. • Insure that the HO2S #1 and the HO2S #2 are secure and that their pigtails and wiring are not damaged or contacting the exhaust. Did you find and correct the condition?	—	*Go to Step 5*	*Go to Step 4*
4	Replace converter. Refer to *Oxidation Catalytic Converter Replacement (5.7 L Right)* in Engine Exhaust. Is the action complete?	—	*Go to Step 5*	—
5	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 6*	*Go to Step 2*
6	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0440 Evaporative Emission (EVAP) System



Circuit Description

The PCM tests the EVAP system for the following conditions:

- Large and small leaks
- Excess vacuum
- Purge flow during non-commanded conditions
- Fuel Level and Fuel Pressure sensor faults
- EVAP Purge and Vent Valve faults

The PCM monitors the Fuel Tank Pressure sensor in order to determine the level of vacuum/pressure in the EVAP system. The PCM commands both the EVAP Purge Solenoid and the EVAP Vent Valve ON when the Conditions for Running the DTC are met in order to apply an engine vacuum to the EVAP system. The PCM commands the EVAP Purge Solenoid OFF once the system has reached a predetermined level of vacuum. This test verifies if a vacuum can be achieved in the EVAP system. Failure to develop a vacuum may be caused by a large leak or a restriction. This DTC sets after twice failing the above test.

Conditions for Running the DTC

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0420, P0430, P0500, P0502, P0503, P0562, P0563, and HO2S DTCs are not set.
- The ignition voltage is between 10 volts and 17 volts.
- The barometric pressure is more than 75 kPa.
- The fuel level is between 15 percent and 85 percent of full capacity.
- The engine coolant temperature is between 4°C (39°F) and 30°C (86°F).
- The intake air temperature is between 4°C (39°F) and 30°C (86°F).
- The start up engine coolant and intake air temperatures are within 9°C (16°F) of each other.

Conditions for Setting the DTC

Important: This DTC does NOT report a first failed test. A first fail of this DTC will have a scan tool status as Not Run. Use the scan tool data display parameter of EVAP Test Result to determine if this DTC has failed or passed for this ignition cycle.

The EVAP system cannot develop a vacuum that is more than a predetermined value.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An accurate indication of fuel level is required for the PCM to properly Pass or Fail this DTC. Always diagnose fuel level sensor DTCs before performing this DTC diagnostic table. Always inspect for fuel level sensor DTCs stored as History.

Perform a physical inspection of the EVAP system. Inspect for the following conditions:

- A loose, missing, defective, or incorrect fuel tank cap
- A loose or missing EVAP service port cap.
- A loose, missing, or damaged schrader valve.
- Incorrectly routed or defective EVAP system vacuum and vapor lines
- A malfunctioning or damaged vapor canister
- A damaged fuel sender O-ring

Inspect for charcoal release from the vapor canister. Refer to the *EVAP System Cleaning* procedure.

Excessive resistance in any circuit related to the EVAP system may cause this DTC to set. Listen for an audible click as the EVAP vent solenoid and the EVAP purge solenoid are commanded using the scan tool. If either component does not operate when commanded ON and OFF, and no other DTC is set, inspect the related circuits for excessive resistance.

The vacuum and pressure in the EVAP system is measured in inches of H2O (water). Most gauges measure vacuum in inches of Hg (mercury) and pressure in psi (pounds per square inch). The following table shows how the values compare:

in. H2O	in. Hg.	psi
1 in. H2O	0.07 in. Hg	0.0361 psi.
5 in. H2O	0.36 in. Hg	0.180 psi.
10 in. H2O	0.73 in. Hg	0.361 psi.
15 in. H2O	1.10 in. Hg	0.541 psi.

Conditions for Running the Service Bay Test

- The Service Bay Test may have to be performed in cold ambient air temperatures when the vehicle is running a winter grade fuel. The scan tool displays a message when the service bay test does not run.
  - The battery voltage is between 10.5 and 17.5 volts.
  - The fuel level is between 15 percent and 85 percent of the full capacity.
  - The engine temperature is between 3.5°C (38°F) and 35°C (95°F).
- The scan tool displays Test Aborted if any of the above conditions are not met.
- 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.
- For an intermittent, refer to *Symptoms*.

Test Description

The numbers below refer to the step numbers on the Diagnostic Table.

3. It may be necessary to partially lower the fuel tank to inspect the upper portion of the tank and the EVAP line connections.
4. An intermittent leak or restriction is indicated if the vehicle passes the Service Bay Test. A fuel tank cap that is loose or off causes this DTC to set.

   If the Service Bay Test can not be run, proceed to step 5. If a fault is not currently present the diagnostic table steps will return you to step 3.

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12. This step tests for a leak at the top of the fuel tank, at the fuel filler hose, and the fuel cap. Place the ultrasonic leak detector in these areas. Refer to the information supplied with the EVAP pressure/purge diagnostic cart on proper setup and adjustment procedures.
13. With pressure applied it may be necessary to disconnect the EVAP lines at the components to verify that a line or component is not restricted. A restriction would prevent a vacuum (or the Step 10 test pressure) from forming in the fuel tank.
19. A Fuel Tank Pressure sensor that does not correctly respond to pressure (or vacuum) causes this DTC to set.

    The Fuel Tank Pressure sensor range is from 7.5 in. H2O of pressure to –17.5 in. H2O of pressure (vacuum).

    In order to test the Fuel Tank Pressure sensor for vacuum response, command the EVAP Purge Solenoid Valve ON with the engine running and quickly SEAL the system. Leaving the EVAP Purge Solenoid Valve ON for a longer period of time allows a greater level of vacuum to develop.

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DTC P0440 Evaporative Emission (EVAP) System

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 other EVAP system DTC's stored in history?	—	Go to the applicable DTC table	*Go to Step 3*
3	1. Inspect the EVAP system for the following conditions: • A loose, incorrect, defective or missing fuel tank cap. • Disconnected, improperly routed, kinked or damaged EVAP system purge lines. • A damaged EVAP system component. • A loose, missing, or damaged service port dust cap and/or schrader valve. Refer to the test description for additional information. 2. Repair the EVAP system if needed. Did you find and repair the condition?	—	*Go to Step 21*	*Go to Step 4*
4	**Important:** Ensure that The Conditions for Running the Service Bay test are met before proceeding with this diagnostic. Refer to Diagnostic Aids. Perform the EVAP system Service Bay Test using a scan tool. Does the EVAP diagnostic pass the Service Bay Test?	—	Go to Diagnostic Aids	*Go to Step 5*
5	**Important:** The DTCs must be cleared from the PCM in order to use the output control function on the scan tool. 1. Clear the DTCs using a scan tool. 2. Turn OFF the ignition. 3. Remove the EVAP Purge line from the EVAP Purge Solenoid Valve. 4. Connect the *J 23738-A* hand held vacuum pump to the vacuum port of the EVAP Purge Solenoid Valve. 5. Attempt to apply a vacuum up to the specified value using the hand vacuum pump. Can the value specified be obtained and held?	10 in Hg	*Go to Step 6*	*Go to Step 15*
6	**Important:** If an audible solenoid click cannot be heard and DTC P0443 is not set, inspect the EVAP canister purge solenoid circuits for high resistance. 1. Connect a vacuum gauge to the EVAP Purge solenoid valve. 2. Idle the engine. 3. Command the EVAP Purge Solenoid Valve to 50% using a scan tool. Is the vacuum measured on the gauge the same or more than the specified value?	12 in Hg	*Go to Step 8*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Remove the vacuum source from the EVAP Purge Solenoid. 3. Connect a vacuum gauge to the vacuum source. 4. Idle the engine. Is the vacuum measured on the gauge the same or more than the specified value?	12 in Hg	*Go to Step 15*	*Go to Step 14*

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DTC P0440 Evaporative Emission (EVAP) System (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn OFF the ignition. 2. Reconnect the EVAP purge line to the EVAP purge solenoid. 3. Lower the fuel tank to gain access to the EVAP canister. Refer to *EVAP Canister Replacement*. 4. Disconnect the EVAP purge line from the EVAP Canister (line from the EVAP purge solenoid valve). 5. Connect the *J 23738-A* vacuum pump to the EVAP purge line from the EVAP purge solenoid valve. 6. Using the *J 23738-A* vacuum pump, attempt to apply a vacuum up to the specified value. Can the specified value of vacuum be obtained and held?	5 in Hg	*Go to Step 9*	*Go to Step 18*
9	1. Turn OFF the ignition. 2. Disconnect the fuel tank vapor line from the EVAP Canister. 3. Plug the EVAP canister port for the fuel tank vapor line. 4. Connect the *J 23738-A* vacuum pump to the EVAP purge port on the EVAP canister. 5. Turn ON the ignition. 6. Command the EVAP Vent Valve ON (closed) using a scan tool. 7. Using the *J 23738-A* vacuum pump, attempt to apply a vacuum up to the specified value. Can the specified value of vacuum be obtained and held?	5 in Hg	*Go to Step 12*	*Go to Step 10*
10	1. Leave the system connected as in Step 9. 2. Disconnect the vent line at the EVAP Vent Valve. 3. Plug the vent line. 4. Attempt to apply a vacuum up to the specified value using the *J 23738-A* vacuum pump. Can the specified value of vacuum be obtained and held?	5 in Hg	*Go to Step 16*	*Go to Step 11*
11	1. Inspect the EVAP Vent line from the canister to the EVAP Vent Valve for leaks or missing/damaged O-ring seals. 2. If you find a condition repair the EVAP system as necessary. Did you find and correct the condition?	—	*Go to Step 21*	*Go to Step 17*
12	**Important:** The following steps require the *J 41413* EVAP pressure/purge diagnostic station and the *J 41416* ultrasonic leak detector. Always zero the EVAP pressure and vacuum (in. H2O) gauges on the *J 41413* EVAP pressure/purge diagnostic station before proceeding with diagnosis. 1. Turn OFF the ignition. 2. Remove the plug and the hand vacuum pump. 3. Reconnect all the EVAP components. 4. Connect the *J 41413* EVAP pressure/purge diagnostic station to the EVAP system service port. 5. Command the EVAP Vent Valve ON (closed) using a scan tool. 6. Continuously attempt to pressurize the EVAP system by leaving the EVAP pressure/purge diagnostic station control knob in the pressurize position. 7. Using the *J 41416* ultrasonic leak detector locate and repair EVAP system leak. Did you find and repair the condition?	—	*Go to Step 21*	*Go to Step 13*

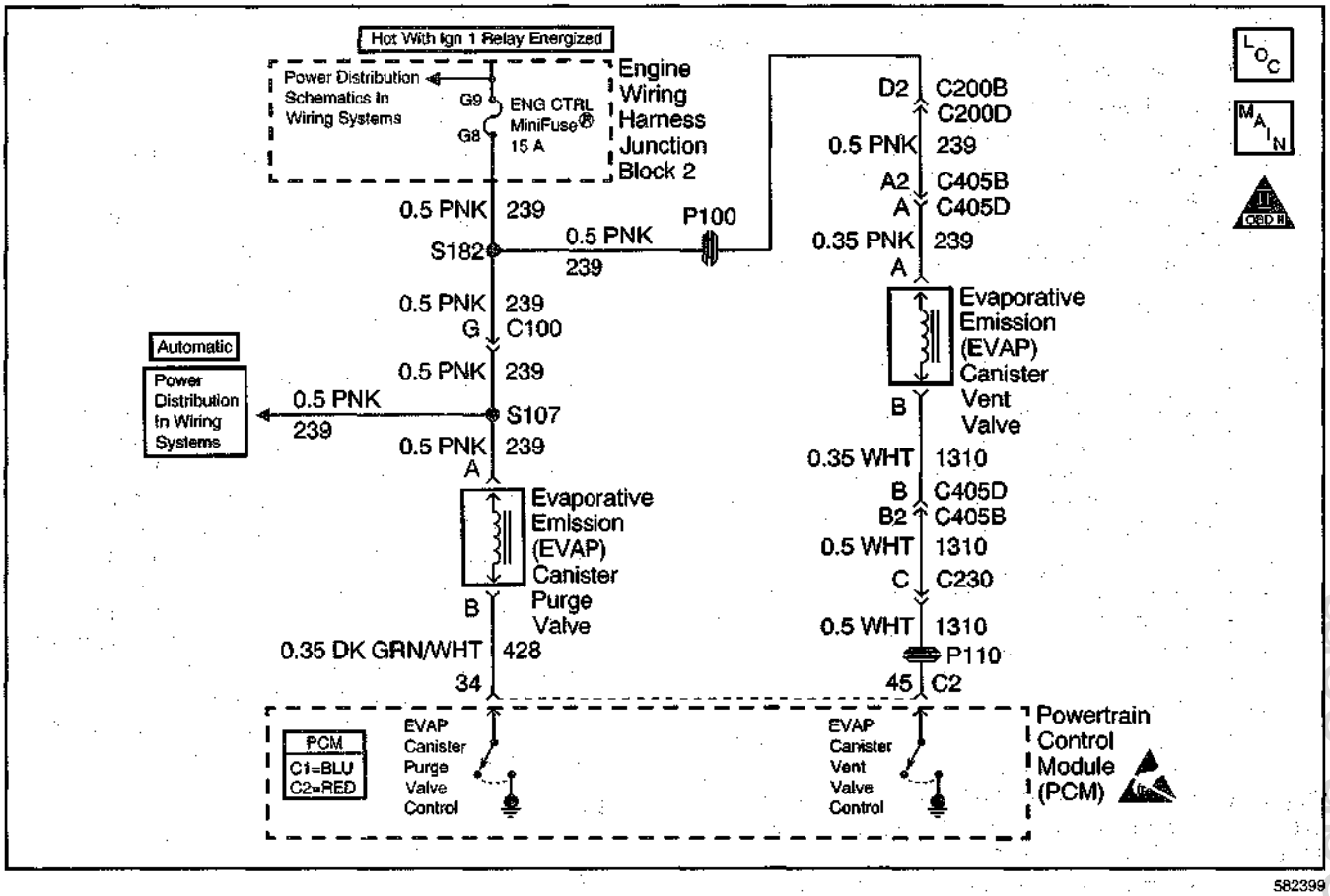
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DTC P0440 Evaporative Emission (EVAP) System (cont'd)

Step	Action	Value(s)	Yes	No
13	1. Inspect the EVAP system for restrictions. Refer to Test Descriptions. 2. Repair as needed. Did you find and correct the condition?	—	*Go to Step 21*	*Go to Step 19*
14	Repair the vacuum source to the EVAP Purge Solenoid Valve. Is the action complete?	—	*Go to Step 21*	—
15	**Important:** Inspect the EVAP Purge Solenoid Valve and the purge line for carbon contamination. Refer to Diagnostic Aids. Replace the EVAP Purge Solenoid Valve. Refer to *EVAP Canister Purge Solenoid Valve Replacement.* Is the action complete?	—	*Go to Step 21*	—
16	Replace the EVAP Vent Valve. Refer to *EVAP Vent Valve Replacement.* Is the action complete?	—	*Go to Step 21*	—
17	Replace the EVAP Vapor Canister. Refer to *EVAP Canister Replacement.* Is the action complete?	—	*Go to Step 21*	—
18	Replace the EVAP line from the EVAP Purge solenoid valve to the EVAP canister. Refer to *Fuel Hose/Pipes Assembly Replacement (Rear).* Is the action complete?	—	*Go to Step 21*	—
19	1. With the EVAP system pressurized, compare the EVAP pressure/purge diagnostic station pressure gauge (in. H20) reading to the Fuel Tank Pressure sensor reading on the scan tool. 2. Compare the readings with the system depressurized. Refer to the Test Description. Does the Fuel Tank Pressure sensor indicate the actual amount of pressure in the EVAP system?	—	Go to *Step 3*	*Go to Step 20*
20	Replace the Fuel Tank Pressure sensor. Refer to *Fuel Tank Pressure Sensor Replacement.* Is the action complete?	—	*Go to Step 21*	—
21	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 22*	*Go to Step 2*
22	Review the captured info on the scan tool. Does the scan tool indicate any DTCs that have not been diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected



Circuit Description

The PCM tests the EVAP system for the following conditions:

- Large and small leaks
- Excess vacuum
- Purge flow during non-commanded conditions
- Fuel Level and Fuel Pressure sensor faults
- EVAP Purge and Vent Valve faults

The PCM monitors the Fuel Tank Pressure sensor in order to determine the level of vacuum/pressure in the EVAP system. The PCM commands both the EVAP Purge Solenoid and the EVAP Vent Valve ON when the Conditions for Running the DTC are met in order to apply an engine vacuum to the EVAP system. The PCM commands the EVAP Purge Solenoid OFF once the system has reached a predetermined level of vacuum. The EVAP system should HOLD the vacuum in the sealed system. The PCM sets this DTC in order to indicate a small leak if the EVAP system fails to hold a predetermined level of vacuum for a predetermined length of time. This DTC sets after failing the above test twice.

Conditions for Running the DTC

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0420, P0430, P0500, P0502, P0503, P0562, P0563, and HO2S DTCs are not set.
- Vehicle speed less than 113 Kph (70 mph).
- TP sensor angle less than 75 percent.
- The barometric pressure is more than 75 kPa.
- The fuel level is between 15 percent and 85 percent of full capacity.
- The engine coolant temperature is between 4°C (39°F) and 30°C (86°F).
- The intake air temperature is between 4°C (39°F) and 30°C (86°F).
- The start up engine coolant temperature and intake air temperature are within 9°C (16°F) of each other.

Conditions for Setting the DTC

The vacuum in the EVAP system decays (leaks) at too fast a rate.

Important: This DTC does NOT report a first failed test. A first fail of this DTC will have a scan tool status as Not Run. Use the scan tool data display parameter of EVAP Test Result to determine if this DTC has failed or passed for this ignition cycle.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An accurate indication of fuel level is required for the PCM to properly Pass or Fail this DTC. Always diagnose fuel level sensor DTCs before performing this DTC diagnostic table. Always inspect for fuel level sensor DTCs stored as History.

Perform a physical inspection of the EVAP system. Inspect for the following conditions:

- A loose, missing, defective, or incorrect fuel tank cap
- Incorrectly routed or defective EVAP system vacuum and vapor lines
- A malfunctioning or damaged vapor canister
- A damaged fuel sender O-ring

Inspect for charcoal release from the vapor canister. Refer to the *EVAP System Cleaning* procedure.

The vacuum and pressure in the EVAP system is measured in inches of H2O (water). Most gauges measure vacuum in inches of Hg (mercury) and pressure in psi (pounds per square inch). The following table illustrates how the values compare:

in. H2O	in. Hg.	psi
1 in. H2O	0.07 in. Hg	0.0361 psi.
5 in. H2O	0.36 in. Hg	0.180 psi.
10 in. H2O	0.73 in. Hg	0.361 psi.
15 in. H2O	1.10 in. Hg	0.541 psi.

Conditions for Running the Service Bay Test

- The Service Bay Test may have to be performed in cold ambient air temperatures when the vehicle is running a winter grade fuel. The scan tool displays a message when the service bay test does not run.
  - The battery voltage is between 10.5 and 17.5 volts.
  - The fuel level is between 15 percent and 85 percent of the full capacity.
  - The engine temperature is between 3.5°C (38°F) and 35°C (95°F).
- The scan tool displays Test Aborted if any of the above conditions are not met.
- 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.
- For an intermittent, refer to *Symptoms*.

Test Description

The numbers below refer to the step numbers on the Diagnostic Table.

3. It may be necessary to partially lower the fuel tank to inspect the upper portion of the tank and the EVAP line connections.
4. An intermittent leak or restriction is indicated if the vehicle passes the Service Bay Test. A fuel tank cap that is loose or off causes this DTC to set.

   If the Service Bay Test can not be run, proceed to step 5. If a fault is not currently present the diagnostic table steps will return you to step 3.

12. This step tests for a leak at the top of the fuel tank, at the fuel filler hose, and the fuel cap. Place the ultrasonic leak detector in these areas. Refer to the information supplied with the EVAP pressure/purge diagnostic cart on proper setup and adjustment procedures.
13. With pressure applied it may be necessary to disconnect the EVAP lines at the components to verify that a line or component is not restricted. A restriction would prevent a vacuum (or the Step 10 test pressure) from forming in the fuel tank.

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19. A Fuel Tank Pressure sensor that does not correctly respond to pressure (or vacuum) causes this DTC to set.

    The Fuel Tank Pressure sensor range is from 7.5 in. H2O of pressure to −17.5 in. H2O of pressure (vacuum).

    In order to test the Fuel Tank Pressure sensor for vacuum response, command the EVAP Purge Solenoid Valve ON with the engine running and quickly SEAL the system. Leaving the EVAP Purge Solenoid Valve ON for a longer period of time allows a greater level of vacuum to develop.

DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected

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 other EVAP system DTC's stored in history?	—	Go to the applicable DTC table	*Go to Step 3*
3	1. Inspect the EVAP system for the following conditions: • A loose, incorrect, defective or missing fuel tank cap. • Disconnected, improperly routed, kinked or damaged EVAP system purge lines. • A damaged EVAP system component. • A loose, missing, or damaged service port dust cap and/or schrader valve. Refer to the test description for additional information. 2. Repair the EVAP system if needed. Did you find and repair the condition?	—	*Go to Step 21*	*Go to Step 4*
4	**Important:** Ensure that The Conditions for Running the Service Bay test are met before proceeding with this diagnostic. Refer to Diagnostic Aids. Perform the EVAP system Service Bay Test using a scan tool. Does the EVAP diagnostic pass the Service Bay Test?	—	Go to Diagnostic Aids	*Go to Step 5*
5	**Important:** The DTCs must be cleared from the PCM in order to use the output control function on the scan tool. 1. Clear the DTCs using a scan tool. 2. Turn OFF the ignition. 3. Remove the EVAP Purge line from the EVAP Purge Solenoid Valve. 4. Connect the *J 23738-A* hand held vacuum pump to the vacuum port of the EVAP Purge Solenoid Valve. 5. Attempt to apply a vacuum up to the specified value using the hand vacuum pump. Can the value specified be obtained and held?	10 in Hg	*Go to Step 6*	*Go to Step 15*
6	**Important:** If an audible solenoid click cannot be heard and DTC P0443 is not set, inspect the EVAP canister purge solenoid circuits for high resistance. 1. Connect a vacuum gauge to the EVAP Purge solenoid valve. 2. Idle the engine. 3. Command the EVAP Purge Solenoid Valve to 50% using a scan tool. Is the vacuum measured on the gauge the same or more than the specified value?	12 in Hg	*Go to Step 8*	*Go to Step 7*

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DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Turn OFF the ignition. 2. Remove the vacuum source from the EVAP Purge Solenoid. 3. Connect a vacuum gauge to the vacuum source. 4. Idle the engine. Is the vacuum measured on the gauge the same or more than the specified value?	12 in Hg	*Go to Step 15*	*Go to Step 14*
8	1. Turn OFF the ignition. 2. Reconnect the EVAP purge line to the EVAP purge solenoid. 3. Lower the fuel tank to gain access to the EVAP canister. Refer to *EVAP Canister Replacement*. 4. Disconnect the EVAP purge line from the EVAP Canister (line from the EVAP purge solenoid valve). 5. Connect the *J 23738-A* vacuum pump to the EVAP purge line from the EVAP purge solenoid valve. 6. Using the *J 23738-A* vacuum pump, attempt to apply a vacuum up to the specified value. Can the specified value of vacuum be obtained and held?	5 in Hg	*Go to Step 9*	*Go to Step 18*
9	1. Turn OFF the ignition. 2. Disconnect the fuel tank vapor line from the EVAP Canister. 3. Plug the EVAP canister port for the fuel tank vapor line. 4. Connect the *J 23738-A* vacuum pump to the EVAP purge port on the EVAP canister. 5. Turn ON the ignition. 6. Command the EVAP Vent Valve ON (closed) using a scan tool. 7. Using the *J 23738-A* vacuum pump, attempt to apply a vacuum up to the specified value. Can the specified value of vacuum be obtained and held?	5 in Hg	*Go to Step 12*	*Go to Step 10*
10	1. Leave the system connected as in Step 9. 2. Disconnect the vent line at the EVAP Vent Valve. 3. Plug the vent line. 4. Attempt to apply a vacuum up to the specified value using the *J 23738-A* vacuum pump. Can the specified value of vacuum be obtained and held?	5 in Hg	*Go to Step 16*	*Go to Step 11*
11	1. Inspect the EVAP Vent line from the canister to the EVAP Vent Valve for leaks or missing/damaged O-ring seals. 2. If you find a condition repair the EVAP system as necessary. Did you find and correct the condition?	—	*Go to Step 21*	*Go to Step 17*

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DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected (cont'd)

Step	Action	Value(s)	Yes	No
12	**Important:** The following steps require the *J 41413* EVAP pressure/purge diagnostic station and the *J 41416* ultrasonic leak detector. Always zero the EVAP pressure and vacuum (in. H2O) gauges on the *J 41413* EVAP pressure/purge diagnostic station before proceeding with diagnosis. 1. Turn OFF the ignition. 2. Remove the plug and the hand vacuum pump. 3. Reconnect all the EVAP components. 4. Connect the *J 41413* EVAP pressure/purge diagnostic station to the EVAP system service port. 5. Command the EVAP Vent Valve ON (closed) using a scan tool. 6. Continuously attempt to pressurize the EVAP system by leaving the EVAP pressure/purge diagnostic station control knob in the pressurize position. 7. Using the *J 41416* ultrasonic leak detector locate and repair EVAP system leak. Did you find and repair the condition?	—	*Go to Step 21*	*Go to Step 13*
13	1. Inspect the EVAP system for restrictions. Refer to Test Descriptions. 2. Repair as needed. Did you find and correct the condition?	—	*Go to Step 21*	*Go to Step 19*
14	Repair the vacuum source to the EVAP Purge Solenoid Valve. Is the action complete?	—	*Go to Step 21*	—
15	**Important:** Inspect the EVAP Purge Solenoid Valve and the purge line for carbon contamination. Refer to Diagnostic Aids. Replace the EVAP Purge Solenoid Valve. Refer to *EVAP Canister Purge Solenoid Valve Replacement.* Is the action complete?	—	*Go to Step 21*	—
16	Replace the EVAP Vent Valve. Refer to *EVAP Vent Valve Replacement.* Is the action complete?	—	*Go to Step 21*	—
17	Replace the EVAP Vapor Canister. Refer to *EVAP Canister Replacement.* Is the action complete?	—	*Go to Step 21*	—
18	Replace the EVAP line from the EVAP Purge solenoid valve to the EVAP canister. Refer to *Fuel Hose/Pipes Assembly Replacement (Rear).* Is the action complete?	—	*Go to Step 21*	—
19	1. With the EVAP system pressurized, compare the EVAP pressure/purge diagnostic station pressure gauge (in. H20) reading to the Fuel Tank Pressure sensor reading on the scan tool. 2. Compare the readings with the system depressurized. Refer to the Test Description. Does the Fuel Tank Pressure sensor indicate the actual amount of pressure in the EVAP system?	—	Go to *Step 3*	*Go to Step 20*
20	Replace the Fuel Tank Pressure sensor. Refer to *Fuel Tank Pressure Sensor Replacement.* Is the action complete?	—	*Go to Step 21*	—

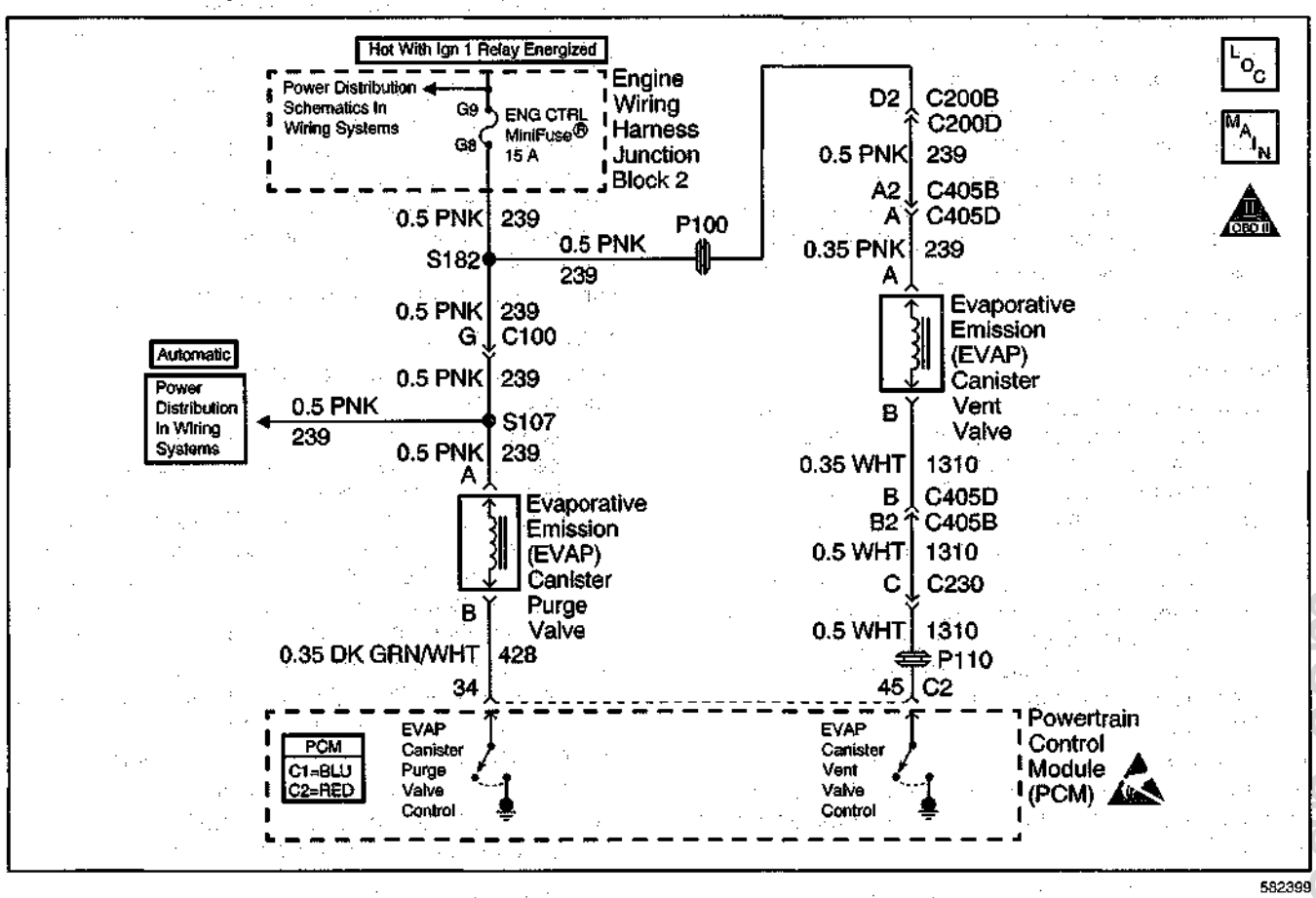
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DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected (cont'd)

Step	Action	Value(s)	Yes	No
21	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 22*	*Go to Step 2*
22	Review the captured info on the scan tool. Does the scan tool indicate any DTCs that have not been diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit



Circuit Description

A voltage is supplied directly to the EVAP Canister Purge Valve. The PCM controls the solenoid by grounding the control circuit via an internal switch called a driver. The primary function of the driver is to supply the ground for the controlled component. Each driver has a fault line which the PCM monitors. The voltage of the control circuit should be low (near 0 volts) when the PCM commands a component ON. The voltage potential of the circuit should be high (near the battery voltage) when the PCM commands the control circuit to a component OFF. If the fault detection circuit senses a voltage other than what the PCM is expects, the fault line status changes causing the DTC to set. The EVAP purge solenoid valve is pulse width modulated (PWM). The PCM controls the EVAP purge solenoid valve duty cycle by controlling the amount of solenoid purge valve ON time. The scan tool displays the amount of ON time in a percentage. This value is the amount of available vacuum that will be applied to the EVAP system.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- The conditions are present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Test the solenoid ignition feed circuit and control circuit for excessive resistance if an audible click cannot be heard when the solenoid is commanded ON and OFF.

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 isolates when the DTC failed.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. Listen for an audible click when the solenoid operates. Be sure that both the ON and the OFF states are commanded. Repeat the commands as necessary. The Fuel Tank Pressure sensor parameter on the scan tool can also be used to determine if the EVAP purge solenoid is operating. You should be able to see the pressure/vacuum change when you command the solenoid on.
4. This step tests for voltage at the EVAP purge solenoid. The ENG IGN fuse supplies power to the coil side of the EVAP purge solenoid.
5. This step verifies that the PCM is providing ground to the EVAP purge solenoid.
6. This step tests if a ground is constantly being applied to the EVAP purge solenoid.

DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit

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	1. Idle the engine at the normal operating temperature. 2. With the scan tool, command the solenoid to 50% and then to 0%. Does the solenoid respond to the commanded positions?	—	*Go to Step 3*	*Go to Step 4*
3	1. Review the Freeze Frame and/or Failure records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure records data that you observe. Does this DTC reset?	—	*Go to Step 4*	Go to *Intermittent Conditions*
4	1. Turn OFF the ignition. 2. Disconnect the EVAP purge solenoid. 3. Turn On the ignition, with the engine OFF. 4. Probe the coil side feed circuit of the EVAP purge solenoid with a test lamp connected to a good ground. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 11*

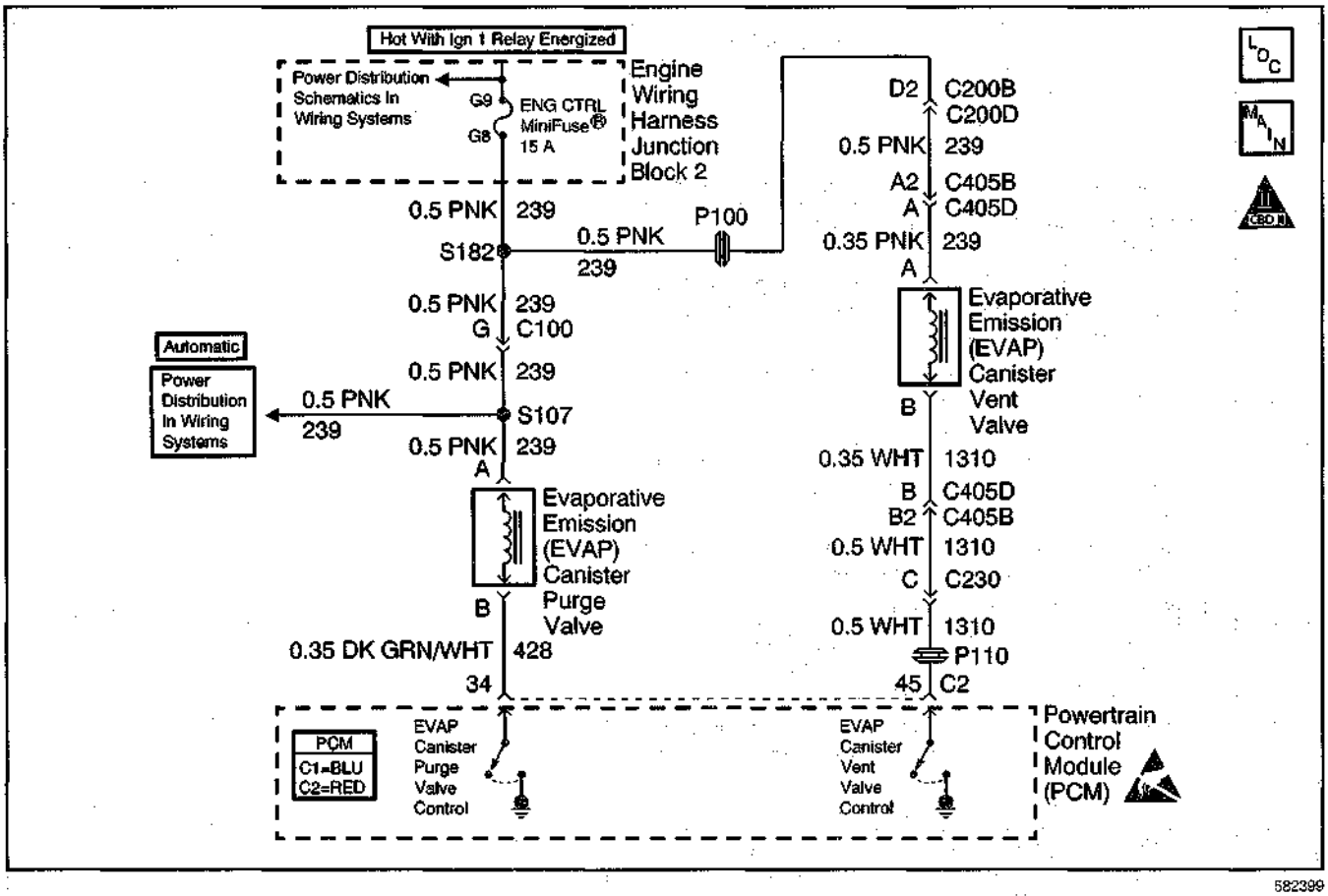
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DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Connect a test lamp between the control circuit of the EVAP purge solenoid and the coil side feed circuit of the EVAP purge solenoid. 2. With a scan tool, command the EVAP purge solenoid to 50% and then to 0%. Does the test lamp respond to each scan tool command?	—	*Go to Step 9*	*Go to Step 6*
6	Does the test lamp remain illuminated with each command?	—	*Go to Step 8*	*Go to Step 7*
7	1. Test the control circuit of the EVAP purge solenoid for a short to voltage or an open. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 10*
8	1. Test the control circuit of the EVAP purge solenoid for a short to ground. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
9	1. Inspect for poor at the connections at the solenoid. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 12*
10	1. Inspect for poor at the connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
11	Repair the coil side feed circuit of the EVAP purge solenoid. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Replace the solenoid. Refer to *EVAP Canister Purge Solenoid Valve Replacement.* Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 14*	—
14	1. Use a scan tool in order to clear the DTCs. 2. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	—	*Go to Step 2*	*Go to Step 15*
15	With a scan tool, review the Stored information (capture info). Does the scan tool display any DTCs that you have not diagnosed?	—	Go to *Diagnostic Trouble Code (DTC) List/Type*	System OK

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DTC P0446 Evaporative Emission (EVAP) Vent System Performance



Circuit Description

The PCM monitors the performance of the EVAP system by applying a predetermined level of vacuum to the EVAP system and then monitors the vacuum decay rate. The PCM sets this DTC if the vacuum decay rate is greater than a predetermined value.

Conditions for Running the DTC

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0420, P0430, P0452, P0453, P0500, P0502, P0503, P0562, P0563, or HO2S DTCs are not set.
- The ignition voltage is between 10 and 17 volts.
- The barometric pressure is more than 75 kPa.
- The fuel level is between 15 percent and 85 percent of full capacity.
- The engine coolant temperature is between 4°C (39°F) and 30°C (86°F).
- The intake air temperature is between 4°C (39°F) and 30°C (86°F).
- The start up engine coolant temperature and the intake air temperature are within 9°C (16°F) of each other.

Conditions for Setting the DTC

- The EVAP vacuum decay rate is more than a predetermined value when the vent solenoid is commanded open.
- The conditions are present for more than 2 seconds.

OR

- The vacuum present in the EVAP system is more than a predetermined value when the vent solenoid is commanded open during normal purge.
- The conditions are present for more than 4 seconds.

Important: This DTC does not report a first failed test. A first fail of this DTC will have a scan tool status as Not Run.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/ replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

A fuel tank pressure sensor ground circuit that is open will cause this DTC to set. The Fuel Tank Pressure sensor and the Fuel Level sensor share the same ground. IF DTC P0463 is also set, inspect the common ground for an open.

An accurate indication of fuel level is required for the PCM to properly Pass or Fail this DTC. Always diagnose the fuel level sensor DTCs before performing this DTC diagnostic table. Always inspect for fuel level sensor DTCs stored as History.

Perform a physical inspection of the EVAP system. Inspect for the following conditions:

- A loose, missing, defective, or incorrect fuel tank cap
- Incorrectly routed or defective EVAP system vacuum and vapor lines
- A stuck closed EVAP Vent Valve
- A restricted or blocked EVAP system hose
- A restricted or stuck closed fuel tank rollover valves
- A malfunctioning or damaged vapor canister

Inspect for charcoal release from the vapor canister. Refer to the *EVAP System Cleaning* procedure.

The vacuum and pressure in the EVAP system is measured in inches of H2O (water). Most gauges measure vacuum in inches of Hg (mercury) and pressure in psi (pounds per square inch). The following shows how the values compare:

in. H2O	in. Hg.	psi
1 in. H2O	0.07 in. Hg	0.0361 psi.
5 in. H2O	0.36 in. Hg	0.180 psi.
10 in. H2O	0.73 in. Hg	0.361 psi.
15 in. H2O	1.10 in. Hg	0.541 psi.

- The Service Bay Test may have to be performed in cold ambient air temperatures when the vehicle is running a winter grade fuel. The scan tool displays a message when the service bay test does not run.

Conditions for Running the Service Bay Test

  - The battery voltage is between 10.5 and 17.5 volts.
  - The fuel level is between 15 percent and 85 percent of the full capacity.
  - The engine temperature is between 3.5°C (38°F) and 35°C (95°F).

- The scan tool displays Test Aborted if any of the above conditions are not met.
- 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 isolates when the DTC failed.
- For an intermittent, refer to *Symptoms*.

Test Description

The numbers below refer to the step numbers on the Diagnostic Table.

3. An intermittent leak or restriction is indicated if the vehicle passes the Service Bay Test. A fuel tank cap that is loose or off causes this DTC to set.

   If the Service Bay Test can not be run, proceed to step 5. If a fault is not currently present the diagnostic table steps will return you to step 3.

5. Testing the vapor canister and the EVAP Vent Valve for restriction.

9. A Fuel Tank Pressure sensor that does not correctly respond to pressure (or vacuum) causes this DTC to set. An open Fuel Tank Pressure sensor ground circuit will cause this DTC to set. If the Fuel Tank Pressure sensor does not respond to pressure (or vacuum) inspect the ground circuit for an open.

   The Fuel Tank Pressure sensor range is from 7.5 in. H2O of pressure to –17.5 in. H2O of pressure (vacuum).

   In order to test the Fuel Tank Pressure sensor for vacuum response, command the EVAP Purge Solenoid Valve ON with the engine running and quickly SEAL the system. Leaving the EVAP Purge Solenoid Valve ON for a longer period of time allows a greater level of vacuum to develop.

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DTC P0446 Evaporative Emission (EVAP) Vent System Performance

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	1. Inspect the EVAP system for the following conditions: • Improperly routed, kinked or damaged EVAP purge and tank vent lines. • A damaged EVAP system component. 2. Repair the EVAP system as necessary if you find a condition. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 3*
3	**Important:** Ensure that The Conditions for Running the Service Bay Test are met before proceeding with this diagnostic. Refer to Diagnostic Aids. Perform the EVAP system Service Bay Test. Does the vehicle pass the Service Bay Test?	—	Go to Diagnostic Aids	*Go to Step 4*
4	1. Turn OFF the ignition. 2. Remove the fuel tank cap. 3. Turn ON the ignition, with the engine OFF. 4. Monitor the fuel tank pressure sensor voltage, with a scan tool. Is the fuel tank pressure sensor voltage less than the specified value?	4 V	*Go to Step 5*	Go to *DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage*
5	1. Turn OFF the ignition. 2. Lower the fuel tank. Refer to *Fuel Tank Replacement*. 3. Disconnect the fuel tank vapor and the EVAP purge lines from the EVAP vapor canister. 4. Plug the canister fitting for the fuel tank vapor line. 5. Connect the hand held vacuum pump *J 23738-A* to the EVAP purge line canister fitting. 6. Turn ON the ignition leaving the engine OFF. 7. Command the EVAP Vent Valve ON (closed) using the scan tool. 8. Attempt to apply and hold the specified amount of vacuum using the hand held vacuum pump *J 23738-A*. 9. Command the EVAP Vent Valve OFF (open) while monitoring the hand held vacuum pump gauge. Does the vacuum drop from the specified value when the EVAP Vent Valve is opened?	5 in Hg	*Go to Step 8*	*Go to Step 6*
6	1. Leave the system as connected in step 4. 2. Disconnect the vent line at the EVAP Vent Valve. 3. Plug the vent line. 4. Attempt to apply and hold the specified amount of vacuum using the hand held vacuum pump *J 23738-A*. 5. Remove the plug from the vent line while monitoring the hand held vacuum pump gauge. Does the vacuum drop from the specified value when the vent line is unplugged?	5 in Hg	*Go to Step 10*	*Go to Step 7*
7	1. Inspect the EVAP Vent line from the canister to the EVAP Vent Valve for restrictions. 2. Repair as necessary if you find a condition. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 11*

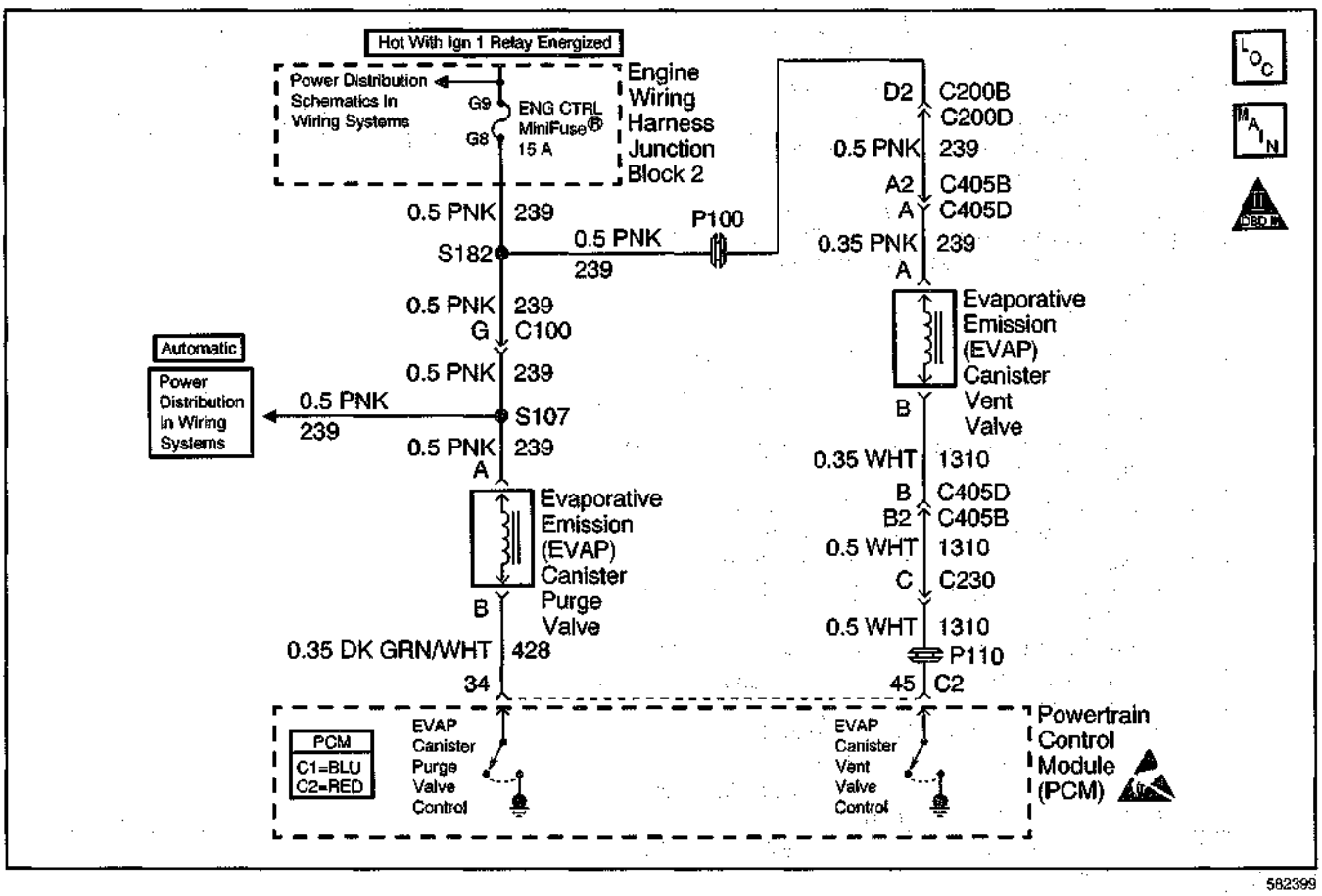
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DTC P0446 Evaporative Emission (EVAP) Vent System Performance (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Test the fuel tank vapor line for a restriction. 2. Repair as necessary if you find a condition. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 9*
9	**Important:** The following steps require the EVAP pressure/purge diagnostic station *J 41413*. Always zero the EVAP Pressure and Vacuum (in. H2O) gauges on the EVAP pressure/purge diagnostic station before proceeding with diagnosis. Refer to the users guide. 1. Turn OFF the ignition. 2. Remove the plug and the hand held vacuum pump. 3. Reconnect the EVAP vapor canister purge and vent lines. 4. Connect the EVAP pressure/purge diagnostic station to the EVAP system service port. 5. Operate the vehicle until the EVAP Purge Solenoid Valve can be commanded ON with a scan tool. 6. Command the EVAP Purge Solenoid Valve ON with the engine running and quickly SEAL the system with the scan tool. **Important:** Refer to test description for further information. 7. Compare the EVAP pressure/purge diagnostic station's vacuum gauge (in. H2O) to the vacuum shown on the scan tool from the Fuel Tank Pressure sensor while the system is sealed. Does the Fuel Tank Pressure sensor indicate the actual amount of vacuum in the EVAP system?	—	*Go to Step 3*	*Go to Step 12*
10	Replace the EVAP Vent Valve. Refer to *EVAP Vent Valve Replacement.* Is the action complete?	—	*Go to Step 13*	—
11	Replace the EVAP Vapor Canister. Refer to *EVAP Canister Replacement.* Is the action complete?	—	*Go to Step 13*	—
12	Replace the Fuel Tank Pressure sensor. Refer to *Fuel Tank Pressure Sensor Replacement.* Is the action complete?	—	*Go to Step 13*	—
13	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 14*	*Go to Step 2*
14	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit



Circuit Description

A voltage is supplied directly to the EVAP Canister Vent valve. The PCM controls the solenoid by grounding the control circuit via an internal switch called a driver. The primary function of the driver is to supply the ground for the controlled component. Each driver has a fault line which the PCM monitors. The voltage of the control circuit should be low (near 0 volts) when the PCM commands a component ON. The voltage potential of the circuit should be high (near the battery voltage) when the PCM commands the control circuit to a component OFF. If the fault detection circuit senses a voltage other than what the PCM is expects, the fault line status changes causing the DTC to set.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- The conditions are present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Test the solenoid ignition feed circuit and control circuit for excessive resistance if an audible click cannot be heard when the solenoid is commanded ON and OFF.

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.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. Listen for an audible click when the solenoid operates. Be sure that both the ON and the OFF states are commanded. Repeat the commands as necessary.
4. This step tests for voltage at the coil side of the EVAP vent solenoid. The ENG CNTRL fuse supplies power to the EVAP vent solenoid.
5. This step verifies that the PCM is providing ground to the EVAP vent solenoid.
6. This step tests if a ground is constantly being applied to the EVAP vent solenoid.

DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit

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	1. Idle the engine at the normal operating temperature. 2. With the scan tool, command the solenoid ON and OFF. Does the solenoid turn ON and OFF when commanded?	—	*Go to Step 3*	*Go to Step 4*
3	1. Review the Freeze Frame and/or Failure records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure records data that you observe. Does this DTC reset?	—	Go to Diagnostic Aids	Go to *Intermittent Conditions*
4	1. Turn OFF the ignition. 2. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information. 3. Lower the fuel tank. Refer to *Fuel Tank Replacement*. 4. Disconnect the solenoid electrical connector. 5. Turn ON the ignition, with the engine OFF. 6. Probe the coil side feed circuit of the EVAP vent solenoid with a test lamp that is connected to a good ground. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 11*

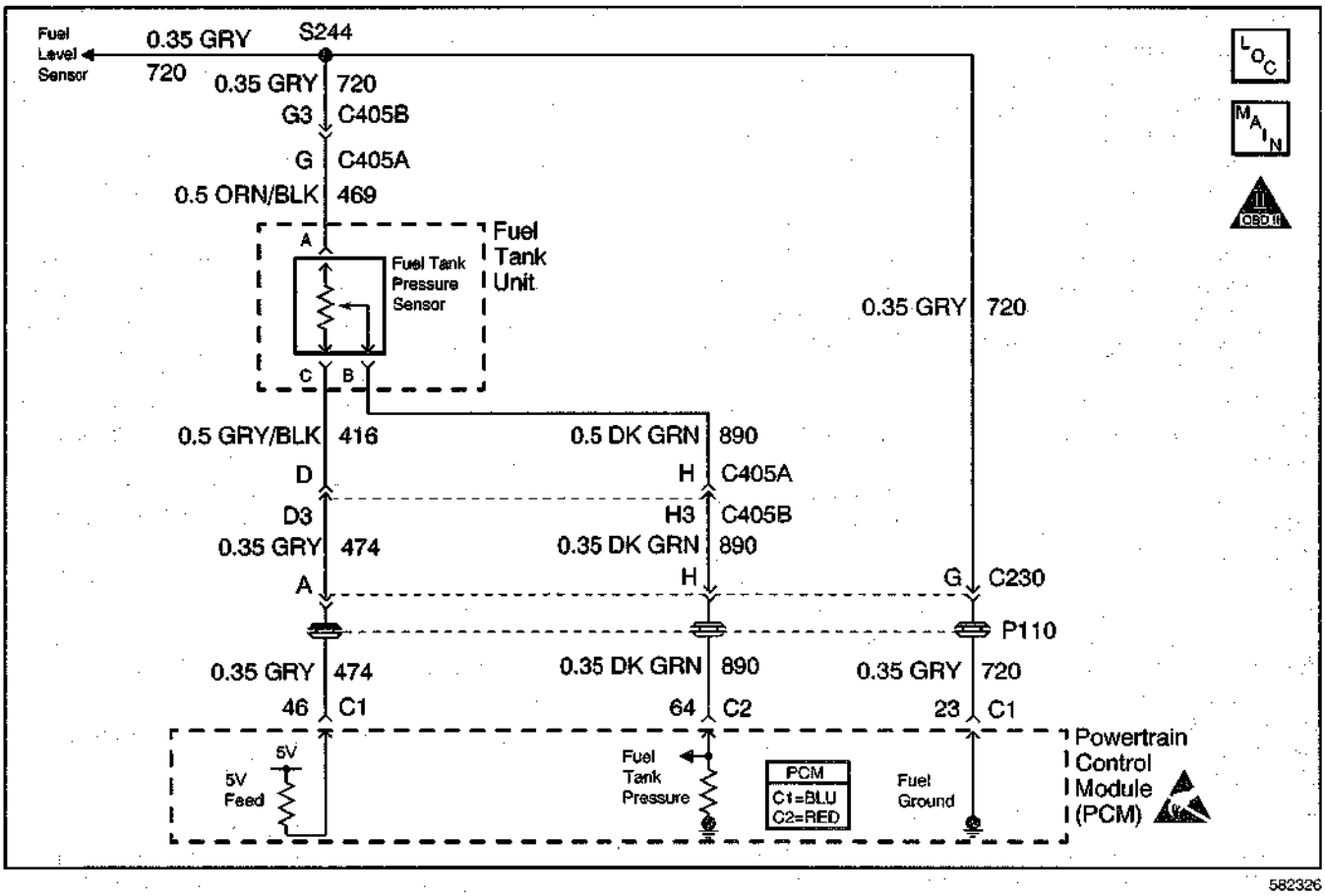
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DTC P0449 Evaporative Emission (EVAP) Vent Solenoid Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Connect a test lamp between the control circuit of the EVAP vent solenoid and the coil side feed circuit of the EVAP vent solenoid. Refer to *Probing Electrical Connectors* in Wiring Systems. 2. With a scan tool, command the EVAP vent solenoid ON and OFF. Does the test lamp turn ON and OFF with each command?	—	*Go to Step 9*	*Go to Step 6*
6	Does the test lamp remain illuminated with each command?	—	*Go to Step 8*	*Go to Step 7*
7	1. Test the control circuit of the EVAP vent solenoid for a short to voltage or an open. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 10*
8	1. Test the control circuit of the EVAP vent solenoid for a short to ground. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
9	1. Inspect for poor connections at the EVAP vent solenoid. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 12*
10	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
11	Repair the coil side feed circuit of the EVAP vent solenoid. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Replace the EVAP vent solenoid. Refer to *EVAP Vent Valve Replacement*. Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 14*	—
14	1. Use a scan tool in order to clear the DTCs. 2. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	—	*Go to Step 2*	*Go to Step 15*
15	With a scan tool, review the Stored information (capture info). Does the scan tool display any DTCs that you have not diagnosed?	—	Go to *Diagnostic Trouble Code (DTC) List/Type*	System OK

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DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage



Circuit Description

The Fuel Tank Pressure sensor changes resistance values based on the fuel tank pressure (or vacuum). A vacuum is considered negative pressure.

The PCM provides a 5.0 volt reference and a ground. The Fuel Tank Pressure sensor signal varies between ground and 5.0 volts as fuel tank pressure varies. The Fuel Tank Pressure sensor voltage increases as the fuel tank pressure decreases (negative pressure, or vacuum). The Fuel Tank Pressure sensor voltage decreases (positive pressure, low voltage) as the fuel tank pressure increases. The PCM uses the Fuel Tank Pressure sensor voltage for EVAP system leak detection. This DTC sets when the Fuel Tank Pressure sensor signal goes below a predetermined value.

Conditions for Running the DTC

The ignition switch is in the RUN position.

Conditions for Setting the DTC

- The Fuel Tank Pressure sensor voltage is less 0.1 volts.
- All conditions present for more than 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The Fuel Tank Pressure Sensor range is from 7.5 in. H2O of pressure to −17.5 in. H2O of pressure (vacuum).

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.

For an intermittent, refer to *Symptoms*.

The vacuum and pressure in the EVAP system is measured in inches of water (H2O). Most gauges measure vacuum in inches of mercury (Hg) and pressure in pounds per square inch (psi). The following shows how the values compare:

in. H2O	in. Hg.	psi
1 in. H2O	0.07 in. Hg	0.0361 psi
5 in. H2O	0.36 in. Hg	0.180 psi
10 in. H2O	0.73 in. Hg	0.361 psi
15 in. H2O	1.10 in. Hg	0.541 psi

Test Description

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

2. If DTC P1639 sets at the same time, this indicates that the 5.0 volt reference circuit is either shorted to ground or shorted to a voltage. The 5.0 volt reference circuit is internally connected within the PCM. The A/C Refrigerant Pressure sensor may be causing this DTC to set.
3. This step determines if the malfunction is present.
4. 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.
5. If the scan tool displays 5.0 volts, the Fuel Tank Pressure sensor signal, 5.0 volt reference circuit, and the PCM are OK.
6. If the scan tool displays 5.0 volts, the Fuel Tank Pressure sensor signal circuit and the PCM are OK.
7. Disconnecting the PCM allows using the DMM in order to test the continuity of the circuits. This aids in locating an open or a shorted circuit.

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DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage

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	1. Install a scan tool. 2. Idle the engine. 3. Monitor the Diagnostic trouble Code (DTC) Information using the scan tool. Did DTC P1639 fail this ignition cycle?	—	Go to *DTC P1639 5 Volt Reference 2 Circuit*	*Go to Step 3*
3	Monitor the Fuel Tank Pressure sensor voltage using the scan tool. Is the Fuel Tank Pressure sensor voltage below the specified value?	0.10V	*Go to Step 5*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids
5	1. Disconnect the Fuel Tank Pressure sensor jumper harness at the body pass through connector. Refer to *Outside left of rear floor pan, foward of rear axle* in Wiring Systems. 2. Jumper the 5.0 volt reference circuit and the Fuel Tank Pressure sensor signal circuit together at the body pass through connector (PCM side of harness). 3. Observe the Fuel Tank Pressure sensor voltage display on the scan tool. Is the Fuel Tank Pressure sensor voltage near the specified value?	5.0V	*Go to Step 11*	*Go to Step 6*
6	1. Connect the *J 34142-B* test lamp between B+ and the Fuel Tank Pressure sensor signal circuit at the body pass through connector. 2. Observe the Fuel Tank Pressure sensor voltage display on the scan tool. Is the Fuel Tank Pressure sensor voltage near the specified value?	5.0V	*Go to Step 7*	*Go to Step 9*
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming*. 3. Test the 5.0 volt reference circuit for an open or short to ground. Refer to *Circuit Testing* in Wiring Systems. 4. If you find the 5.0 volt reference circuit is open or shorted to ground, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 19*	*Go to Step 8*

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DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Inspect the 5.0 volt reference circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. Repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 19*	*Go to Step 18*
9	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the Fuel Tank Pressure sensor signal circuit for the following: • Open circuit • Short to ground • Short to sensor ground circuit • Short to another C1 circuit. 4. If you find the Fuel Tank Pressure sensor signal circuit is open or shorted to ground, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 19*	*Go to Step 10*
10	1. Inspect the Fuel Tank Pressure sensor signal circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections.* 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 19*	*Go to Step 18*
11	1. Inspect for a poor connection at the body pass through connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 19*	*Go to Step 12*
12	1. Turn OFF the ignition. 2. Re-connect the Fuel Tank Pressure sensor jumper harness to the body pass through connector. 3. Lower the fuel tank to gain access to the Fuel Tank Pressure sensor. Refer to *Fuel Tank Replacement.* 4. Disconnect the Fuel Tank Pressure Sensor. 5. Turn ON the ignition leaving the engine OFF. 6. Jumper the Fuel Tank Pressure sensor 5 volt reference circuit and signal circuit together at the Fuel Tank Pressure sensor connector. 7. Observe the Fuel Tank Pressure sensor voltage using a scan tool. Is the Fuel Tank Pressure sensor voltage near the specified value?	5.0V	*Go to Step 16*	*Go to Step 13*
13	Measure the Fuel Tank Pressure sensor 5.0 volt reference circuit between the Fuel Tank Pressure sensor connector and body ground using the DMM. Does the DMM display a voltage near the specified voltage?	5.0V	*Go to Step 14*	*Go to Step 15*
14	Repair the open or grounded Fuel Tank Pressure sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—

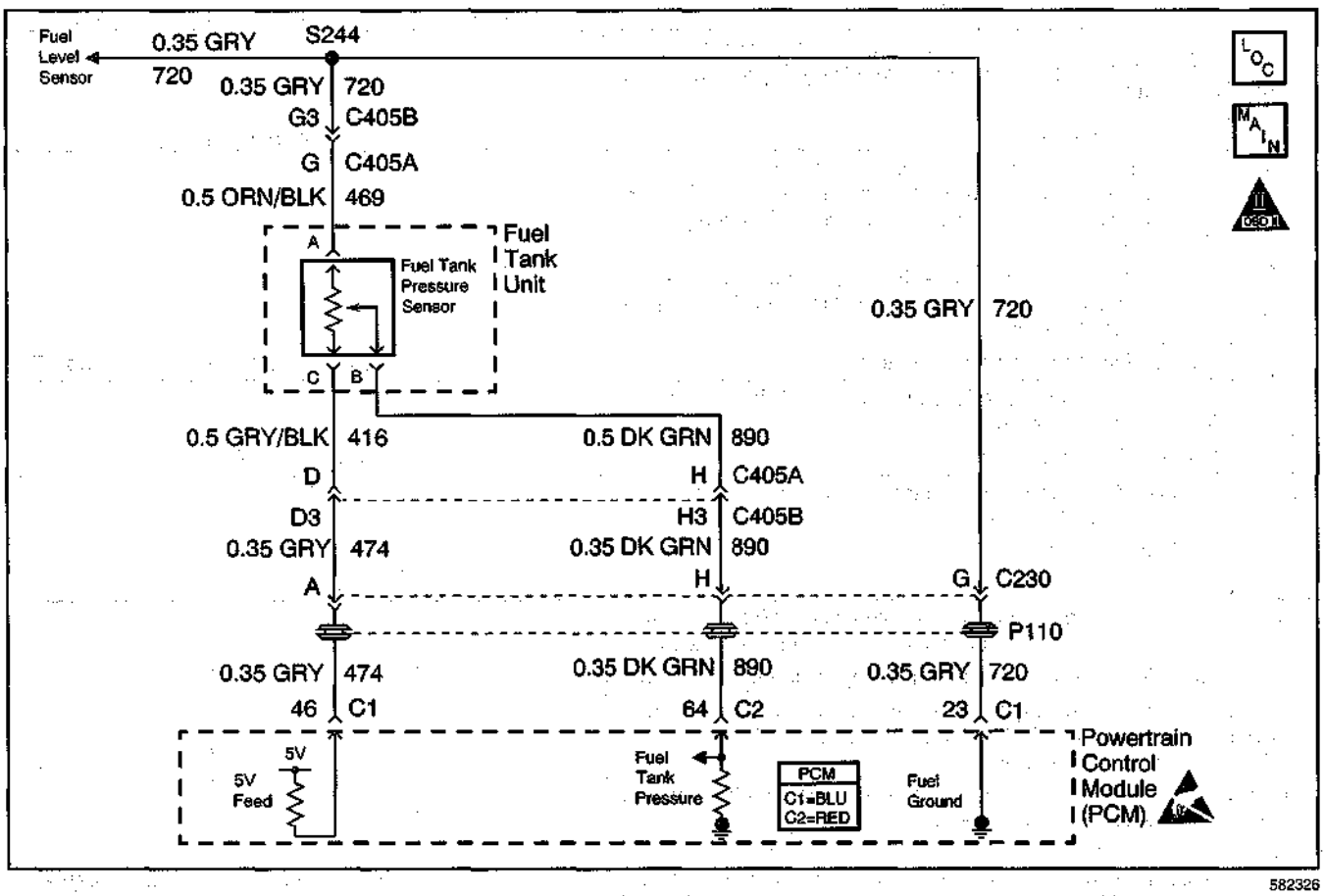
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DTC P0452 Fuel Tank Pressure Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
15	Repair the open or grounded Fuel Tank Pressure sensor 5.0 volt reference circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—
16	1. Inspect for a poor connection at the Fuel Tank Pressure sensor harness connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 19*	*Go to Step 17*
17	Replace the Fuel Tank Pressure sensor. Refer to *Fuel Tank Pressure Sensor Replacement.* Is the action complete?	—	*Go to Step 19*	—
18	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 19*	—
19	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 20*	*Go to Step 2*
20	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage



Circuit Description

The Fuel Tank Pressure sensor changes resistance values based on the fuel tank pressure (or vacuum). A vacuum is considered negative pressure.

The PCM provides a 5.0 volt reference and a ground. The Fuel Tank Pressure sensor signal varies between ground and 5.0 volts as fuel tank pressure varies. The Fuel Tank Pressure sensor voltage increases as the fuel tank pressure decreases (negative pressure, or vacuum). The Fuel Tank Pressure sensor voltage decreases (positive pressure, low voltage) as the fuel tank pressure increases. The PCM uses the Fuel Tank Pressure sensor voltage for EVAP system leak detection. This DTC sets when the Fuel Tank Pressure sensor signal goes above a predetermined value.

Conditions for Setting the DTC

The ignition switch is in the RUN position.

Conditions for Setting the DTC

- The Fuel Tank Pressure sensor voltage is more than 4.90 volts.
- All conditions present for more than 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An open Fuel Tank Pressure sensor ground circuit will not set this DTC. A Fuel Tank Pressure sensor that does not respond to pressure changes may indicate a circuit condition.

The Fuel Tank Pressure Sensor range is from 7.5 in. H2O of pressure to −17.5 in. H2O of pressure (vacuum).

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.

For an intermittent, refer to *Symptoms*.

The vacuum and pressure in the EVAP system is measured in inches of H2O (water). Most gauges measure vacuum in inches of Hg (mercury) and pressure in psi (pounds per square inch). The following shows how the values compare:

In. H2O	in. Hg.	psi
1 in. H2O	0.07 in. Hg	0.0361 psi.
5 in. H2O	0.36 in. Hg	0.180 psi.
10 in. H2O	0.73 in. Hg	0.361 psi.
15 in. H2O	1.10 in. Hg	0.541 psi.

Test Description

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

2. This step determines if the malfunction is present. If DTC P1635 sets at the same time, this indicates that the 5.0 volt reference circuit is either shorted to ground or shorted to a voltage. The 5 volt reference circuit is internally connected within the PCM. The A/C Refrigerant Pressure sensor may be causing this DTC to set. Refer to DTC P1635 for further diagnosis.
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.
4. This step tests whether the signal circuit is shorted to a voltage.
5. This step tests whether a ground circuit is available for the Fuel Tank Pressure sensor at the body pass through connector.
9. This step tests whether a ground circuit is available for the Fuel Tank Pressure sensor.

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DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage

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	1. Turn ON the ignition leaving the engine OFF. 2. Monitor the Fuel Tank Pressure sensor voltage using the scan tool. Is the Fuel Tank Pressure sensor voltage above the specified value?	4.3V	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Disconnect the Fuel Tank Pressure sensor jumper harness at the body pass through connector. Refer to *Outside left of rear floor pan, foward of rear axle* in Wiring Systems. 2. Observe the Fuel Tank Pressure sensor voltage displayed on the scan tool. Is the Fuel Tank Pressure sensor voltage below the specified value?	1.0V	*Go to Step 5*	*Go to Step 11*
5	Probe the sensor ground circuit at the body pass through connector (PCM side) with the *J 34142-B* test lamp connected to B+. Is the test lamp illuminated?	—	*Go to Step 6*	*Go to Step 12*
6	Measure the voltage at the 5.0 volt reference circuit at the body pass through connector to the battery ground using the DMM. Is the voltage near the specified value?	5.0V	*Go to Step 7*	*Go to Step 19*
7	1. Inspect for a poor connections at the body pass through connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the terminal as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 20*	*Go to Step 8*

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DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn OFF the ignition. 2. Re-connect the Fuel Tank Pressure sensor jumper harness to the body pass through connector. 3. Lower the fuel tank to gain access to the Fuel Tank Pressure sensor. Refer to *Fuel Tank Replacement*. 4. Disconnect the Fuel Tank Pressure Sensor electrical connector. 5. Turn ON the ignition leaving the engine OFF. 6. Observe the Fuel Tank Pressure sensor voltage using a scan tool. Is the Fuel Tank Pressure sensor voltage below the specified value?	1.0V	*Go to Step 9*	*Go to Step 14*
9	Probe the Fuel Tank Pressure sensor ground circuit with the *J 34142-B* test lamp connected to B+ at the Fuel Tank Pressure sensor jumper harness (PCM side). Is the test lamp illuminated?	—	*Go to Step 10*	*Go to Step 15*
10	Measure the voltage at the Fuel Tank Pressure sensor 5.0 volt reference circuit to the battery ground using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Is the voltage near the specified value?	5.0V	*Go to Step 17*	*Go to Step 16*
11	1. Test the Fuel Tank Pressure sensor signal circuit for a short to voltage or a short to the 5 volt reference circuit between the body pass through connector and the PCM. Refer to *Measuring Voltage* in Wiring Systems. 2. Repair the Fuel Tank Pressure sensor signal circuit if the circuit is shorted. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 20*	*Go to Step 13*
12	1. Disconnect the PCM connector C1 located on the same side as the manufacturers logo. Refer to *PCM Replacement/Programming*. 2. Test for continuity of the Fuel Tank Pressure sensor ground circuit between the body pass through connector and the PCM. Refer to *Testing for Continuity* in Wiring Systems. 3. Repair the open or excessive resistance if the Fuel Tank Pressure sensor ground circuit measures over the specified value. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	2Ω	*Go to Step 21*	*Go to Step 13*
13	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* In Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	–	*Go to Step 21*	*Go to Step 14*
14	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 21*	—
15	Repair the poor connection or the signal circuit for a short to voltage in the Fuel Tank Pressure sensor jumper harness. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 21*	—

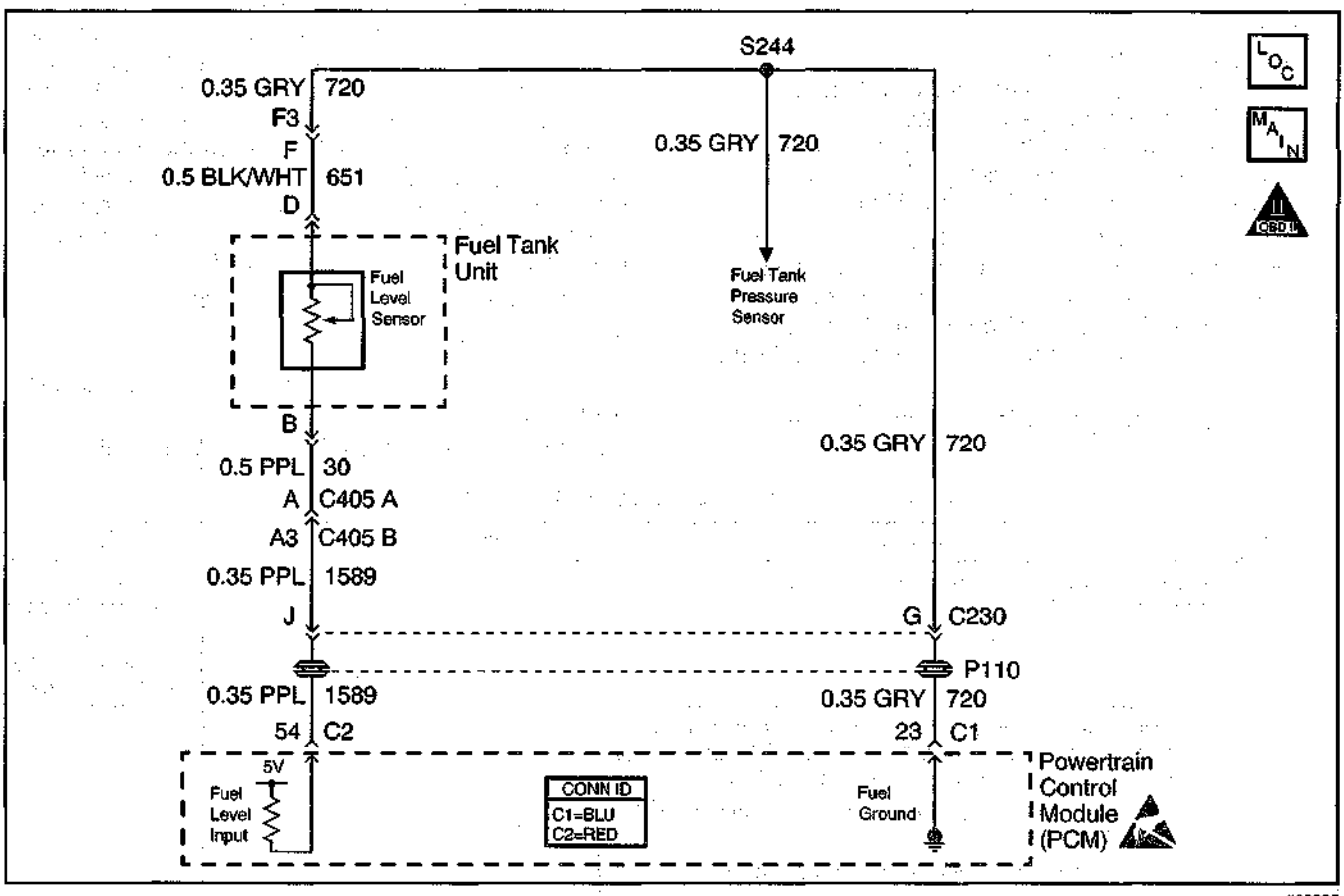
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DTC P0453 Fuel Tank Pressure Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
16	Repair the poor connection or open ground circuit in the Fuel Tank Pressure sensor jumper harness. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 21*	—
17	Repair the 5 volt reference circuit in the Fuel Tank Pressure jumper harness for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 21*	—
18	1. Inspect for a poor sensor ground terminal connection at the Fuel Tank Pressure sensor jumper harness connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 21*	*Go to Step 19*
19	Replace the Fuel Tank Pressure sensor. Refer to *Fuel Tank Pressure Sensor Replacement.* Is the action complete?	—	*Go to Step 21*	—
20	Repair the 5 volt reference circuit for a short to voltage between the PCM and the jumper harness. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 21*	—
21	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 22*	*Go to Step 2*
22	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0461 Fuel Level Sensor Performance



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 the changes in this voltage caused by changes in the resistance of the sensor in order to determine fuel level.

When the fuel tank is full, the sensor resistance is high, therefore, the PCM senses a high signal voltage (fuel tank full). When the fuel tank is empty, the sensor resistance is low, and the PCM senses a low signal voltage (fuel tank empty).

The PCM uses inputs from the Fuel Level Sensor in order to calculate the total fuel remaining in the fuel tank. This information is then sent to the fuel gauge. The Fuel Level information is also used for misfire and EVAP diagnostics.

This diagnostic tests for a stuck fuel level sensor signal. The PCM sets this DTC if the fuel level signal appears to be stuck based on a lack of signal variation expected during normal operation.

Conditions for Running the DTC

- The ignition switch is in the RUN position.
- More than 150 miles have been accumulated.

Conditions for Setting the DTC

The fuel level in the fuel tank does not decrease by at least 3.0 liters (3/4 gallon).

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

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.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. This step determines if the fault is present.

DTC P0461 Fuel Level Sensor Performance

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	1. Disconnect the Fuel Tank jumper harness from the body pass through connector. Refer to *Outside left of rear floor pan, foward of rear axle* in Wiring Systems. 2. Jumper the fuel level signal circuit to a known good ground. 3. Monitor the Fuel Level sensor parameter using the scan tool. Is the Fuel Level sensor at the specified value?	0.0V	*Go to Step 3*	*Go to Step 5*
3	1. Jumper the Fuel Level sensor signal circuit and the ground circuit together at the body pass through connector. 2. Monitor the Fuel Level sensor parameter using the scan tool. Is the Fuel Level sensor at the specified value?	0.0V	*Go to Step 4*	*Go to Step 6*
4	1. Remove the tank fuel level sensor. Refer to *Fuel Sender Assembly Replacement*. 2. Inspect for the following: • Damage to the Fuel Tank jumper harness. • Poor connections at the Fuel Pump Tank Module. • A stuck Fuel Level sensor (i.e. the fuel strainer interfering with the sender float arm.) • Foreign material in the fuel tank (ice) • A deformed fuel tank. 3. If you find a condition, repair the condition as necessary. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 7*

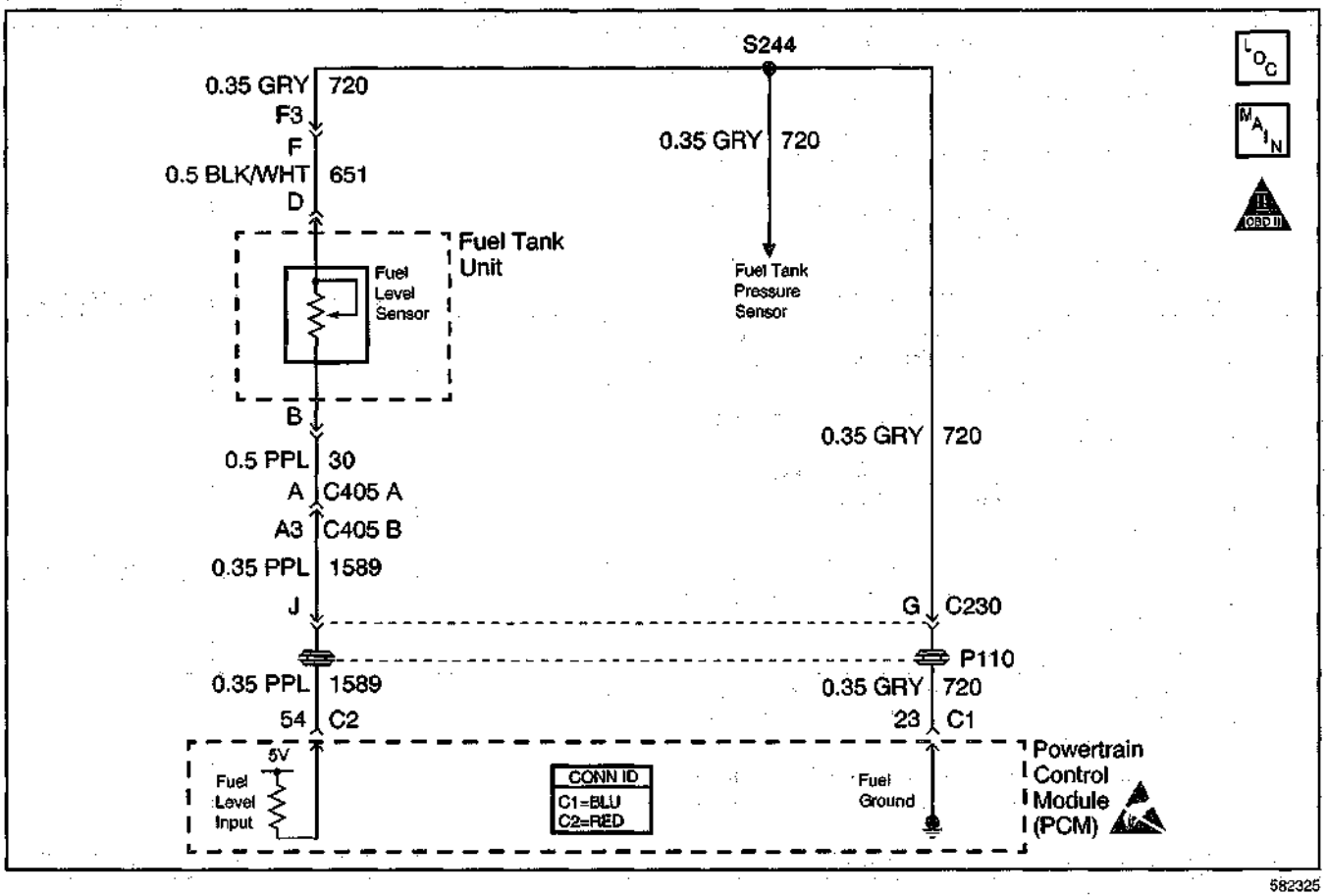
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DTC P0461 Fuel Level Sensor Performance (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 2. Test the Fuel Level signal circuit for excessive resistance. Refer to *Testing for Continuity* in Wiring Systems. 3. If you find a circuit condition, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 8*
6	1. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 2. Test the Fuel Level ground circuit for excessive resistance. 3. If you find a circuit condition, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 8*
7	Replace the Fuel Level sensor. Refer to *Fuel Level Sensor Replacement.* Is the action complete?	—	*Go to Step 10*	—
8	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 9*
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 10*	—
10	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 11*	*Go to Step 2*
11	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0462 Fuel Level Sensor Circuit Low Voltage



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, 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 PCM senses 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 via the class 2 circuit. The Fuel Level information is also used for misfire and EVAP diagnostics.

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 stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

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.

For an intermittent, refer to *Symptoms*.

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	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	1. Install the scan tool. 2. Turn ON the ignition leaving the engine OFF. 3. Monitor the Fuel Level sensor display on the scan tool. Is the Fuel Level sensor voltage above the specified value?	0.39V	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 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 jumper harness at the body pass through connector. Refer to *Outside left of rear floor pan, foward of rear axle* in Wiring Systems. 2. Observe the Fuel Level sensor display on the scan tool. Is the Fuel Level sensor near the specified value?	5V	*Go to Step 6*	*Go to Step 5*

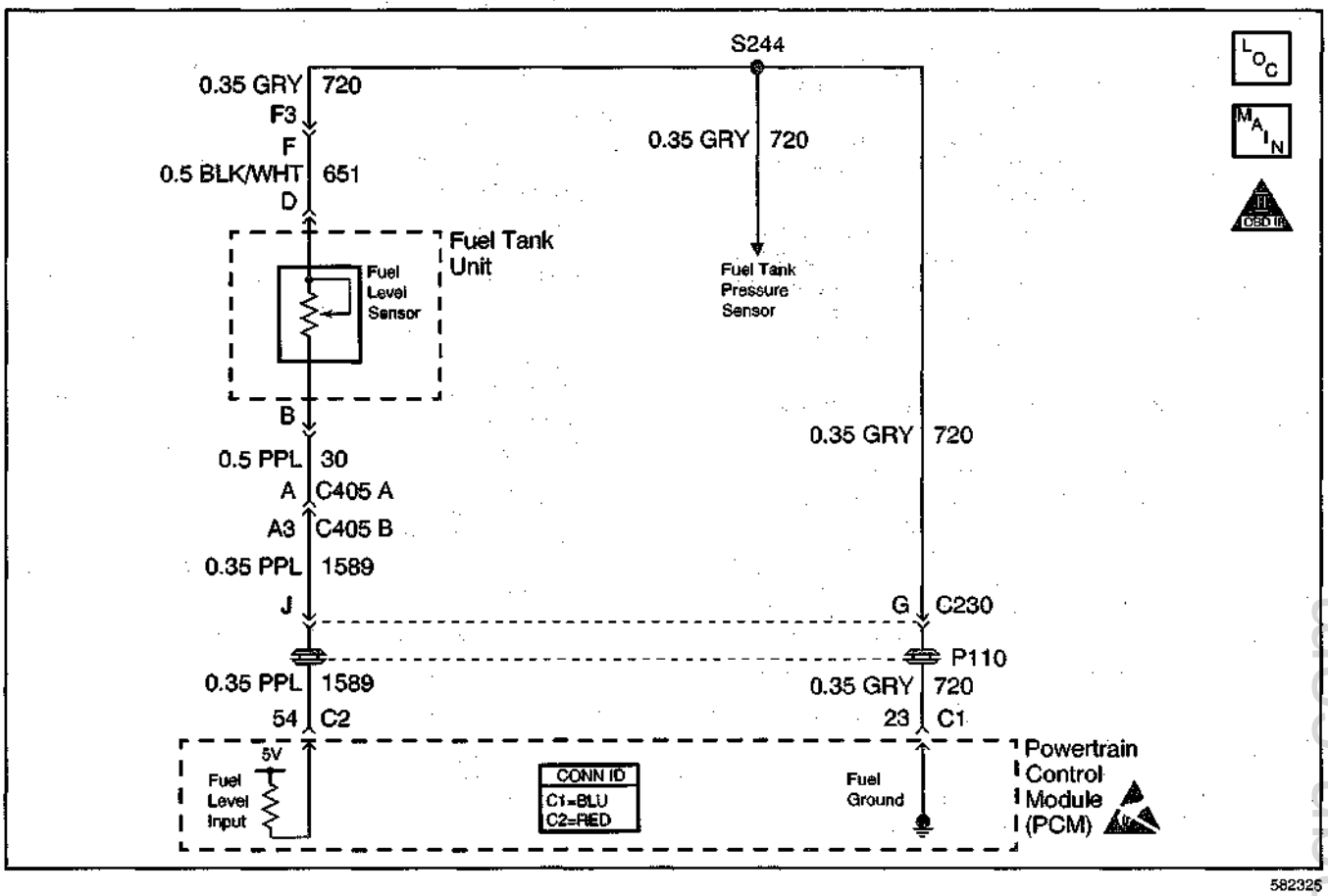
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DTC P0462 Fuel Level Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the Fuel Level sensor signal circuit for continuity to ground. Refer to *Testing for Continuity* in Wiring Systems. 4. If you find the Fuel Level sensor signal circuit is grounded, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 8*
6	1. Lower the fuel tank to gain access if necessary. Refer to *Fuel Tank Replacement.* 2. Inspect the fuel tank jumper harness for the following: • Damage to the harness. • Broken or rubbed through wires. 3. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 7*
7	Replace the Fuel Level sensor. Refer to *Fuel Level Sensor Replacement.* Is the action complete?	—	*Go to Step 9*	—
8	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0463 Fuel Level Sensor Circuit High Voltage



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, 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 PCM senses 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 via the class 2 circuit. The Fuel Level information is also used for misfire and EVAP diagnostics.

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 stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

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.

For an intermittent, refer to *Symptoms*.

Test Description

The numbers below refer to the step numbers on the Diagnostic Table.

3. This step determines if the fault is present.
4. 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.
5. Inspect the Fuel level signal circuit for short to the Fuel Pump ignition feed circuit.

DTC P0463 Fuel Level Sensor Circuit High Voltage

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	1. Install the scan tool. 2. Idle the engine at the normal operating temperature. Did DTC P1635 and P1639 Fail This Ignition cycle?	—	Go to *DTC P1635 5 Volt Reference 1 Circuit*	*Go to Step 3*
3	1. Install the scan tool. 2. Turn ON the ignition leaving the engine OFF. 3. Monitor the Fuel Level sensor display on the scan tool. Is the Fuel Level Sensor voltage above the specified value?	2.9V	*Go to Step 5*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame and/or Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids

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DTC P0463 Fuel Level Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information. 3. Disconnect the fuel tank jumper harness at the body pass through connector. Refer to *Outside left of rear floor pan, foward of rear axle* in Wiring Systems. 4. Turn ON the ignition leaving the engine OFF. 5. Measure the voltage from the Fuel Level signal circuit to a known good ground using the DMM. Is the Fuel Level sensor signal voltage above the specified value?	5V	*Go to Step 14*	*Go to Step 6*
6	1. Jumper the Fuel Level sensor terminals together at the body pass through connector (PCM side). 2. Observe the Fuel Level sensor parameter on the scan tool. Is the Fuel Level sensor voltage near the specified value?	0V	*Go to Step 11*	*Go to Step 7*
7	Jumper the Fuel Level sensor signal circuit (PCM side) to a known good ground. Is the Fuel Level sensor voltage near the specified value?	0V	*Go to Step 10*	*Go to Step 8*
8	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the Fuel Level sensor signal circuit for an open. Is the Fuel Level sensor signal circuit open?	—	*Go to Step 9*	*Go to Step 16*
9	Repair the Fuel Level sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
10	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the Fuel Level sensor ground circuit for an open. Refer to *Testing for Continuity* in Wiring Systems. Is the Fuel Level sensor ground circuit open?	—	*Go to Step 15*	*Go to Step 16*
11	1. Inspect the fuel tank jumper harness for poor connections at the body pass through connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 12*
12	1. Lower the fuel tank. Refer to *Fuel Tank Replacement.* 2. Inspect the fuel tank jumper harness for the following conditions: • Damage to the fuel tank jumper harness. • Poor connections at the fuel level sender assembly. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. • Open circuit in the fuel tank jumper harness. • Broken or rubbed through wires. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 13*

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DTC P0463 Fuel Level Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
13	Replace the Fuel Level sensor. Refer to *Fuel Level Sensor Replacement.* Is the action complete?	—	*Go to Step 18*	—
14	Repair the Fuel Level sensor signal circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
15	Repair the Fuel Level sensor ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
16	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the terminal as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0480 Cooling Fan Relay 1 Control Circuit

Refer to Engine Controls Schematics, *Cooling Fans* for complete circuit details.

Circuit Description

The cooling fan system in this vehicle provides for two separate modes of operation. These are the low speed fan and the high speed fan operating modes. The low speed mode operates both fans at half speed by using a series circuit configuration. The high speed mode operates both fans at full speed by using a parallel circuit configuration. These two operating modes are accomplished using 3 fan control relays.

This system which uses three relays to control two fan motors appears complicated. To aid in better understanding this system it is suggested to follow the circuits in the schematic as you read the description. This will aid in understanding the two distinct modes of operating the relays and coolant fans.

Low speed fan operation is established when the PCM commands Fan Relay #1 ON by grounding circuit 335 with an internal driver (relays #2 and #3 are left OFF). This closes the relay switch and allows current to flow from the battery, through the switch contacts on circuit 409 to the Left Hand cooling fan. Current flow continues out of the fan motor on circuit 532 to relay #3. The unenergized relay #3 switch contacts allow current to flow to circuit 504. This provides power to the Right Hand cooling fan motor. The low side of the RH cooling fan completes the circuit to ground on circuit 150. This circuit is a series circuit which allows half speed operation for each fan since each fan motor will use half of the supplied battery power.

High speed operation is established when all three relays are energized. Relays #2 and #3 share the same control circuit to the PCM. This is circuit 473. As in the low speed mode, Relay #1 supplies current flow to the LH cooling fan on circuit 409. Current flow continues through the motor on circuit 532 to relay #3 which is now energized. The switch has now provided a path for current to flow through circuit 150 directly to ground. This circuit now only has the LH fan motor to power and allows it to run at full speed. Relay #2 is also energized and provides current flow on circuit 504 to the RH cooling fan. This fan now has its own dedicated circuit and will operate at full speed. This mode is operating as a parallel circuit.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- The conditions must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent, refer to *Symptoms*.

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 the OFF states. Repeat the commands as necessary.
4. This step tests for voltage at the coil side of the cooling fan relay 1. The cooling fan mini fuse supplies power to the coil side of the cooling fan relay 1.
5. This step verifies that the PCM is providing ground to the cooling fan relay 1.
6. This step tests if ground is constantly being applied to the cooling fan relay.

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DTC P0480 Cooling Fan Relay 1 Control Circuit

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	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, command the cooling fan relay 1 ON and OFF. Does the cooling fan relay turn ON and OFF with each command?	—	*Go to Step 3*	*Go to Step 4*
3	1. Review the Freeze Frame and/or Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the same Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure Records data that you observed. Does the DTC reset?	—	*Go to Step 4*	Go to *Intermittent Conditions*
4	1. Turn OFF the ignition. 2. Disconnect the cooling fan relay 1 from the underhood electrical center. 3. Turn ON the ignition, with the engine OFF. 4. Probe the coil side feed circuit of the cooling fan relay with a test lamp that is connected to a good ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 11*
5	1. Connect a test lamp between the control circuit of the cooling fan relay and the coil side feed circuit of the cooling fan relay. 2. With a scan tool, command the cooling fan relay ON and OFF. Does the test lamp turn ON and OFF with each command?	—	*Go to Step 9*	*Go to Step 6*
6	Does the test lamp remain illuminated with each command?	—	*Go to Step 8*	*Go to Step 7*
7	1. Test the control circuit of the cooling fan relay for an open. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 10*
8	1. Test the control circuit of the cooling fan relay for a short to ground. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
9	1. Inspect for poor connections at the cooling fan relay. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 12*

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DTC P0480 Cooling Fan Relay 1 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
11	Repair the coil side feed circuit of the cooling fan relay. Refer to *Wiring Repairs* in Wiring Systems. Did you complete the repair?	—	*Go to Step 14*	—
12	Replace the cooling fan relay 1. Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 14*	—
14	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	—	*Go to Step 2*	*Go to Step 15*
15	With a scan tool, review the Stored Information (capture info). Does the scan tool display any DTCs that you have not diagnosed?	—	Go to *Diagnostic Trouble Code (DTC) List/Type*	System OK

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DTC P0481 Cooling Fan Relay 2 and 3 Control Circuit

Refer to Engine Controls Schematics, *Cooling Fans* for complete circuit details.

Circuit Description

The cooling fan system in this vehicle provides for two separate modes of operation. These are the low speed fan and the high speed fan operating modes. The low speed mode operates both fans at half speed by using a series circuit configuration. The high speed mode operates both fans at full speed by using a parallel circuit configuration. These two operating modes are accomplished using 3 fan control relays.

This system which uses three relays to control two fan motors appears complicated. To aid in better understanding this system it is suggested to follow the circuits in the schematic as you read the description. This will aid in understanding the two distinct modes of operating the relays and coolant fans.

Low speed fan operation is established when the PCM commands Fan Relay #1 ON by grounding circuit 335 with an internal driver (relays #2 and #3 are left OFF). This closes the relay switch and allows current to flow from the battery, through the switch contacts on circuit 409 to the Left Hand cooling fan. Current flow continues out of the fan motor on circuit 532 to relay #3. The unenergized relay #3 switch contacts allow current to flow to circuit 504. This provides power to the Right Hand cooling fan motor. The low side of the RH cooling fan completes the circuit to ground on circuit 150. This circuit is a series circuit which allows half speed operation for each fan since each fan motor will drop half of the supplied battery power.

High speed operation is established when all three relays are energized. Relays #2 and #3 share the same control circuit to the PCM. This is circuit 473. As in the low speed mode, Relay #1 supplies current flow to the LH cooling fan on circuit 409. Current flow continues through the motor on circuit 532 to relay #3 which is now energized. The switch has now provided a path for current to flow through circuit 150 directly to ground. This circuit now only has the LH fan motor to power and allows it to run at full speed. Relay #2 is also energized and provides current flow on circuit 504 to the RH cooling fan. This fan now has its own dedicated circuit and will operate at full speed. This mode is operating as a parallel circuit.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- Condition must exist for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent, refer to *Symptoms*.

Test Description

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

4. This step tests for a control circuit that may be shorted to ground.
5. This step tests for an open control circuit.
11. The repair is not complete if the scan tool indicates that the diagnostic ran and failed.

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DTC P0481 Cooling Fan Relay 2 and 3 Control Circuit

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	Is the customer concern that the fans are ON at all times?	—	*Go to Step 3*	*Go to Step 4*
3	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition. Are the fans ON?	—	*Go to Step 7*	*Go to Step 10*
4	**Important:** For underhood electrical center relay terminal identification refer to *Electrical Center Identification Views* in Wiring Systems. 1. Disconnect engine cooling fan relays #2 and #3 at the underhood electrical center 1. 2. Probe the control side of the relay #2 at the underhood electrical center 1 using the test lamp *J 34142-B* connected to ground. Is the test lamp illuminated?	—	*Go to Step 8*	*Go to Step 5*
5	1. Turn OFF the ignition. 2. Reconnect both relays. 3. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 4. Probe the engine cooling fan relay #2 and #3 control circuit at the PCM harness using test lamp *J 34142-B* connected to ground. 5. Turn ON the ignition. Is the test lamp illuminated?	—	*Go to Step 9*	*Go to Step 6*
6	Repair the open circuit between the PCM harness connector and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 11*	—
7	Repair the short to ground in the engine cooling fan relay #2 and #3 control circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 11*	—
8	Repair the short to B+ in the engine cooling fan relay #2 and #3 control circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 11*	—
9	1. Inspect the PCM harness connector for poor connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 11*	*Go to Step 10*
10	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 11*	—

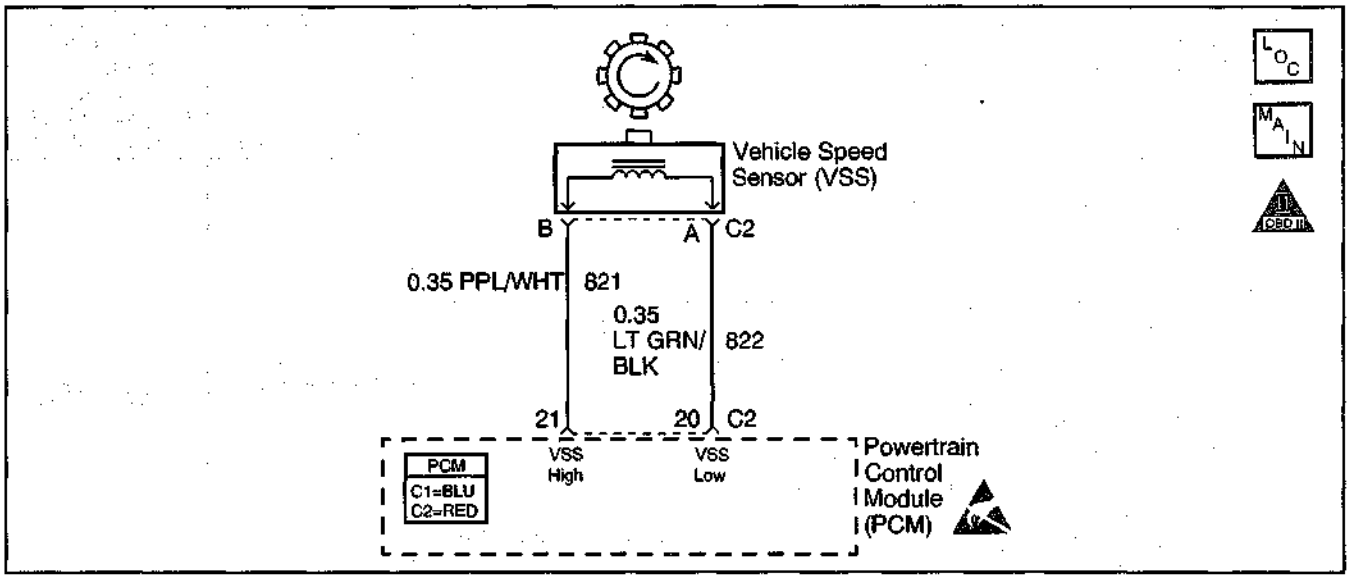
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DTC P0481 Cooling Fan Relay 2 and 3 Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
11	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test passed?	—	*Go to Step 12*	*Go to Step 2*
12	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0500 Vehicle Speed Sensor (VSS) Circuit



Circuit Description

A toothed wheel mounted on the output shaft of the transmission generates an AC voltage pulse as it moves past the Vehicle Speed Sensor (VSS). The VSS contains a permanent magnet surrounded by a coil of wire, which produces a magnetic field. The toothed wheel interrupts the magnetic field that generates an AC voltage pulse. As the vehicle speed increases the AC voltage pulse rate also increases.

Conditions for Running the DTC

- DTCs P0107, P0108, P0117, P0118, P0121, P0122, P0123, P0125, P0506, P0507 are not set.
- The engine coolant temperature is more than 35°C (95°F).
- The engine speed is more than 1,000 RPM.
- The TP sensor angle is between 5.0 percent and 100 percent.
- The MAP is between 40 kPa and 100 kPa when the A/C is OFF.
- The MAP is between 45 kPa and 100 kPa when the A/C is ON.
- All conditions met for 2 seconds.

Conditions for Setting the DTC

The PCM detects vehicle speed at 0 km/h (0 mph) for 100 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. The ASR/TCS must be disabled when performing this step. Whenever the ignition key is cycled to the OFF position and then cycled back ON, the ASR/TCS system will default ON.

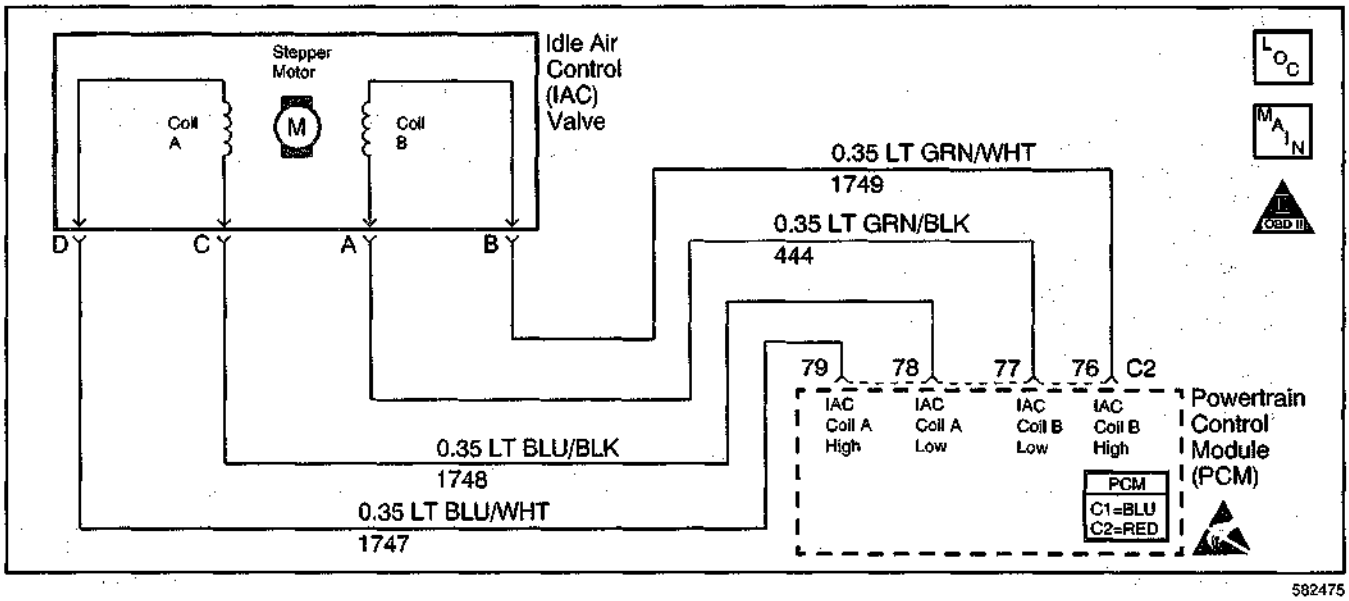
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DTC P0500 Vehicle Speed Sensor (VSS) Circuit

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	1. Turn OFF the ignition. 2. Raise the drive wheels. Refer to *Lifting and Jacking the Vehicle* in General Information. 3. Start the engine. 4. Disable ASR/TCS systems, if so equipped. 5. Idle the engine in gear. Does the scan tool indicate a vehicle speed above the specified value?	0.0 mph (0.0 km/h)	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the VSS electrical connector. 3. Connect the *J 33431-B* signal generator tester to the VSS harness. 4. Turn ON the ignition, tester ON and set to generate a VSS signal. Does the scan tool indicate a vehicle speed above the specified value?	0.0 mph (0.0 km/h)	*Go to Step 4*	*Go to Step 5*
4	Repair the faulty VSS connection or faulty VSS. Is the action complete?	—	*Go to Step 12*	—
5	Measure the voltage from the VSS signal circuit to a known good ground using the DMM. Does the DMM indicate the specified value?	5.0 V	*Go to Step 6*	*Go to Step 9*
6	Measure the voltage from the VSS signal circuit to the VSS ground circuit using the DMM. Does the DMM indicate the specified value?	5.0 V	*Go to Step 7*	*Go to Step 10*
7	Check the calibration ID for the most current and/or incorrect calibration. Is the most current and proper calibration present?	—	*Go to Step 8*	*Go to Step 11*
8	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 12*	—
9	Repair the signal circuit to the vehicle speed sensor. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
10	Repair the ground circuit to the vehicle speed sensor. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
11	Install proper calibration and/or most current. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0506 Idle Speed Low



Circuit Description

The Idle Air Control valve is a PCM controlled stepper motor located on the throttle body. The stepper motor drives a valve pintle which protrudes into a passage that bypasses the throttle plates. The PCM commands the IAC valve pintle to extend to decrease the idle speed. The bypass air flow is reduced and the idle speed decreases as the pintle approaches its seat. The PCM retracts the IAC valve pintle away from its seat to increase the idle speed. The retracting of the IAC valve pintle allows more air to bypass the throttle plates. The PCM uses the IAC system to maintain a desired idle speed. This DTC sets when the PCM detects an engine speed outside of the IAC's range of control.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0171, P0172, P0174, P0175, P0220, P0300, P0401, P0404, P0405, P0443, P0500–P0503, P1414 and P1441 are not set.
- The engine run time is more than 60 seconds.
- The engine coolant temperature is more than 60°C (140°F).
- The intake air temperature is more than −10°C (14°F).
- The barometric pressure is more than 65 kPa.
- The ignition voltage is between 9.0 and 17.0 volts
- The vehicle speed is no more than 1 mph (1.6 km/h).
- The throttle position is less than 1 percent.

Conditions for Setting the DTC

- The actual idle speed is 100 RPM less than the desired idle speed.
- All of the above conditions are present for 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent, refer to *Symptoms*.

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.

DTC P0506 Idle Speed Low

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	**Important:** If any MAF/MAP sensor DTCs are set go to appropriate diagnostic table. 1. Idle the engine. 2. Command the engine speed up to 1500 RPM, down to 500 RPM, up to 1500 RPM, and then EXIT using the scan tool. 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 above desired RPM?	—	*Go to Step 4*	*Go to Step 5*
4	1. Inspect for the following conditions: • Vacuum leaks • Throttle plates not closing properly • A faulty PCV valve 2. If you find a condition, repair as necessary. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 6*
5	1. Inspect for the following conditions: • Excessive deposits in the throttle body. • Parasitic load on the engine (i.e. transmission condition etc.). 2. If you find a condition, repair as necessary. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 6*
6	1. Start and idle the engine. 2. Disconnect the IAC harness connector and install the appropriate IAC node light from kit *J 37027-A*. 3. Command the RPM up to 1500, down to 500 and up to 1500 using the scan tool while observing the node light. Do both of the LEDs on the node light cycle red and green, but never OFF?	—	*Go to Step 7*	*Go to Step 8*

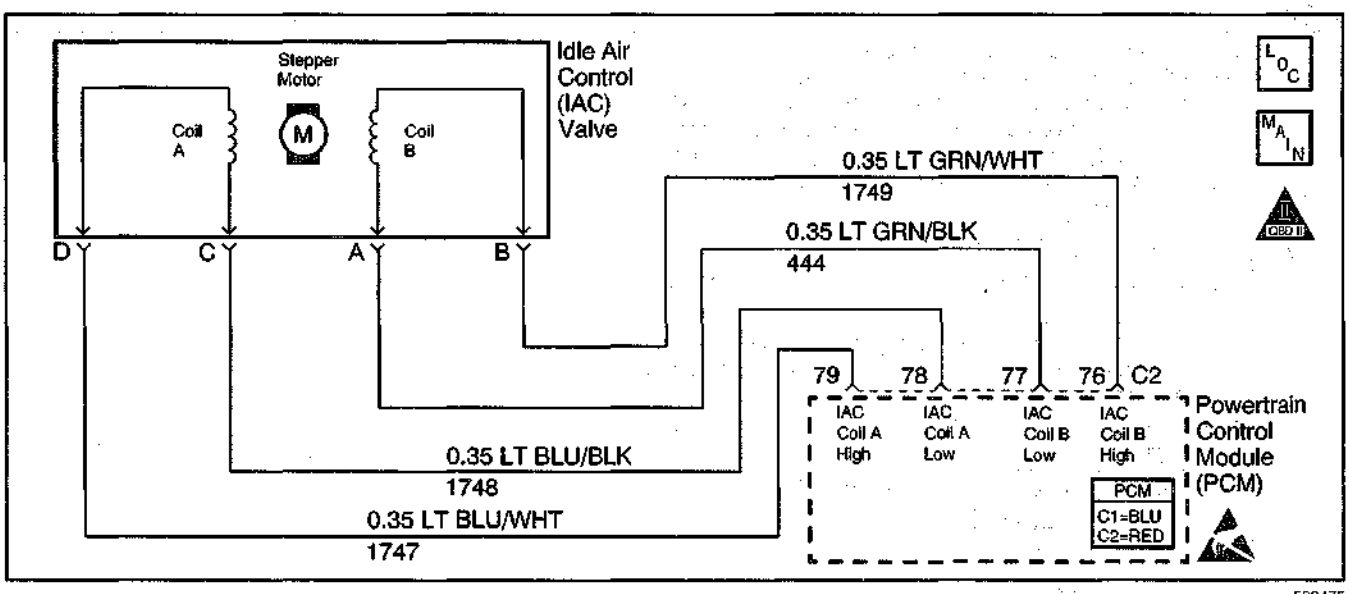
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DTC P0506 Idle Speed Low (cont'd)

Step	Action	Value(s)	Yes	No
7	**Important:** During the following test it is possible to overextend the IAC valve pintle until it falls out of the worm drive. If this occurs, manually screw the pintle shaft into the worm drive about 2 turns to get it started, align the keyways on the shaft with the keys in the housing and gradually retract the pintle using the IAC driver tool. 1. Turn OFF the ignition. 2. Remove the IAC valve. 3. Connect the IAC valve to the IAC Driver tool from kit *J 37027-A*. 4. Hold the IAC valve with a finger over the pintle in case it is over extended. Using the driver tool retract and extend the pintle. Does the pintle move steadily with each flash of the IAC driver light?	—	*Go to Step 9*	*Go to Step 10*
8	1. Inspect the IAC circuits for the following conditions: • Faulty connection • Open circuits • Short to B+ • Short to ground 2. If you find a condition, repair as necessary. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 11*
9	1. Inspect the IAC passages for the following: • Blockages • Heavy deposits 2. Clean the passages as necessary. Refer to *Throttle Body Cleaning Procedure*. Is the action complete?	—	*Go to Step 13*	—
10	Replace the IAC valve. Refer to *IAC Valve Replacement* Is the action complete?	—	*Go to Step 13*	—
11	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 12*
12	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 13*	—
13	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 14*	*Go to Step 2*
14	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0507 Idle Speed High



Circuit Description

The Idle Air Control valve is a PCM controlled stepper motor located on the throttle body. The stepper motor drives a valve pintle which protrudes into a passage that bypasses the throttle plates. The PCM commands the IAC valve pintle to extend to decrease the idle speed. The bypass air flow is reduced and the idle speed decreases as the pintle approaches its seat. The PCM retracts the IAC valve pintle away from its seat to increase the idle speed. The retracting of the IAC valve pintle allows more air to bypass the throttle plates. The PCM uses the IAC system to maintain a desired idle speed. This DTC sets when the PCM detects an engine speed outside of the IAC's range of control.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0171, P0172, P0174, P0175, P0200, P0300, P0401, P0404, P0405, P0443, P0500–P0503, P1404, and P1441 are not set.
- The engine run time is more than 60 seconds.
- The engine coolant temperature is more than 60°C (140°F).
- The intake air temperature is more than –10°C (14°F).
- The barometric pressure is more than 65 kPa.
- The ignition voltage is between 9.0 and 17.0 volts
- The vehicle speed is no more than 1 mph (1.6 km/h).
- The throttle position is less than 1 percent.

Conditions for Setting the DTC

- The actual idle speed is 200 RPM more than the desired idle speed.
- All of the above conditions are present for 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent, refer to *Symptoms*.

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.

DTC P0507 Idle Speed High

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	**Important:** If any MAF/MAP sensor DTCs are set go to appropriate diagnostic table. 1. Idle the engine. 2. Command the engine speed up to 1500 RPM, down to 500 RPM, up to 1500 RPM, and then EXIT using the scan tool. 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 above desired RPM?	—	*Go to Step 4*	*Go to Step 5*
4	1. Inspect for the following conditions: • Vacuum leaks • Throttle plates not closing properly • A faulty PCV valve 2. If you find a condition, repair as necessary. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 6*
5	1. Inspect for the following conditions: • Excessive deposits in the throttle body. • Parasitic load on the engine (i.e. transmission condition etc.). 2. If you find a condition, repair as necessary. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 6*
6	1. Start and idle the engine. 2. Disconnect the IAC harness connector and install the appropriate IAC node light from kit *J 37027-A*. 3. Command the RPM up to 1500, down to 500 and up to 1500 using the scan tool while observing the node light. Do both of the LEDs on the node light cycle red and green, but never OFF?	—	*Go to Step 7*	*Go to Step 8*

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DTC P0507 Idle Speed High (cont'd)

Step	Action	Value(s)	Yes	No
7	**Important:** During the following test it is possible to overextend the IAC valve pintle until it falls out of the worm drive. If this occurs, manually screw the pintle shaft into the worm drive about 2 turns to get it started, align the keyways on the shaft with the keys in the housing and gradually retract the pintle using the IAC driver tool. 1. Turn OFF the ignition. 2. Remove the IAC valve. 3. Connect the IAC valve to the IAC Driver tool from kit *J 37027-A*. 4. Hold the IAC valve with a finger over the pintle in case it is over extended. Using the driver tool retract and extend the pintle. Does the pintle move steadily with each flash of the IAC driver light?	—	*Go to Step 9*	*Go to Step 10*
8	1. Inspect the IAC circuits for the following conditions: • Faulty connection • Open circuits • Short to B+ • Short to ground 2. If you find a condition, repair as necessary. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 11*
9	1. Inspect the IAC passages for the following: • Blockages • Heavy deposits 2. Clean the passages as necessary. Refer to *Throttle Body Cleaning Procedure*. Is the action complete?	—	*Go to Step 13*	—
10	Replace the IAC valve. Refer to *IAC Valve Replacement* Is the action complete?	—	*Go to Step 13*	—
11	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 12*
12	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 13*	—
13	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 14*	*Go to Step 2*
14	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0530 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit

Refer to Engine Controls Schematics, *A/C Compressor Control* for complete circuit details.

Circuit Description

The A/C system uses an A/C refrigerant pressure sensor mounted in the high side of the A/C system to monitor A/C refrigerant pressure. The PCM utilizes this information in order to turn ON the engine coolant fans when the A/C refrigerant pressure is high.

The PCM supplies a 5.0 volt reference and ground to the sensor. As the A/C pressure increases or decreases, the resistance of the sensor changes and varies the amount of signal returning to the PCM.

The PCM monitors the A/C refrigerant pressure sensor signal circuit and can determine when the A/C pressure is too high or too low. The PCM disables the A/C compressor clutch and sets a DTC P0530 when the pressures are out of range (high or low) for a predetermined time. The PCM disables the A/C compressor in order to prevent A/C compressor damage.

Conditions for Running the DTC

The PCM detects an A/C request.

Conditions for Setting the DTC

A/C refrigerant pressure sensor indicates A/C refrigerant pressure is below 3.0 psi for 5 seconds.

OR

A/C refrigerant pressure sensor indicates A/C refrigerant pressure is above 445 psi for 5 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the test did not fail this ignition cycle, move the related electrical harnesses and the connectors while monitoring a scan tool.

For an intermittent, refer to *Symptoms*.

Test Description

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

3. The normal A/C voltage is between 1.0 and 1.8 volts. If the A/C voltage is within the range, review the Freeze Frame/Failure Records data in order to determine when the DTC P0530 set.
5. If the A/C pressure/voltage stays high after disconnecting the A/C refrigerant pressure sensor electrical connector, this indicates the signal circuit is shorted to a voltage.
7. This step tests for a good ground circuit.
8. This step tests the integrity of the A/C refrigerant pressure sensor signal circuit.
11. If you have thoroughly tested the 5 volt reference circuit (for opens, shorts to ground, PCM connections etc.) and tests OK, then replace the PCM.
12. If you have thoroughly tested the ground circuit for opens and the PCM connections are OK, then replace the PCM.

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DTC P0530 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit

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	Measure the refrigerant within the A/C system. Refer to *Cooling Insufficient, A/C System* in HVAC. Is the refrigerant within the specified levels?	–	*Go to Step 3*	Go to *Cooling Insufficient, A/C System* in HVAC
3	1. Install the scan tool. 2. Idle the engine. 3. Monitor the Diagnostic Trouble Code (DTC) information using the scan tool. Did DTC P1639 Fail This Ignition cycle?	—	Go to *DTC P1639 5 Volt Reference 2 Circuit*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Monitor the A/C High Side using the scan tool. Does the scan tool indicate the A/C High Side between the specified range?	0.1–1.8V	*Go to Step 5*	*Go to Step 6*
5	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and note the parameters. 3. Start the engine and operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in conditions for running the DTC. 4. Select the Diagnostic Trouble Code (DTC) option, the specific DTC option, and enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 6*	Go to Diagnostic Aids
6	Disconnect the A/C refrigerant pressure sensor electrical connector. Does the scan tool indicate the A/C High Side less than the specified value?	1V	*Go to Step 7*	*Go to Step 11*
7	Measure the voltage from the A/C refrigerant pressure sensor 5 volt reference circuit to the battery ground using the DMM. Is the voltage near the specified value?	5V	*Go to Step 8*	*Go to Step 12*
8	Measure the voltage from the A/C refrigerant pressure sensor 5 volt reference circuit to the sensor ground circuit using the DMM. Is the voltage at the specified value?	5V	*Go to Step 9*	*Go to Step 13*
9	Jumper the 5 volt reference circuit to the A/C refrigerant pressure sensor signal circuit using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the scan tool indicate the A/C High Side voltage at the specified value?	5V	*Go to Step 10*	*Go to Step 14*
10	Repair the faulty A/C refrigerant pressure sensor connection or faulty sensor. Refer to *A/C Refrigerant Pressure Sensor Replacement* in Heating, Ventilation, and Air Conditioning. Is the action complete?	—	*Go to Step 15*	—
11	Repair the short to voltage in the A/C refrigerant pressure sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 15*	—

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DTC P0530 Air Conditioning (A/C) Refrigerant Pressure Sensor Circuit (cont'd)

Step	Action	Value(s)	Yes	No
12	**Important:** Inspect the PCM engine grounds for being secure and clean. Repair the 5 volt reference circuit to the A/C refrigerant pressure sensor. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 15*	—
13	Repair the ground circuit to the A/C refrigerant pressure sensor. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 15*	—
14	Repair the signal circuit to the A/C refrigerant pressure sensor. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 15*	—
15	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 16*	*Go to Step 3*
16	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0562 System Voltage Low

Refer to Engine Controls Schematics, *5.7L Power, Ground and MIL* for complete circuit details.

Circuit Description

The PCM continuously monitors the system voltage. The system voltage information is taken from the PCM's ignition feed circuits. Voltages below 8.0 volts or above 18.0 volts causes improper system operation and/or component damage. The PCM operates in a default mode if a PCM voltage DTC sets. The PCM disables most outputs to protect the hardware if the system voltage is high. A scan tool may not display data if system voltage is below 8.0 volts. Use a DMM to monitor the system voltage in order to verify if the fault is currently present. A low voltage may cause a stalling condition, or other driveability concerns.

Conditions for Running the DTC

- The engine run time is longer than 10 seconds.
- The engine speed is more than 1,000 RPM.
- The vehicle speed is more than 8 km/h (5 mph).

Conditions for Setting the DTC

- The PCM senses system voltage below 8.0 volts.
- All the above conditions are present for 5 seconds.

Action Taken When the DTC Sets

- The PCM stores DTC P0562 in memory when the diagnostic runs and fails.
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The PCM will record the operating conditions at the time the diagnostic fails. The PCM stores this information in Failure Records.
- The PCM will command a high idle speed.
- The transmission defaults to third gear.
- The TCC operation is inhibited.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An extremely low voltage (below 7.5 volts) may cause the loss of serial data and the MIL may not function. An open ignition feed circuit causes a no start and the MIL will not illuminate. A low system voltage may cause other DTCs to set.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. Ensure the battery is at a full state of charge before proceeding with this diagnostic. Monitoring the Ignition 1 voltage with the scan tool will help isolate the condition. If B+ is displayed on the scan tool, then the wiring and PCM are OK.

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DTC P0562 System Voltage Low

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	**Important:** If DTC P1637 is also set, refer to *DTC P1637 Generator L-Terminal Circuit* for further diagnosis. Ensure the Battery is fully charged before proceeding with this diagnostic. Monitor the Ignition 1 Voltage using the scan tool. Does the scan tool display the specified value?	B+	Go to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical	*Go to Step 3*
3	Inspect the PCM IGN fuse Is the fuse open?	—	*Go to Step 6*	*Go to Step 4*
4	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition leaving the engine OFF. 4. Measure the voltage at terminal (C1-19) for the ignition feed circuit using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Is the voltage at the specified value?	B+	*Go to Step 7*	*Go to Step 5*
5	Test the continuity of the Ignition feed circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity below the specified value?	5Ω	*Go to Step 7*	*Go to Step 6*
6	1. Repair the ignition feed circuit to the PCM for an open or a short to ground. Refer to *Wiring Repairs* in Wiring Systems. 2. Replace the PCM IGN fuse if necessary. Is the action complete?	—	*Go to Step 9*	—
7	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 8*
8	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0563 System Voltage High

Refer to Engine Controls Schematics, *5.7L Power, Ground and MIL* for complete circuit details.

Circuit Description

The PCM continuously monitors the system voltage. The system voltage information is taken from the PCM ignition feed circuits. Since voltages below 8.0 volts or above 18.0 volts, could cause improper system operation and/or component damage, the PCM operates in a default mode if a PCM voltage DTC sets. If the system voltage is high, the PCM disables most outputs to protect the hardware. A scan tool may not display data if system voltage is outside this range. Use a DMM to monitor system voltage to verify if the fault is currently present. A high voltage may cause a stalling condition, or other driveability concerns.

Conditions for Running the DTC

The engine run time is more than 10 seconds.

Conditions for Setting the DTC

- The PCM senses the system voltage is above 18.0 volts.
- All the conditions are present for 5 seconds.

Action Taken When the DTC Sets

- The PCM stores DTC P0563 in the PCM memory when the diagnostic runs and fails.
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The PCM will record the operating conditions at the time the diagnostic fails. The PCM stores this information in Failure Records.
- The PCM disables most outputs.
- The transmission defaults to third gear.
- The TCC operation is inhibited.
- The PCM will cycle the cooling fans ON and OFF every few seconds during the time the condition is present.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Inspect the generator voltage sense circuit for high resistance or loose connections. These could cause an intermittent overcharging condition. Refer to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step tests for excessive generator output. The voltage should remain below 18.0 volts.

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DTC P0563 System Voltage High

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	**Important:** If DTC P1635 and/or P1639 are set, refer to *DTC P1635 5 Volt Reference 1 Circuit* and/or *DTC P1639 5 Volt Reference 2 Circuit* for further diagnosis. 1. Turn OFF all the accessories. 2. Measure the battery voltage at the battery using the DMM. 3. Operate the engine speed above 2000 RPM. Is the battery voltage less than the specified value?	18V	Go to Diagnostic Aids	*Go to Step 3*
3	Repair the Charging system. Refer to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical. Is the repair completed?	—	*Go to Step 4*	—
4	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 5*	*Go to Step 2*
5	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0601Control Module Read Only Memory (ROM)

Circuit Description

The PCM EEPROM contains data which is essential to running the engine and transmission. The PCM continuously checks the integrity of this data.

Conditions for Running the DTC

The ignition switch is in the crank position or the run position.

Conditions for Setting the DTC

The PCM is unable to correctly read data from the flash memory.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

Conditions for Clearing the MIL/DTC

Replace the PCM.

Diagnostic Aids

Replace the PCM even if this DTC exists only in history.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. This DTC indicates an internal PCM condition.

DTC P0601Control Module Read Only Memory (ROM)

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	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 3*	—
3	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 4*	*Go to Step 2*
4	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0602 Control Module Not Programmed

Circuit Description

This DTC indicates that the PCMs internal EEPROM is not flashed with any vehicle software. If you install a service PCM and do not flash the EEPROM, the engine will not run. This DTC indicates that an un-flashed PCM causes the engine cranks but will not run situation.

Conditions for Running the DTC

The ignition switch is in the run position.

Conditions for Setting the DTC

No software data is present in the PCM.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Test Description

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

3. If the flashing routine fails, verify that the equipment used is functioning properly and that all cable connections are clean and tight. Also, make sure that the software you download is correct for the PCM being flashed. If everything is OK, and a second attempt fails, the PCM is faulty.

DTC P0602 Control Module Not Programmed

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	Flash the PCM with the correct software. Refer to *PCM Replacement/Programming.* Does DTC P0602 reset?	—	*Go to Step 3*	*Go to Step 5*
3	1. Verify that the equipment being used is functioning properly and that all the cable connections are clean and tight. 2. Attempt to flash the PCM again. Does DTC P0602 reset?	—	*Go to Step 4*	*Go to Step 5*
4	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 5*	—
5	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 6*	*Go to Step 2*
6	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0604 Control Module Random Access Memory (RAM)

Circuit Description

The PCM performs an internal self-test on it's 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 illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

Conditions for Clearing the MIL/DTC

Replace the PCM.

Test Description

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

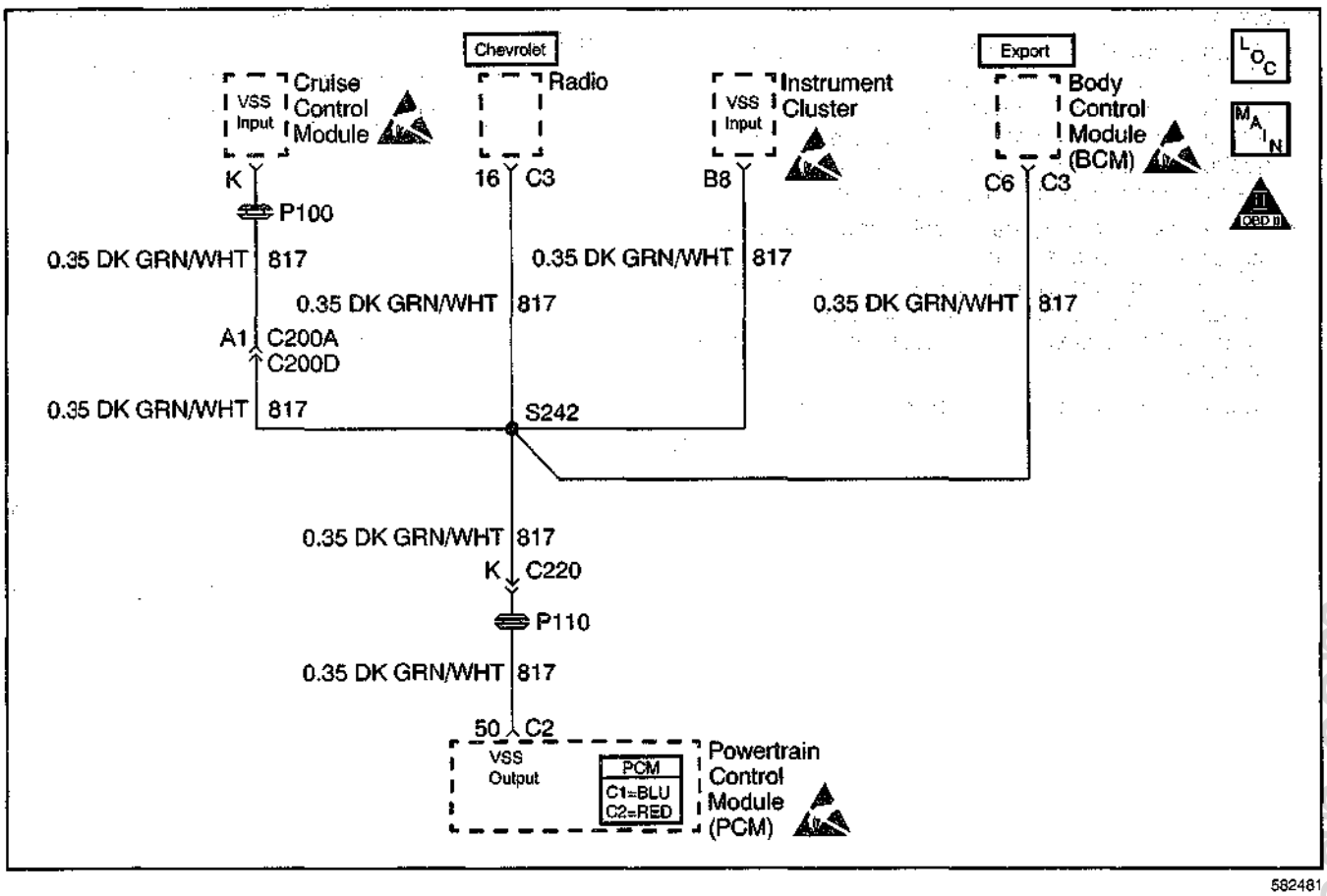
2. This DTC indicates an internal PCM condition.

DTC P0604 Control Module Random Access Memory (RAM)

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	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 3*	—
3	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 4*	*Go to Step 2*
4	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0608 Vehicle Speed Output Circuit



Circuit Description

Various components apply a voltage to the Vehicle Speed Output circuit. The PCM creates the Vehicle Speed Output signal by rapidly grounding this circuit via an internal switch called a driver. The driver operates at the same rate as the VSS signal input. The various components recognize the voltage being pulled to ground as an indication of vehicle speed.

The driver supplies the ground for the component being controlled. Each driver has a fault line which the PCM monitors. When the PCM commands a component ON, the voltage of the control circuit should be low (near 0 volts). When the PCM commands the control circuit to a component OFF, the voltage potential of the circuit should be high (near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status changes causing the DTC to set.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- The condition must be present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

3. This step is verifying a voltage to the PCM.
5. This step is testing for a short to ground.

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DTC P0608 Vehicle Speed Output Circuit

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	1. Turn OFF the ignition. 2. Raise the drive wheels. Refer to *Lifting and Jacking the Vehicle* in General Information. 3. Start and idle the engine. 4. Disable the ASR/TCS systems, if so equipped. 5. Idle the engine in gear. Does the vehicle speedometer indicate a vehicle speed?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition. 4. Measure the Voltage from the vehicle speed circuit using the DMM. Does the DMM display above the specified value?	9.6V	*Go to Step 8*	*Go to Step 4*
4	1. Remove the Instrument Cluster. Refer to *IP Cluster Replacement* in Instrument Panel, Gauges, and Console. 2. Test the continuity of the vehicle speed circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	—	*Go to Step 5*	*Go to Step 6*
5	Test the continuity of the vehicle speed circuit using the DMM connected to battery ground. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	—	*Go to Step 7*	Go to *A Diagnostic System Check - Instrument Cluster* in Instrument Panel, Gauges, and Console
6	Repair the open vehicle speed circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 10*	—
7	Repair the grounded vehicle speed circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 10*	—
8	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 10*	*Go to Step 9*
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 10*	—
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0645 Air Conditioning (A/C) Clutch Relay Control Circuit

Refer to Engine Controls Schematics, *A/C Compressor Control* for complete circuit details.

Circuit Description

A voltage is supplied directly to the A/C compressor clutch relay coil. The PCM controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is to supply the ground for the controlled component. Each driver has a fault line which the PCM monitors. When the PCM commands a component ON, the voltage of the control circuit should be low (near 0 volts). When the PCM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be high (near battery voltage). If the fault detection circuit senses a voltage other than what the circuit expects, the fault line status changes causing the DTC to set.

The relay controls the high current flow to the A/C compressor clutch. This allows the PCM driver to only have to handle the relatively low current used by the relay.

Conditions for Running the DTC

- The engine speed is greater than 400 RPM.
- The ignition voltage is between 6.0 volts and 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- Condition must exist for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the Connector Test Adapter Kit *J 35616-A*. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

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 the OFF states. Repeat the commands as necessary.
4. This step tests for voltage at the coil side of the A/C relay. The A/C Cruise mini fuse supplies power to the coil side of the A/C relay.
5. This step verifies that the PCM is providing ground to the A/C relay.
6. This step tests if ground is constantly being applied to the A/C relay.

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DTC P0645 Air Conditioning (A/C) Clutch Relay Control Circuit

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	1. Turn ON the ignition, with the engine OFF. 2. With a scan tool, command the A/C relay ON and OFF. Does the A/C relay turn ON and OFF with each command?	—	*Go to Step 3*	*Go to Step 4*
3	1. Review the Freeze Frame and/or Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the same Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure Records data that you observed. Does the DTC reset?	—	*Go to Step 4*	Go to *Intermittent Conditions*
4	1. Turn OFF the ignition. 2. Disconnect the A/C relay from the underhood electrical center. 3. Turn ON the ignition, with the engine OFF. 4. Probe the coil side feed circuit of the A/C relay with a test lamp that is connected to a good ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 11*
5	1. Connect a test lamp between the control circuit of the A/C relay and the coil side feed circuit of the A/C relay. 2. With a scan tool, command the A/C relay ON and OFF. Does the test lamp turn ON and OFF with each command?	—	*Go to Step 9*	*Go to Step 6*
6	Does the test lamp remain illuminated with each command?	—	*Go to Step 8*	*Go to Step 7*
7	1. Test the control circuit of the A/C relay for an open. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 10*
8	1. Test the control circuit of the A/C relay for a short to ground. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
9	1. Inspect for poor connections at the A/C relay. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 12*

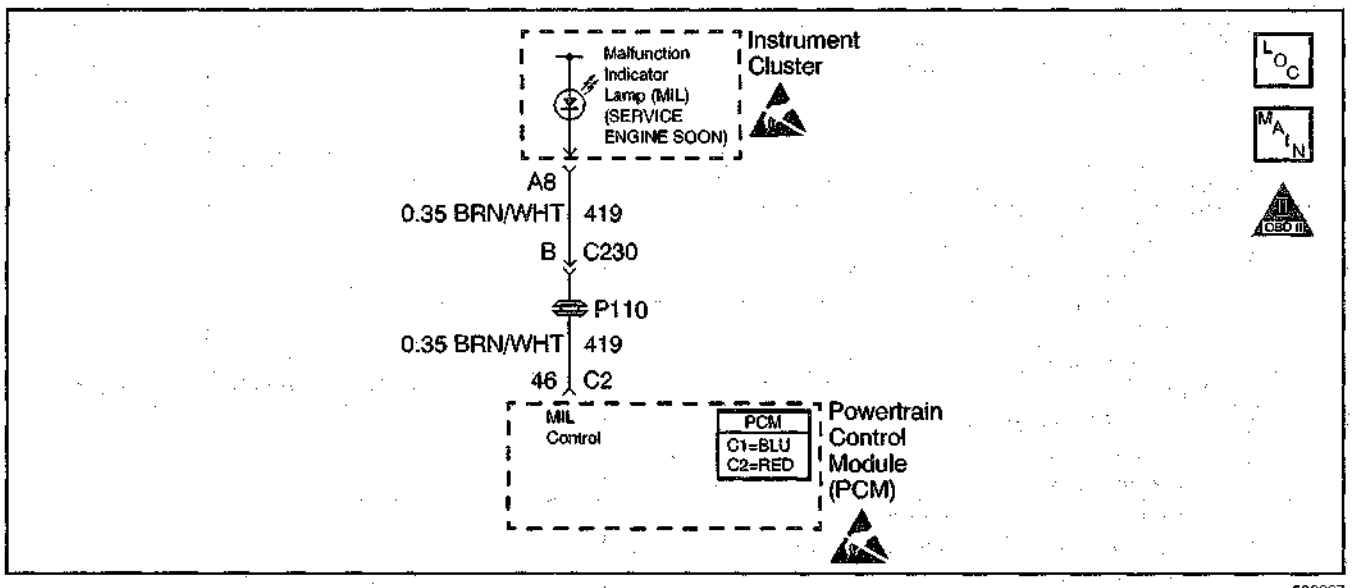
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DTC P0645 Air Conditioning (A/C) Clutch Relay Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
11	Repair the coil side feed circuit of the A/C relay. Refer to *Wiring Repairs* in Wiring Systems. Did you complete the repair?	—	*Go to Step 14*	—
12	Replace the A/C relay. Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 14*	—
14	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	—	*Go to Step 2*	*Go to Step 15*
15	With a scan tool, review the Stored Information (capture info). Does the scan tool display any DTCs that you have not diagnosed?	—	Go to *Diagnostic Trouble Code (DTC) List/Type*	System OK

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DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit



Circuit Description

A voltage is supplied directly to the malfunction indicator lamp (MIL). The powertrain control module (PCM) controls the lamp by grounding the control circuit via an internal switch called a driver. The primary function of the driver is to supply the ground for the component being controlled. Each driver has a fault line which is monitored by the PCM. When the PCM is commanding a component ON, the voltage of the control circuit should be near 0 volts. When the PCM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be near battery voltage. If the fault detection circuit senses a voltage other than what is expected, the fault line status will change causing the DTC to set.

Conditions for Running the DTC

- Engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- The conditions are present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM stores DTC P0650 in memory on the second consecutive ignition cycle that the diagnostic runs and fails.
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the ignition feed circuit is suspected of being open, inspect for lamps on the same circuit not illuminating.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. Command both the ON and the OFF states. Repeat the commands as necessary.
8. If you do not find trouble in the control circuit or the connection at the PCM, the PCM may be faulty. However, this is an extremely unlikely failure.

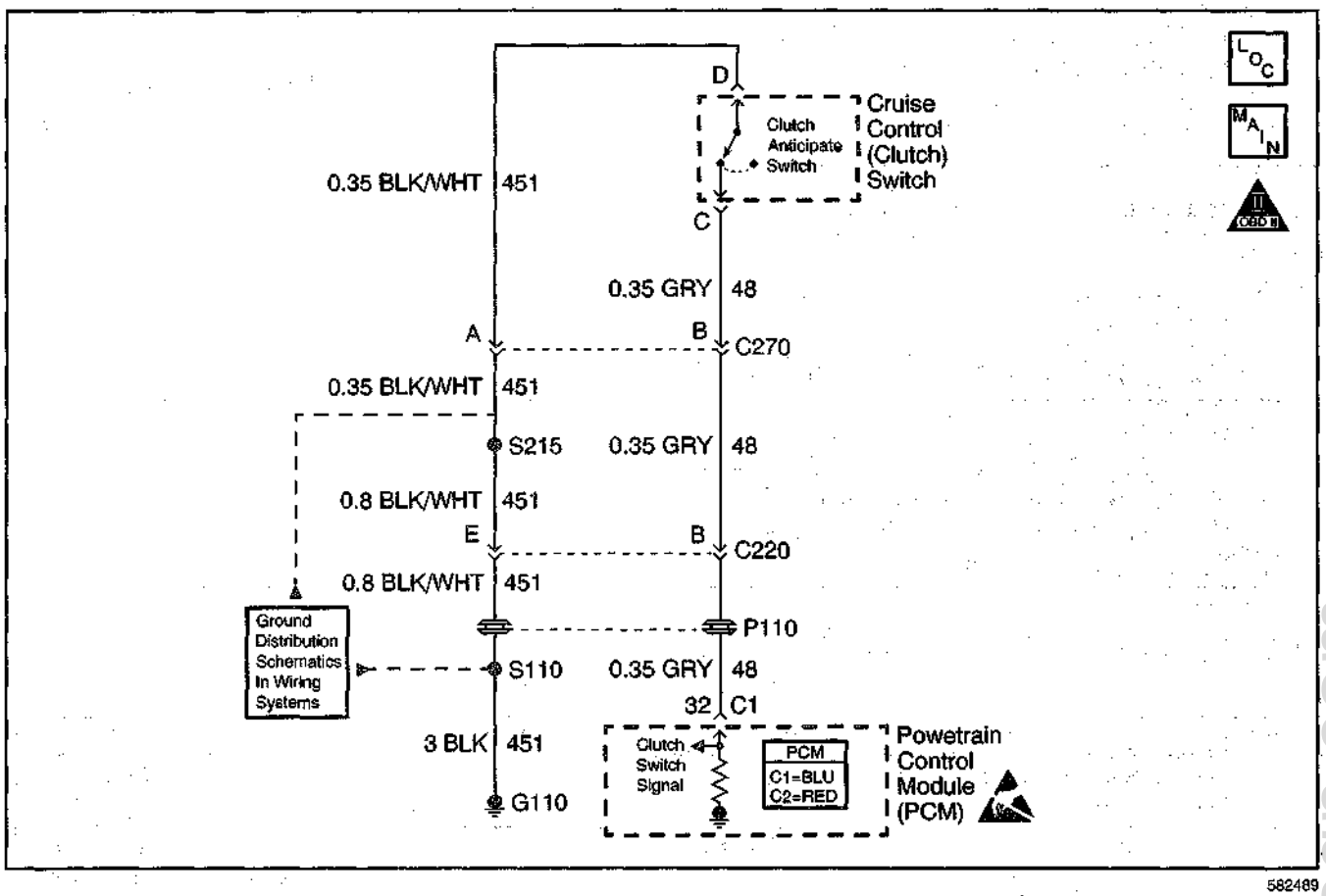
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DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit

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	**Important:** If the I/P is completely inoperative, refer to *A Diagnostic System Check - Instrument Cluster* in Instrument Panel, Gauges, and Console. 1. Turn ON the ignition leaving the engine OFF. 2. Command the indicator lamp ON and OFF using the Scan tool. Does the indicator lamp turn ON and OFF with each command?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition leaving the engine OFF. Is the indicator lamp OFF?	—	*Go to Step 4*	*Go to Step 5*
4	Probe the indicator lamp control circuit in the PCM harness connector with a fused jumper wire connected to ground. Refer to *Using Fused Jumper Wires* in Wiring Systems. Is the indicator lamp ON?	—	*Go to Step 6*	*Go to Step 7*
5	Repair the short to ground in the indicator lamp control circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
6	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 8*
7	Inspect for the following conditions: • Faulty indicator lamp • Open ignition feed to the indicator lamp • Control circuit open or shorted to B+ Did you find and correct the condition?	—	*Go to Step 9*	—
8	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0704 Clutch Switch Circuit



Circuit Description

The Clutch Pedal Position Switch is a normally closed switch. The PCM applies a voltage (B+) to the Clutch Pedal Position Switch circuit. When the Clutch Pedal Position Switch is depressed (clutch pedal released) the circuit is open and the PCM senses a high voltage. When the Clutch Pedal Position Switch is released (clutch pedal depressed) the Clutch Pedal Position Switch contacts close, causing the applied voltage to go low.

The PCM determines if the Clutch Pedal Position Switch has failed by not sensing a clutch switch transition. The PCM monitors vehicle speed from 0 to a predetermined speed.

Conditions for Running the DTC

No VSS DTCs.

Conditions for Setting the DTC

- Vehicle speed goes from 0 mph to more than 24 mph and back to 0 mph for 2 seconds without the PCM detecting a clutch transition.
- This occurs 7 times before the diagnostic reports a fault.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

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Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step determines if the fault is present.

DTC P0704 Clutch Switch Circuit

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	1. Install a scan tool. 2. Turn ON the ignition leaving the engine OFF. 3. Monitor the clutch pedal position switch parameter using the scan tool. 4. Depress and release the clutch pedal several times. Does the scan tool display change states when the clutch pedal is depressed and released?	—	Go to Diagnostic Aids	*Go to Step 3*
3	Inspect the adjustment of the clutch pedal position switch. Refer to *Clutch Pedal Position Switch Replacement* in Clutch. Was an adjustment necessary?	—	*Go to Step 14*	*Go to Step 4*
4	1. Turn OFF the ignition. 2. Disconnect the clutch pedal position switch connector. 3. Turn ON the ignition leaving the engine OFF. 4. Measure the voltage from the clutch pedal position signal circuit using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Does the DMM display the specified voltage?	B+	*Go to Step 5*	*Go to Step 6*
5	1. Jumper the clutch pedal position switch terminals together using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. 2. Monitor the clutch pedal position switch parameter using a scan tool. Does the scan tool display the Clutch Switch Released?	—	*Go to Step 9*	*Go to Step 8*

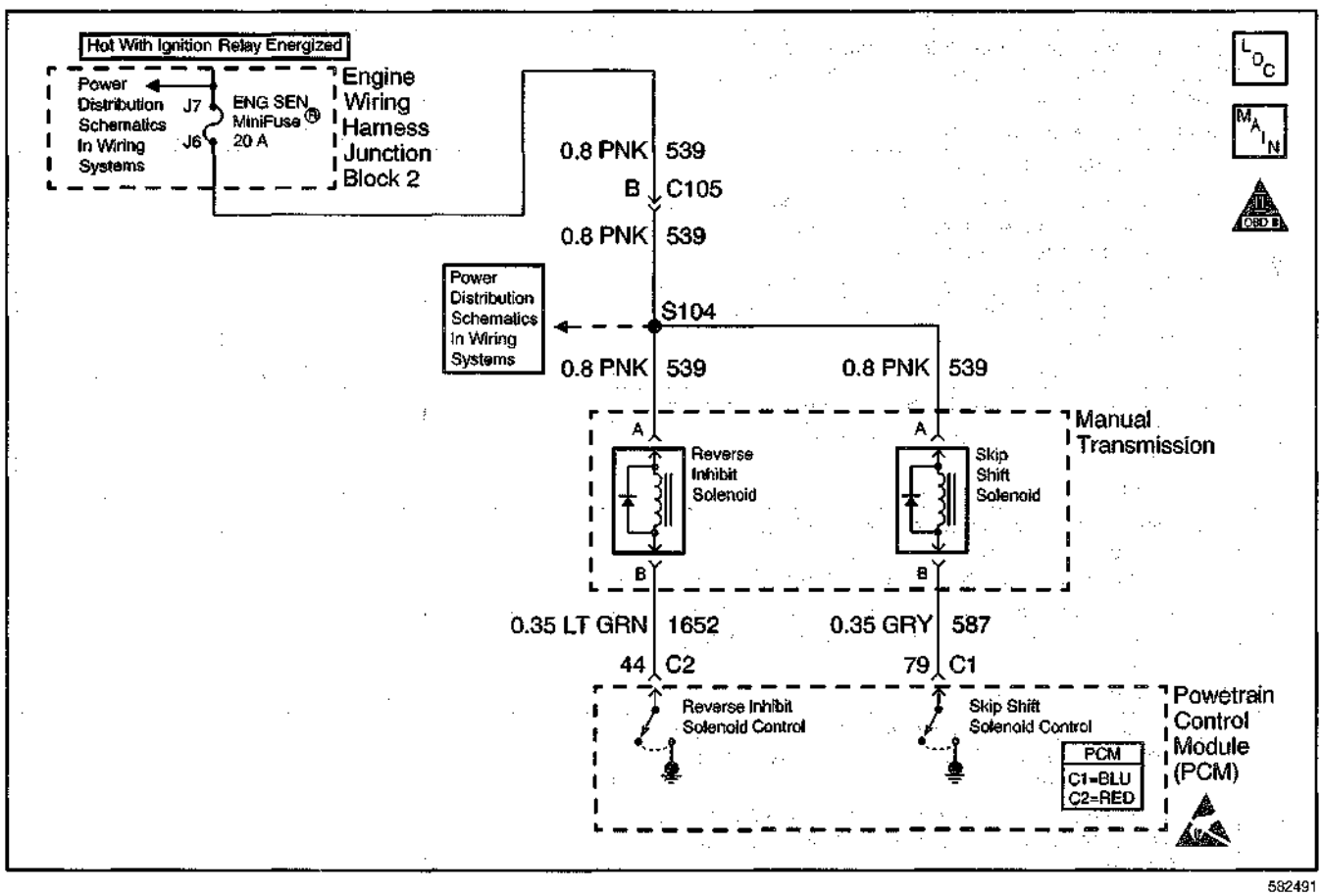
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DTC P0704 Clutch Switch Circuit (cont'd)

Step	Action	Value(s)	Yes	No
6	Test the continuity of the clutch pedal signal circuit using the DMM connected to ground. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	—	*Go to Step 11*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity of the clutch pedal signal circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	B+	*Go to Step 10*	*Go to Step 11*
8	Test the continuity of the clutch pedal ground circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	—	*Go to Step 9*	*Go to Step 12*
9	1. Inspect for poor connections at the clutch pedal position switch connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you correct the condition?	—	*Go to Step 15*	*Go to Step 13*
10	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you correct the condition?	—	*Go to Step 15*	*Go to Step 14*
11	Repair the clutch pedal position switch signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 15*	—
12	Repair the clutch pedal position switch ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 15*	—
13	Replace the clutch pedal position switch. Refer to *Clutch Pedal Position Switch Replacement* in Clutch. Is the action complete?	—	*Go to Step 15*	—
14	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 15*	—
15	1. Select the Diagnostic Trouble Codes (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Specific DTC option under the Diagnostic Trouble Code (DTC) option using a scan tool. 4. Operate vehicle within the Conditions for Running this DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 16*	*Go to Step 2*
16	Select the Capture Info option and the Review Info option using the scan tool. Are any DTCs displayed that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P0801 Reverse Inhibit Solenoid Control Circuit



Circuit Description

A voltage is supplied directly to the Reverse Inhibit solenoid. The PCM controls the solenoid by grounding the control circuit via an internal switch called a driver. The driver supplies the ground for the component being controlled. Each driver has a fault line which the PCM monitors. When the PCM commands a component ON, the voltage of the control circuit should be low (near 0 volts). When the PCM commands the control circuit to a component OFF, the voltage potential of the circuit should be high (near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status changes causing the DTC to set.

When the Reverse Inhibit solenoid energizes, the operator can shift the transmission into reverse. The PCM enables the Reverse Inhibit solenoid whenever vehicle speed is below 5 mph. When the vehicle speed is above 5 mph, the PCM de-energizes the solenoid, which prevents the operator from shifting the transmission into reverse.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- Condition must exist for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Low system voltage can cause this DTC to set. When reviewing captured data, verify if a low system voltage condition was present at the time the DTC was stored in memory.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. Listen for an audible click when the solenoid operates. Be sure that both the ON and the OFF states are commanded. Repeat the commands as necessary.
4. This step tests for voltage at the coil side of the Reverse Inhibit solenoid. The ENG SEN fuse supplies power to the coil side of the Reverse Inhibit solenoid.
5. This step verifies that the PCM is providing ground to the Reverse Inhibit solenoid.
6. This step tests if a ground is constantly being applied to the Reverse Inhibit solenoid.

DTC P0801 Reverse Inhibit 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. Start the engine and idle at the normal operating temperature. 2. With the scan tool, command the solenoid ON and OFF. Does the solenoid turn ON and OFF when commanded?	—	*Go to Step 3*	*Go to Step 4*
3	1. Review the Freeze Frame and/or Failure records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure records data that you observe. Does this DTC reset?	—	*Go to Step 4*	Go to *Intermittent Conditions*
4	1. Turn OFF the ignition. 2. Disconnect the solenoid electrical connector. 3. Turn ON the ignition, with the engine OFF. 4. Probe the coil side feed circuit of the Reverse Inhibit solenoid with a test lamp that is connected to a good ground. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 11*
5	1. Connect a test lamp between the control circuit of the Reverse Inhibit solenoid and the coil side feed circuit of the Reverse Inhibit solenoid. Refer to *Probing Electrical Connectors* in Wiring Systems. 2. With a scan tool, command the Reverse Inhibit solenoid ON and OFF. Does the test lamp turn ON and OFF with each command?	—	*Go to Step 9*	*Go to Step 6*
6	Does the test lamp remain illuminated with each command?	—	*Go to Step 8*	*Go to Step 7*

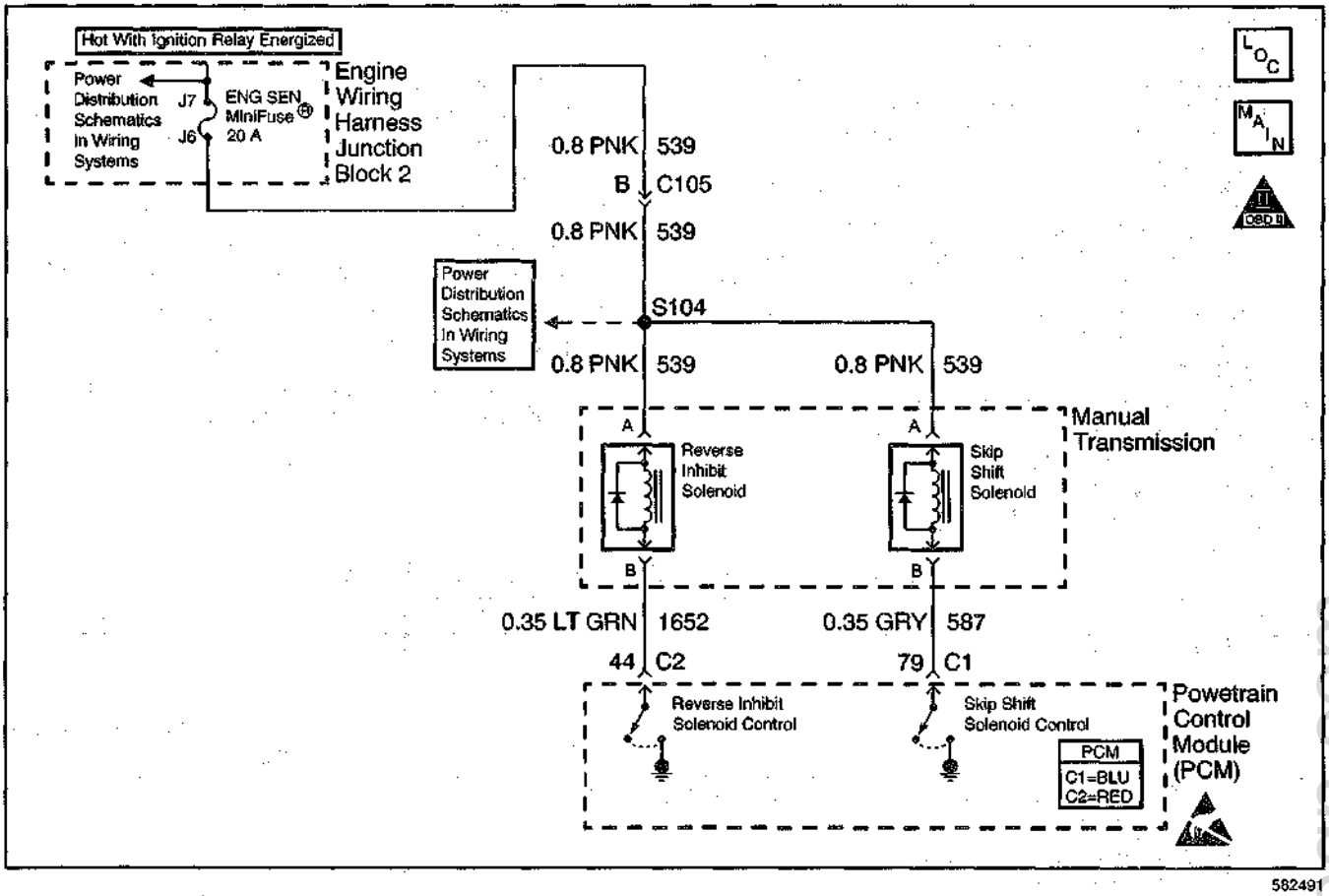
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DTC P0801 Reverse Inhibit Solenoid Control Circuit (cont'd)

Step	Action	Values	Yes	No
7	1. Test the control circuit of the Reverse Inhibit solenoid for a short to voltage or an open. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 10*
8	1. Test the control circuit of the Reverse Inhibit solenoid for a short to ground. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
9	1. Inspect for poor connections at the Reverse Inhibit solenoid. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 12*
10	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
11	Repair the coil side feed circuit of the Reverse Inhibit solenoid. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Replace the Reverse Inhibit solenoid. Refer to *Reverse Lockout Solenoid* in Manual Transmission MM6. Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Replace the PCM. Refer to *PCM Replacement/ Programming.* Is the action complete?	—	*Go to Step 14*	—
14	1. Use a scan tool in order to clear the DTCs. 2. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	—	*Go to Step 2*	*Go to Step 15*
15	With a scan tool, review the Stored information (capture info). Does the scan tool display any DTCs that you have not diagnosed?	—	Go to *Diagnostic Trouble Code (DTC) List/Type*	System OK

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DTC P0803 Skip Shift Solenoid Control Circuit



Circuit Description

A voltage is supplied directly to the Skip Shift solenoid coil. The PCM controls the solenoid by grounding the control circuit via an internal switch called a driver. The driver supplies the ground for the component being controlled. Each driver has a fault line which the PCM monitors. When the PCM commands a component ON, the voltage of the control circuit should be low (near 0 volts). When the PCM commands the control circuit to a component OFF, the voltage potential of the circuit should be high (near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status changes causing the DTC to set.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- Ignition voltage is more than 6.0 volts but less than 18.0 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- All conditions exist for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Low system voltage can cause this DTC to set. When reviewing captured data, verify if a low system voltage condition was present at the time the DTC was stored in memory.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. Listen for an audible click when the solenoid operates. Be sure that both the ON and the OFF states are commanded. Repeat the commands as necessary.
4. This step tests for voltage at the coil side of the Skip shift solenoid. The ENG SEN fuse supplies power to the coil side of the Skip shift solenoid.
5. This step verifies that the PCM is providing ground to the Skip shift solenoid.
6. This step tests if a ground is constantly being applied to the Skip shift solenoid.

DTC P0803 Skip Shift 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. Start the engine and idle at the normal operating temperature. 2. With the scan tool, command the solenoid ON and OFF. Does the solenoid turn ON and OFF when commanded?	—	*Go to Step 3*	*Go to Step 4*
3	1. Review the Freeze Frame and/or Failure records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure records data that you observe. Does this DTC reset?	—	*Go to Step 4*	Go to *Intermittent Conditions*
4	1. Turn OFF the ignition. 2. Disconnect the Skip shift solenoid electrical connector. 3. Turn ON the ignition, with the engine OFF. 4. Probe the coil side feed circuit of the Skip shift solenoid with a test lamp that is connected to a good ground. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 11*
5	1. Connect a test lamp between the control circuit of the Skip shift solenoid and the coil side feed circuit of the Skip shift solenoid. Refer to *Probing Electrical Connectors* in Wiring Systems. 2. With a scan tool, command the Skip shift solenoid ON and OFF. Does the test lamp turn ON and OFF with each command?	—	*Go to Step 9*	*Go to Step 6*
6	Does the test lamp remain illuminated with each command?	—	*Go to Step 8*	*Go to Step 7*

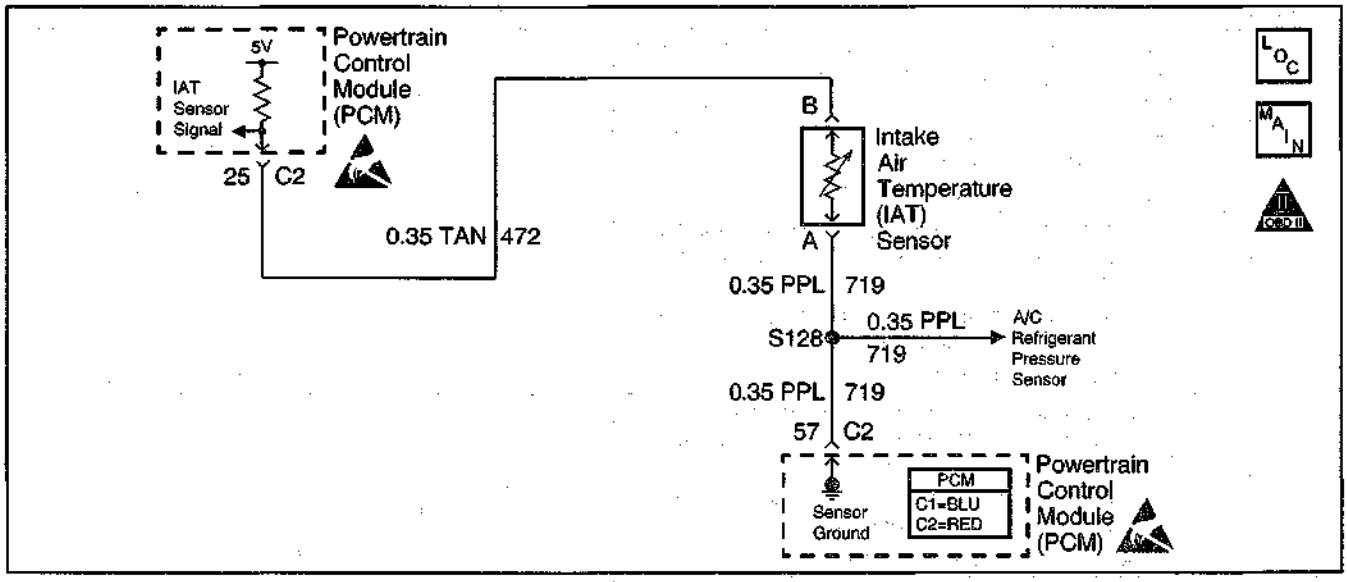
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DTC P0803 Skip Shift Solenoid Control Circuit (cont'd)

Step	Action	Values	Yes	No
7	1. Test the control circuit of the Skip shift solenoid for a short to voltage or an open. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 10*
8	1. Test the control circuit of the Skip shift solenoid for a short to ground. Refer to *Circuit Testing* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
9	1. Inspect for poor connections at the Skip shift solenoid. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 12*
10	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 13*
11	Repair the coil side feed circuit of the Skip shift solenoid. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Replace the Skip shift solenoid. Refer to *Gear Select/Skip Shift Solenoid Replacement* in Manual Transmission MM6. Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Replace the PCM. Refer to *PCM Replacement/ Programming.* Is the action complete?	—	*Go to Step 14*	—
14	1. Use a scan tool in order to clear the DTCs. 2. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	—	*Go to Step 2*	*Go to Step 15*
15	With a scan tool, review the Stored information (capture info). Does the scan tool display any DTCs that you have not diagnosed?	—	Go to *Diagnostic Trouble Code (DTC) List/Type*	System OK

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DTC P1111 Intake Air Temperature (IAT) Sensor Circuit Intermittent High Voltage



Circuit Description

The Intake Air Temperature (IAT) sensor contains a semiconductor device which changes resistance based on temperature (a thermistor). The IAT sensor mounts in the air intake passage of the engine air induction system. The IAT 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 in order to determine the intake air temperature.

When the intake air is cold, the sensor (thermistor) resistance is high, and the PCMs signal voltage is only pulled down a small amount through the sensor to ground. The PCM senses a high signal voltage (low temperature). When the intake air is warm, 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 (high temperature).

This DTC sets when the PCM senses a signal voltage higher than the normal operating range of the sensor.

Conditions for Running the DTC

- DTCs P0102, P0103, P0117, P0118, P0500, P0502, P0503 are not set.
- The engine run time is more than 100 seconds.
- The engine coolant temperature is more than 0°C (32°F).
- The vehicle speed is less than 11 km/h (7 mph).
- The mass air flow is less than 15 g/s.

Conditions for Setting the DTC

- The intake air temperature is less than –35°C (–31°F).
- The intermittent condition exists for a total of 1 second during a 20 second time period.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the engine has sat overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

For an intermittent condition, refer to *Symptoms*.

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Test Description

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

2. If DTC P0113 also failed this indicates a hard failure is present. When a hard failure is present, both the hard and intermittent DTCs set.
3. When moving related connectors, visually/physically inspect connectors for the following:
   - Poor mating of the connector halves or a terminal not fully seated in the connector body (backed out).
   - Improperly formed or damaged terminals. Carefully reform or replace all connector terminals in the related circuits in order to insure proper terminal contact tension.
   - Poor terminal to wire connection. Inspect for poor crimps, crimping over wire insulation rather than the wire.
   - Dirt or corrosion on the terminals. Inspect for missing connector seals and for damage to the connector seals.
4. When moving the related wiring harnesses, visually/physically inspect the wiring for the following:
   - Wire insulation that is rubbed through, causing an intermittent short.
   - Wiring broken inside the insulation.
5. 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.

DTC P1111 Intake Air Temperature (IAT) Sensor Circuit Intermittent High Voltage

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	Did DTC P0113 Fail This Ignition cycle?	—	Go to *DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Voltage*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Observe the affected sensor value on a scan tool while moving the related harness connectors (at the component and the PCM). Does the sensor value change abruptly while a related connector is being moved?	—	*Go to Step 6*	*Go to Step 4*
4	Observe the affected sensor value on a scan tool while moving the related wiring harnesses. Does the sensor value change abruptly while moving the related electrical harnesses?	—	*Go to Step 7*	*Go to Step 5*

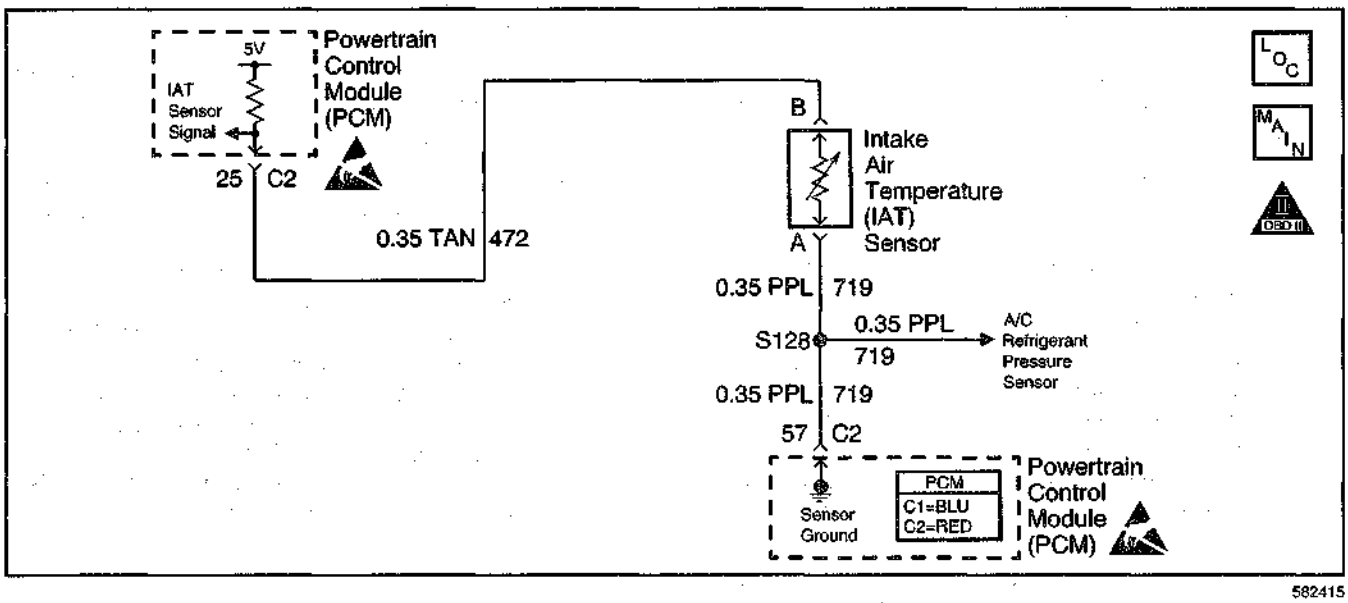
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DTC P1111 Intake Air Temperature (IAT) Sensor Circuit Intermittent High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 8*	Go to Diagnostic Aids
6	Repair the damaged connectors/terminals. Refer to *Connector Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
7	Repair the faulty wiring. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
8	1. Re-inspect all the related circuits and the connectors. 2. Replace the sensor/component if all the circuits have been tested thoroughly and no faults can be found. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1112 Intake Air Temperature (IAT) Sensor Circuit Intermittent Low Voltage



Circuit Description

The Intake Air Temperature (IAT) sensor contains a semiconductor device which changes resistance based on temperature (a thermistor). The IAT sensor mounts in the air intake passage of the engine air induction system. The IAT 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 in order to determine the intake air temperature.

When the intake air is cold, the sensor (thermistor) resistance is high, and the PCMs signal voltage is only pulled down a small amount through the sensor to ground. The PCM senses a high signal voltage (low temperature). When the intake air is warm, 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 (high temperature).

When the PCM senses a signal voltage lower than the normal operating range of the sensor, this DTC sets.

Conditions for Running the DTC

- DTCs P0102, P0103, P0117, P0118, P0500, P0502, P0503 are not set.
- The engine run time is more than 100 seconds.
- The engine coolant temperature is more than 0°C (32°F).
- The vehicle speed is at least 40 km/h (25 mph).
- The mass air flow is less than 15 g/s.

Conditions for Setting the DTC

- The intake air temperature is less than –35°C (–31°F).
- The intermittent condition exists for a total of 1 second during a 20 second time period.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

If the engine has sat overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

For an intermittent condition, refer to *Symptoms*.

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Test Description

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

2. If DTC P0112 also failed this indicates a hard failure is present. When a hard failure is present, both the hard and intermittent DTCs set.
3. When moving related connectors, visually/physically inspect connectors for the following:
   - Poor mating of the connector halves or a terminal not fully seated in the connector body (backed out).
   - Improperly formed or damaged terminals. Carefully reform or replace all connector terminals in the related circuits in order to insure proper terminal contact tension.
   - Poor terminal to wire connection. Inspect for poor crimps, crimping over wire insulation rather than the wire.
   - Dirt or corrosion on the terminals. Inspect for missing connector seals and for damage to the connector seals.
4. When moving the related wiring harnesses, visually/physically inspect the wiring for the following:
   - Wire insulation that is rubbed through, causing an intermittent short.
   - Wiring broken inside the insulation.
5. 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.

DTC P1112 Intake Air Temperature (IAT) Sensor Circuit Intermittent Low Voltage

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	Did DTC P0112 also set?	—	Go to *DTC P0112 Intake Air Temperature (IAT) Sensor Circuit Low Voltage*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Observe the affected sensor value on a scan tool while moving related harness connectors (at the component and the PCM). Does the sensor value change abruptly while a related connector is being moved?	—	*Go to Step 6*	*Go to Step 4*
4	Observe the affected sensor value on a scan tool while moving the related wiring harnesses. Does the sensor value change abruptly while moving the related electrical harnesses?	—	*Go to Step 7*	*Go to Step 5*

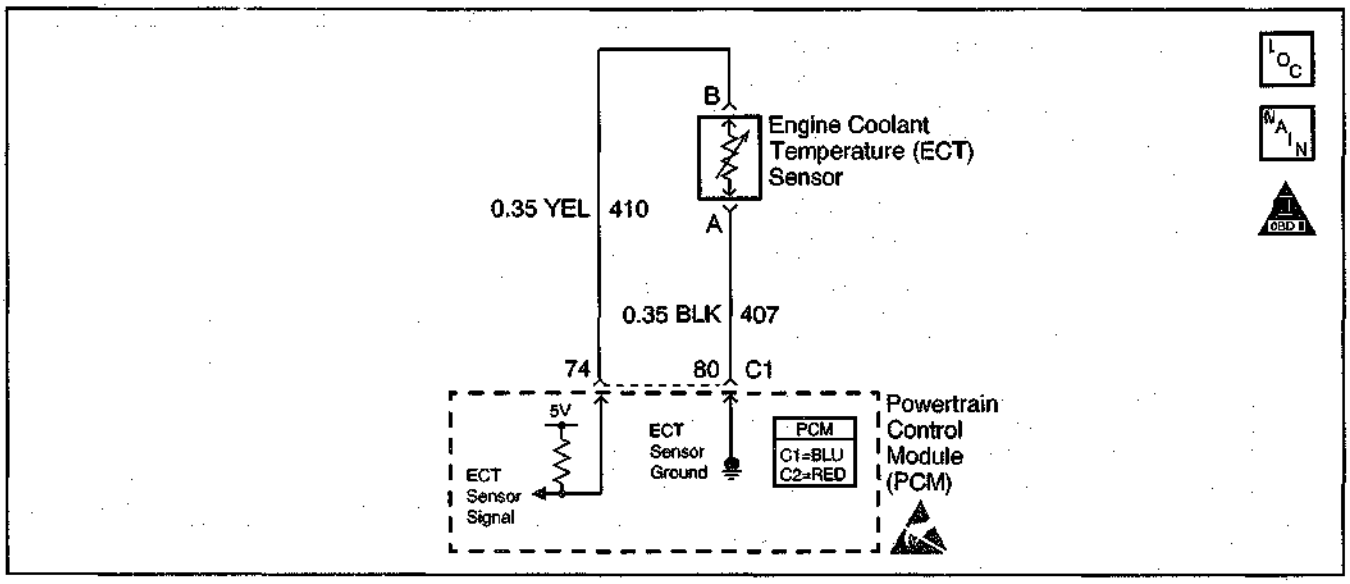
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DTC P1112 Intake Air Temperature (IAT) Sensor Circuit Intermittent Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 8*	Go to Diagnostic Aids
6	Repair the damaged connectors/terminals. Refer to *Connector Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
7	Repair the faulty wiring. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
8	1. Re-inspect all the related circuits and the connectors. 2. Replace the sensor/component if all the circuits have been tested thoroughly and no faults can be found. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	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 contains a semiconductor device which changes resistance based on temperature (a thermistor). The ECT sensor mounts in the left bank cylinder head near the front of the engine. The ECT 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 in order to determine the engine coolant temperature.

When the engine coolant is cold, the sensor (thermistor) resistance is high, and the PCMs signal voltage is only pulled down a small amount through the sensor to ground. The PCM senses a high signal voltage (low temperature). When the engine coolant is warm, 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 (high temperature).

The engine coolant temperature information is sent to the instrument panel cluster via the class 2 circuit.

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 engine run time is more than 10 seconds.

Conditions for Setting the DTC

- The Engine Coolant Temperature is more than 139°C (282°F) for less than a second.
- The intermittent condition exists for a total of 1 second during a 20 second time period.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Electromagnetic interference (EMI) can cause an intermittent DTC. Inspect the related circuits for being too close to secondary ignition wires and the generator.

If the engine has sat overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. If DTC P0117 also failed this indicates a hard failure is present. When a hard failure is present, both the hard and intermittent DTCs set.
3. When moving related connectors, visually/physically inspect connectors for the following:
   - Poor mating of the connector halves or a terminal not fully seated in the connector body (backed out).
   - Improperly formed or damaged terminals. Carefully reform or replace all connector terminals in the related circuits in order to insure proper terminal contact tension.
   - Poor terminal to wire connection. Inspect for poor crimps, crimping over wire insulation rather than the wire.
   - Dirt or corrosion on the terminals. Inspect for missing connector seals and for damage to the connector seals.
4. When moving the related wiring harnesses, visually/physically inspect the wiring for the following:
   - Wire insulation that is rubbed through, causing an intermittent short.
   - Wiring broken inside the insulation.
5. 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.

DTC P1114 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent Low Voltage

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	Did DTC P0117 fail this ignition cycle?	—	Go to *DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Observe the affected sensor value on the scan tool while moving the related harness connectors (at the component and the PCM). Does the sensor value change abruptly while a related connector is being moved?	—	*Go to Step 6*	*Go to Step 4*
4	Observe the affected sensor value on the scan tool while moving the related wiring harnesses. Does the sensor value change abruptly while moving the related electrical harnesses?	—	*Go to Step 7*	*Go to Step 5*

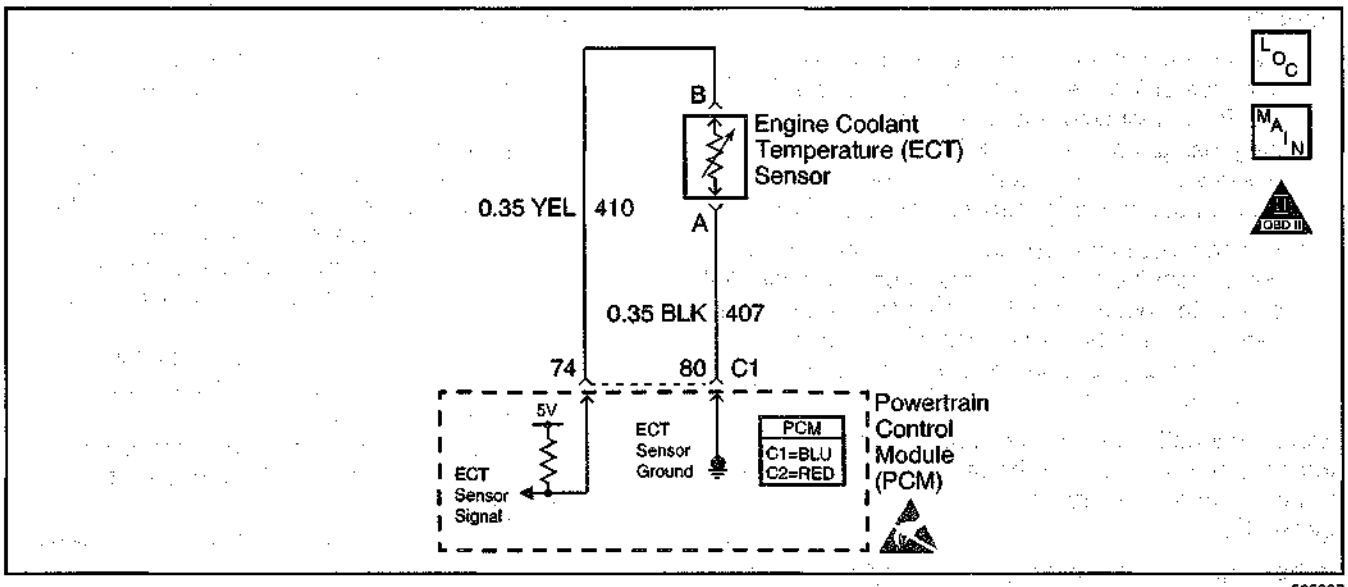
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DTC P1114 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 8*	Go to Diagnostic Aids
6	Repair the damaged connectors/terminals. Refer to *Connector Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
7	Repair the faulty wiring. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
8	1. Re-inspect all the related circuits and the connectors. 2. Replace the sensor/component if all the circuits have been tested thoroughly and no faults can be found. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	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 contains a semiconductor device which changes resistance based on temperature (a thermistor). The ECT sensor mounts in the left bank cylinder head near the front of the engine. The ECT 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 in order to determine the engine coolant temperature.

When the engine coolant is cold, the sensor (thermistor) resistance is high, and the PCMs signal voltage is only pulled down a small amount through the sensor to ground. The PCM senses a high signal voltage (low temperature). When the engine coolant is warm, 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 (high temperature).

The engine coolant temperature information is sent to the instrument panel cluster via the class 2 circuit.

When the PCM senses a signal voltage higher than the normal operating range of the sensor, this DTC sets.

Conditions for Running the DTC

Engine operates longer than 60 seconds.

Conditions for Setting the DTC

- The intermittent condition exists for a total of 1 second during a 20 second time period.
- The engine coolant temperature is less than –35°C (–31°F) for less than a second.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Electromagnetic interference (EMI) can cause an intermittent DTC. Inspect the related circuits for being too close to secondary ignition wires and the generator.

If the engine has sat overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. If DTC P0118 also failed this indicates a hard failure is present. When a hard failure is present, both the hard and intermittent DTCs set.
3. When moving related connectors, visually/physically inspect connectors for the following:
   - Poor mating of the connector halves or a terminal not fully seated in the connector body (backed out).
   - Improperly formed or damaged terminals. Carefully reform or replace all connector terminals in the related circuits in order to insure proper terminal contact tension.
   - Poor terminal to wire connection. Inspect for poor crimps, crimping over wire insulation rather than the wire.
   - Dirt or corrosion on the terminals. Inspect for missing connector seals and for damage to the connector seals.
4. When moving the related wiring harnesses, visually/physically inspect the wiring for the following:
   - Wire insulation that is rubbed through, causing an intermittent short.
   - Wiring broken inside the insulation.
5. 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.

DTC P1115 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent High Voltage

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	Did DTC P0118 also set?	—	Go to *DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Observe the affected sensor value on the scan tool while moving the related harness connectors (at the component and the PCM). Does the sensor value change abruptly while a related connector is being moved?	—	*Go to Step 6*	*Go to Step 4*
4	Observe the affected sensor value on the scan tool while moving the related wiring harnesses. Does the sensor value change abruptly while moving the related electrical harnesses?	—	*Go to Step 7*	*Go to Step 5*

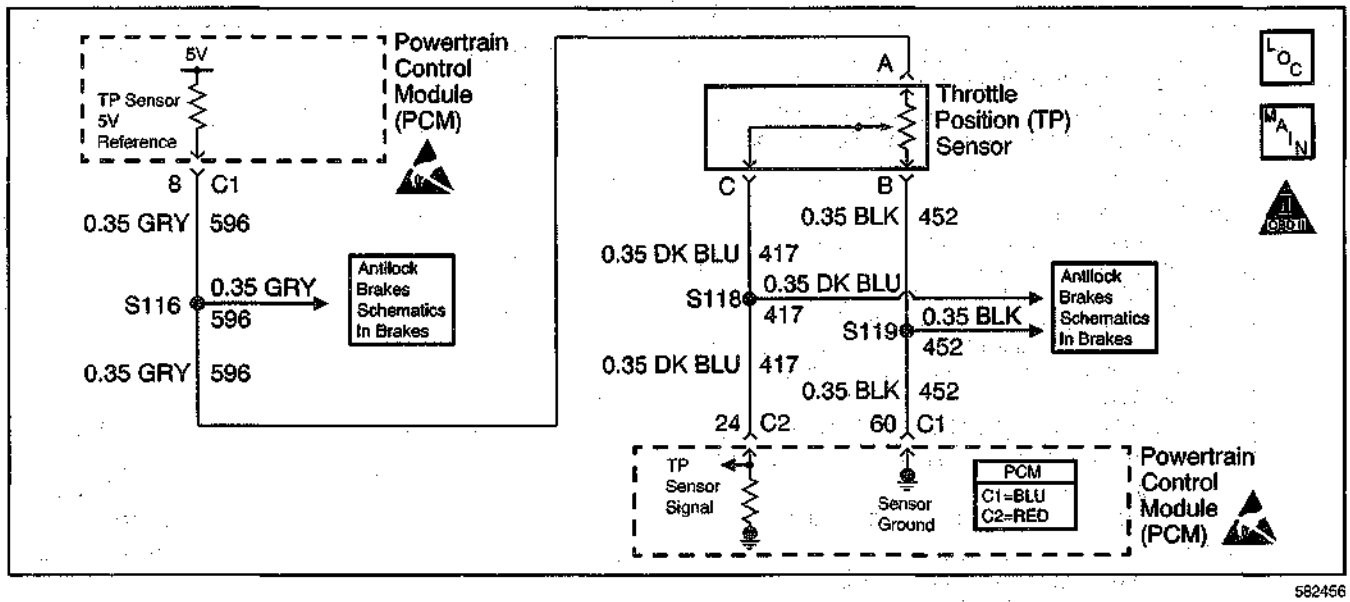
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DTC P1115 Engine Coolant Temperature (ECT) Sensor Circuit Intermittent High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in the Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 8*	Go to Diagnostic Aids
6	Repair the damaged connectors/terminals. Refer to *Connector Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
7	Repair the faulty wiring. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
8	1. Re-inspect all the related circuits and the connectors. 2. Replace the sensor/component if all the circuits have been tested thoroughly and no faults can be found. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1121 Throttle Position (TP) Sensor Circuit Intermittent High Voltage



Circuit Description

The Throttle Position (TP) sensor is a potentiometer. The TP sensor is mounted to the left side of the throttle body. The TP sensor provides a voltage signal that changes relative to throttle blade angle. This signal voltage is one of the most important inputs used by the PCM. The TP sensor has a 5.0 volt reference, a ground and a signal circuit.

TP sensor Signal voltage should be about 0.6 volt at idle. The TP sensor voltage should increase to above 4.0 volts at wide open throttle (WOT).

When the PCM senses a signal voltage higher than the normal operating range of the sensor, this DTC sets.

Conditions for Running the DTC

The ignition switch is in the Run position.

Conditions for Setting the DTC

- The TP sensor voltage is more than 4.8 volts.
- The intermittent condition exists for a total of 1 second during a 20 second time period.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Electromagnetic interference (EMI) can cause an intermittent DTC. Inspect the related circuits for being too close to secondary ignition wires and the generator.

If the engine has sat overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

For an intermittent condition, refer to *Symptoms*.

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Test Description

Number(s) below refer to step numbers on the diagnostic table.

2. If DTC P0123 also failed this indicates a hard failure is present. When a hard failure is present, both the hard and intermittent DTCs will set.
3. When moving related connectors, visually/physically inspect connectors for the following:
   - Poor mating of the connector halves or a terminal not fully seated in the connector body (backed out).
   - Improperly formed or damaged terminals. Carefully reform or replace all connector terminals in the related circuits in order to insure proper terminal contact tension.
   - Poor terminal to wire connection. Inspect for poor crimps, crimping over wire insulation rather than the wire.
   - Dirt or corrosion on terminals. Inspect for missing connector seals and for damage to the connector seals.
4. When moving related wiring harnesses, visually/physically inspect wiring for the following:
   - Wire insulation that is rubbed through, causing an intermittent short.
   - Wiring broken inside the insulation.
5. Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or Failure Records data can be useful in determining how many miles since the DTC set. The Fail Counter and Pass Counter can also be used to determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that were noted. This will isolate when the DTC failed. If this DTC runs and passes the diagnostic, the scan tool will not indicate any information under DTC Status.

DTC P1121 Throttle Position (TP) Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *A Powertrain On Board Diagnostic (OBD) System Check*
2	Did DTC P0123 fail this ignition cycle?	—	Go to *DTC P0123 Throttle Position (TP) Sensor Circuit High Voltage*	*Go to Step 3*
3	1. Install the scan tool. 2. Turn the ignition ON, engine OFF. 3. Using a scan tool, observe affected sensor value while moving related harness connectors (at component and PCM). Does sensor value change abruptly while a related connector is being moved?	—	*Go to Step 6*	*Go to Step 4*
4	Using a scan tool, observe affected sensor value while moving related wiring harnesses. Does sensor value change abruptly while moving related electrical harnesses?	—	*Go to Step 7*	*Go to Step 5*

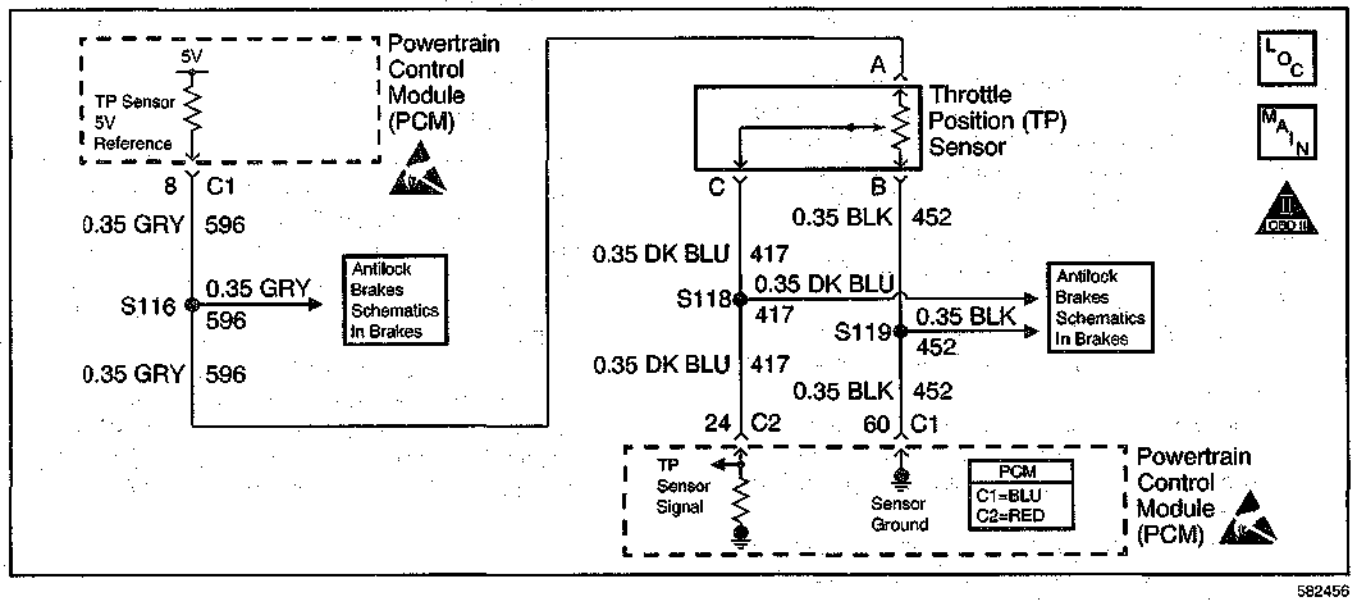
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DTC P1121 Throttle Position (TP) Sensor Circuit Intermittent High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition ON, engine OFF, review Freeze Frame and/or Failure Records data for this DTC and note parameters. 2. Turn the ignition OFF for 15 seconds. 3. Start the engine and operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 4. Using the scan tool, select DTC, Specific, then enter the DTC number which was set. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 8*	Go to Diagnostic Aids
6	Repair damaged connectors/terminals. Refer to *Connector Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
7	Repair faulty wiring. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
8	1. Re-inspect all related circuits and connectors. 2. If all the circuits have been tested thoroughly and no faults can be found, replace the sensor/component. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1122 Throttle Position (TP) Sensor Circuit Intermittent Low Voltage



582456

Circuit Description

The Throttle Position (TP) sensor is a potentiometer. The TP sensor is mounted to the left side of the throttle body. The TP sensor provides a voltage signal that changes relative to throttle blade angle. This signal voltage is one of the most important inputs used by the PCM. The TP sensor has a 5.0 volt reference, a ground and a signal circuit.

TP sensor Signal voltage should be about 0.6 volt at idle. The TP sensor voltage should increase to above 4.0 volts at wide open throttle (WOT).

When the PCM senses a signal voltage lower than the normal operating range of the sensor, this DTC sets.

Conditions for Running the DTC

TP sensor voltage is less than 0.2 volts for 0.3 second.

Conditions for Setting the DTC

- TP sensor voltage is less than 0.2 volts.
- The intermittent condition exists for a total of 1 second during a 20 second time period.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Electromagnetic interference (EMI) can cause an intermittent DTC. Inspect the related circuits for being too close to secondary ignition wires and the generator.

If the engine has sat overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other. If the temperatures are not within 3°C (5°F), refer to *Temperature vs Resistance*.

For an intermittent condition, refer to *Symptoms*.

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Test Description

Number(s) below refer to step numbers on the diagnostic table.

2. If DTC P0122 also failed this indicates a hard failure is present. When a hard failure is present, both the hard and intermittent DTCs will set. The engine must be operating longer than 30 seconds before inspecting if the DTC set.
3. When moving related connectors, visually/physically inspect connectors for the following:
   - Poor mating of the connector halves or a terminal not fully seated in the connector body (backed out).
   - Improperly formed or damaged terminals. All connector terminals in the related circuits should be carefully reformed or replaced to insure proper contact tension.
   - Poor terminal to wire connection. Inspect for poor crimps, crimping over wire insulation rather than the wire.
   - Dirt or corrosion on terminals. Inspect for missing connector seals and for damage to the connector seals.
4. When moving related wiring harnesses, visually/physically inspect wiring for the following:
   - Wire insulation that is rubbed through, causing an intermittent short.
   - Wiring broken inside the insulation.
5. Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or Failure Records data can be useful in determining how many miles since the DTC set. The Fail Counter and Pass Counter can also be used to determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that were noted. This will isolate when the DTC failed.

DTC P1122 Throttle Position (TP) Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	*Go to Step 2*	Go to *A Powertrain On Board Diagnostic (OBD) System Check*
2	Did DTC P0122 fail this ignition cycle?	—	Go to *DTC P0122 Throttle Position (TP) Sensor Circuit Low Voltage*	*Go to Step 3*
3	1. Install the scan tool. 2. Turn the ignition ON leaving the engine OFF. 3. Using a scan tool, observe affected sensor value while moving related harness connectors (at component and PCM). Does sensor value change abruptly while a related connector is being moved?	—	*Go to Step 6*	*Go to Step 4*
4	Using a scan tool, observe affected sensor value while moving related wiring harnesses. Does sensor value change abruptly while moving related electrical harnesses?	—	*Go to Step 7*	*Go to Step 5*

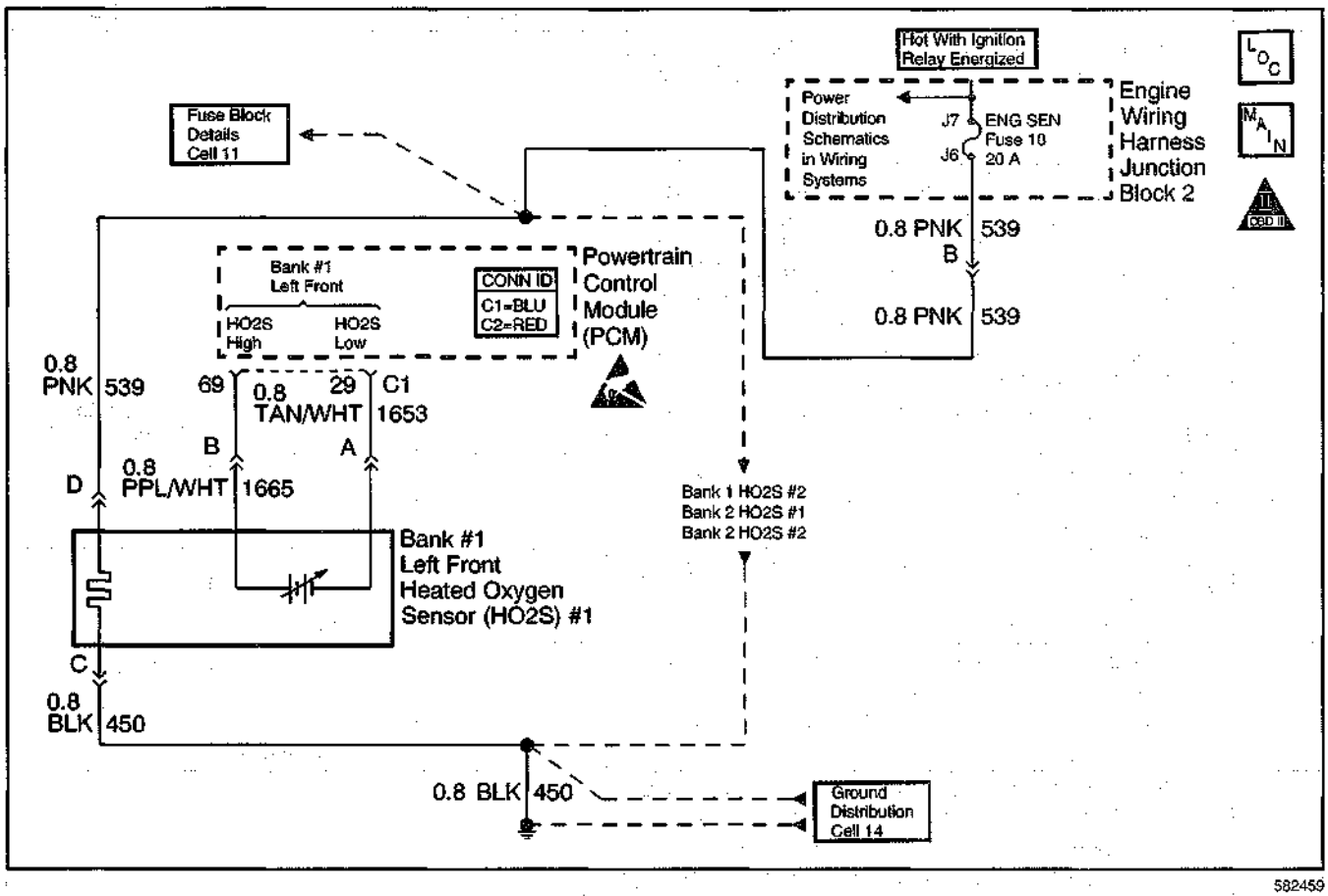
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DTC P1122 Throttle Position (TP) Sensor Circuit Intermittent Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition ON leaving the engine OFF. Review Freeze Frame and/or Failure Records data for this DTC and note parameters. 2. Turn the ignition OFF for 15 seconds. 3. Start the engine and operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 4. Using the scan tool, select DTC, Specific, then enter the DTC number which was set. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 8*	Go to Diagnostic Aids
6	Repair the damaged connectors/terminals. Refer to *Connector Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
7	Repair the faulty wiring. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
8	1. Re-inspect all the related circuits and connectors. 2. If all the circuits have been tested thoroughly and no faults can be found, replace the sensor/component. Is the action complete?	—	*Go to Step 9*	—
9	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 10*	*Go to Step 2*
10	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1



Circuit Description

The PCM monitors the Heated Oxygen Sensor (HO2S) activity for 100 seconds. During this monitor period the PCM counts the number of times that the HO2S switches form rich to lean and lean to rich. A DTC P1133 sets when the PCM determines that the HO2S did not switch enough times.

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

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P0506, P0507, P1258 not set.
- The fuel system is operating in Closed Loop.
- The engine run time is more than 120 seconds.
- The engine speed is more than 1,000 RPM but less than 2,300 RPM.
- The ignition voltage is more than 9.0 volts.
- The engine coolant temperature is more than 50°C (122°F).
- The MAF is between 20 g/s and 50 g/s.
- The EVAP purge duty cycle is more than 0 percent.

Conditions for Setting the DTC

The PCM determines that within 100 seconds the HO2S lean to rich switches are less than 10 and rich to lean switches are less than 10.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Inspect the HO2S signal circuit for being shorted to a PCM ground. The HO2S signal circuit shorted to a PCM ground will not cause a HO2S low DTC to set, but will set a switching DTC.

A malfunction in the HO2S heater circuits will cause a DTC P1133 to set. Inspect the HO2S heater circuits for intermittent opens/connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.

An oxygen supply inside the HO2S is necessary for proper operation. This supply of oxygen is provided through the HO2S wires. All HO2S wires and connections should be inspected for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step determines if the fault is present. This test may take 5 minutes for the diagnostic to run.
3. When DTCs 1133 and P1153 are set at the same time, it is a good indication that a fuel contamination condition is present.
4. An exhaust leak 6–12 inches away from the HO2S can cause a DTC to set.
5. This step tests whether a good ground circuit is available.
6. This step tests the integrity of the signal circuit to the PCM.
7. This step tests the integrity of the signal circuit to the PCM.
8. Certain RTV silicone gasket materials give off vapors that can contaminate the HO2S. There is also a possibility of silicone contamination caused by silicone in the fuel. If the sensors appear to be contaminated by silicone and all the silicone sealant is a non silicone base, advise the customer to try a different fuel company. A missing fuel filler restrictor indicates the customer may have used leaded fuel.

DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1

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	**Important:** If any DTCs are set (except P1153), refer to those DTCs before proceeding with this diagnostic table. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within the parameters specified under Conditions for Running the DTC in the supporting text. 4. Monitor the Diagnostic Trouble Code (DTC) Information using the scan tool. Did DTC P1133 fail this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	Did DTC P1153 also fail this ignition?	—	*Go to Step 8*	*Go to Step 4*
4	1. Inspect for an exhaust system leak. Refer to *Exhaust System Inspection* in Engine Exhaust. After you inspect the exhaust system, return to this diagnostic. 2. If you find an exhaust leak, repair the exhaust leak as necessary. Did you isolate an exhaust leak?	—	*Go to Step 14*	*Go to Step 5*
5	Visually/physically inspect the following items: • Ensure that the HO2S is securely installed. • Inspect for corrosion on the terminals. • Test the terminal tension at the HO2S and at the PCM. • Inspect for damaged wiring. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 6*

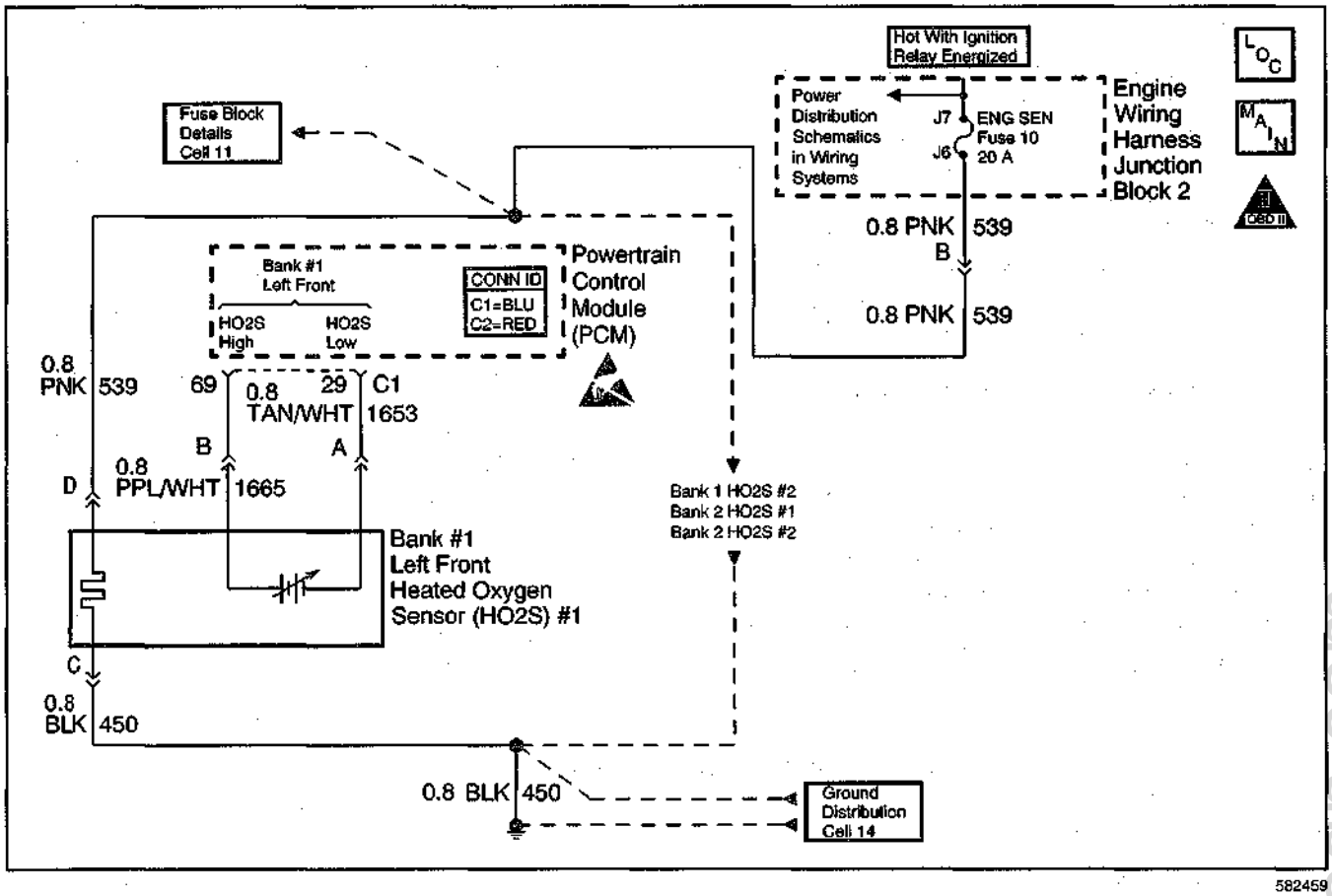
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DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
6	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage on the Engine 1 Data List using the scan tool. Does the scan tool indicate a voltage within the specified range?	350–550 mV	*Go to Step 7*	*Go to Step 10*
7	1. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 2. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate a voltage below the specified value?	200 mV	*Go to Step 13*	*Go to Step 9*
8	**Important:** Determine and correct the cause of the contamination before replacing a sensor. Inspect for the following conditions: • Fuel contamination • Use of improper RTV sealant • Engine oil/coolant consumption Replace the affected heated oxygen sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1* and/or *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1*. Is the action complete?	—	*Go to Step 14*	—
9	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Does the DMM indicate a voltage near the specified value?	5 Volts	*Go to Step 12*	*Go to Step 11*
10	Repair the high signal circuit for a short to ground or shorted to a voltage. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
11	Repair the open HO2S low circuit or repair the faulty PCM connections. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Repair the HO2S high signal circuit for an open or repair the faulty PCM connections. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
13	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1*. Is the action complete?	—	*Go to Step 14*	—
14	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 15*	*Go to Step 2*
15	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1



Circuit Description

The PCM monitors the Heated Oxygen Sensor (HO2S) activity. During the monitor period 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. 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. A DTC P1134 sets if the HO2S ratio is not within range.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P0506, P0507, P1258 not set.
- The fuel system is operating in Closed Loop.
- The engine run time is more than 120 seconds.
- The engine speed is more than 1,000 RPM but less than 2,300 RPM.
- The ignition voltage is more than 9.0 volts.
- The engine coolant temperature is more than 50°C (122°F).
- The MAF is between 20 g/s and 50 g/s.
- The EVAP purge duty cycle is more than 0 percent.

Conditions for Setting the DTC

The PCM determines that the HO2S transition time ratio is not at the expected value.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An oxygen supply inside the HO2S is necessary for proper operation. This supply of oxygen is provided through the HO2S wires. All HO2S wires and connections should be inspected for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step determines if the fault is present. This test may take 5 minutes for the diagnostic to run.
3. When DTCs P1134 and P1154 are set at the same time, it is a good indication that a fuel contamination condition is present.
4. An exhaust leak 6–12 inches away from the HO2S can cause a DTC to set.
5. This step tests whether a good ground circuit is available.
6. This step tests the integrity of the signal circuit to the PCM.
7. This step tests the integrity of the signal circuit to the PCM.
8. Certain RTV silicone gasket materials give off vapors that can contaminate the HO2S. There is also a possibility of silicone contamination caused by silicone in the fuel. If the sensors appear to be contaminated by silicone and all the silicone sealant is a non silicone base, advise the customer to try a different fuel company. A missing fuel filler restrictor indicates the customer may have used leaded fuel.

DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1

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	**Important:** If any DTCs are set (except P1154), refer to those DTCs before proceeding with this diagnostic table. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within the parameters specified under Conditions for Running the DTC in the supporting text. 4. Monitor the Diagnostic Trouble Code (DTC) information using the scan tool. Did DTC P1134 fail this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	Did DTC P1154 also fail this ignition?	—	*Go to Step 8*	*Go to Step 4*
4	1. Inspect for an exhaust system leak. Refer to *Exhaust System Inspection* in Engine Exhaust. After you inspect the exhaust system, return to this diagnostic. 2. If you find an exhaust leak, repair the exhaust leak as necessary. Did you isolate an exhaust leak?	—	*Go to Step 14*	*Go to Step 5*
5	Visually/physically inspect the following items: • Ensure that the HO2S is securely installed. • Inspect for corrosion on the terminals. • Test the terminal tension at the HO2S and at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. • Inspect for damaged wiring. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 6*

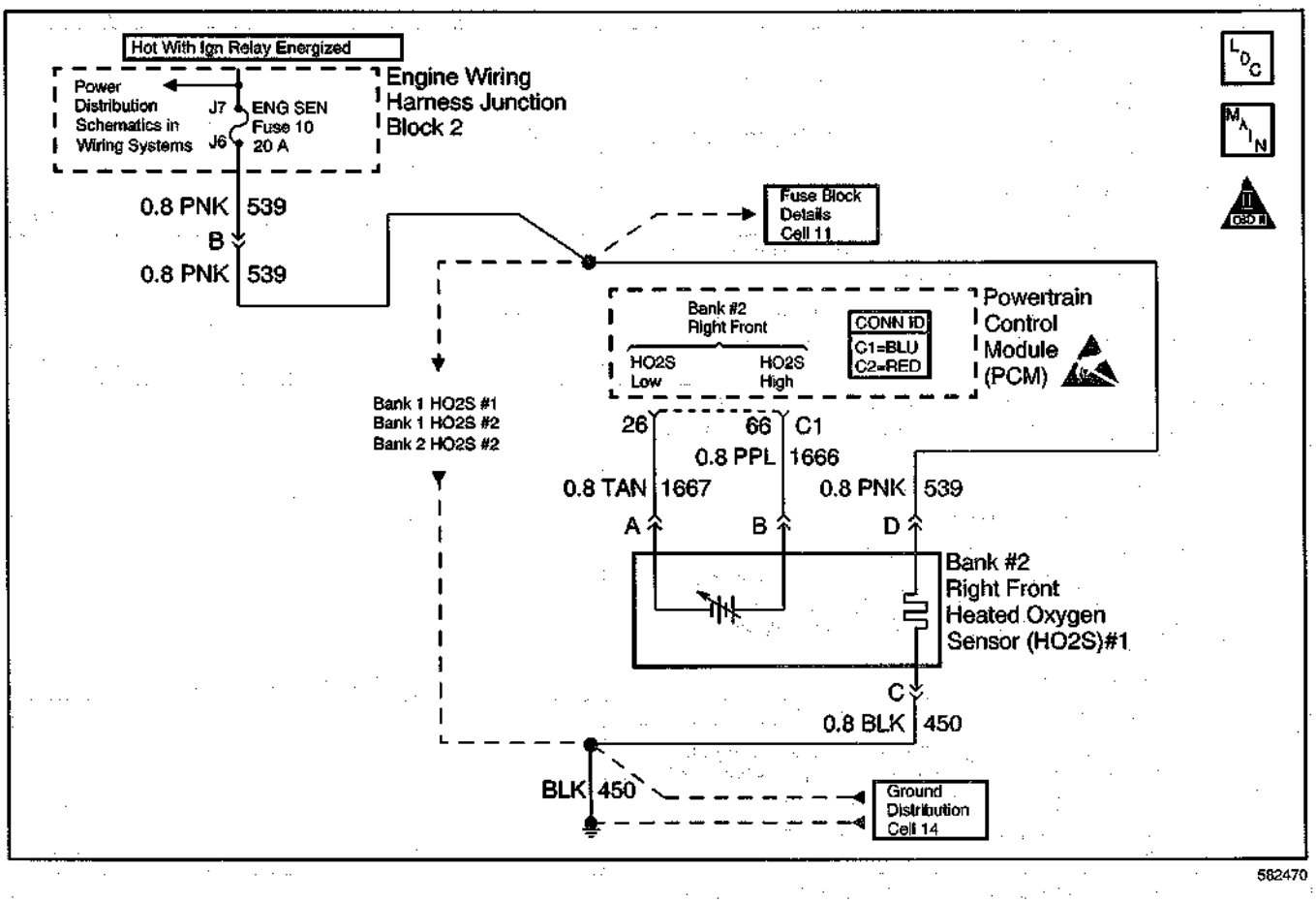
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DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
6	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage on the Engine 1 Data List using the scan tool. Does the scan tool indicate a voltage within the specified range?	350–550 mV	*Go to Step 7*	*Go to Step 10*
7	1. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 2. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate a voltage below the specified value?	200 mV	*Go to Step 13*	*Go to Step 9*
8	**Important:** Determine and correct the cause of the contamination before replacing a sensor. Inspect for the following conditions: • Fuel contamination • Use of improper RTV sealant • Engine oil/coolant consumption Replace the affected Heated Oxygen sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1* and/or *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1*. Is the action complete?	—	*Go to Step 14*	—
9	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM *J 39200*. Refer to *Measuring Voltage* in Wiring Systems. Does the DMM indicate a voltage near the specified value?	5V	*Go to Step 12*	*Go to Step 11*
10	Repair the high signal circuit for a short to ground or shorted to a voltage. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
11	Repair the open HO2S low circuit or repair the faulty PCM connections. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Repair the HO2S high signal circuit for an open or repair the faulty PCM connections. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
13	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1*. Is the action complete?	—	*Go to Step 14*	—
14	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 15*	*Go to Step 2*
15	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	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 for 100 seconds. During this monitor period the PCM counts the number of times that the HO2S switches form rich to lean and lean to rich. A DTC P1153 sets when the PCM determines that the HO2S did not switch enough times.

A lean to rich switch is determined when the HO2S voltage changes from less than 300 mV to greater 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

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P1258 not set.
- The fuel system is operating in Closed Loop.
- The engine run time is more than 2 minutes.
- The engine speed is more than 1,000 RPM but less than 2,300 RPM.
- The ignition voltage is more than 9.0 volts.
- The engine coolant temperature is more than 50°C (122°F).
- The MAF is between 20 g/s and 50 g/s.
- The EVAP purge duty cycle is more than 0 percent.

Conditions for Setting the DTC

The PCM determines that within 100 seconds the HO2S lean to rich switches are less than 10 and rich to lean switches are less then 10.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Inspect the HO2S signal circuit for being shorted to a PCM ground. The HO2S signal circuit shorted to a PCM ground will not cause a HO2S low DTC to set, but will set a switching DTC.

A malfunction in the HO2S heater circuits will cause a DTC P1153 to set. Inspect the HO2S heater circuits for intermittent opens/connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.

An oxygen supply inside the HO2S is necessary for proper operation. This supply of oxygen is provided through the HO2S wires. All HO2S wires and connections should be inspected for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step determines if the fault is present. This test may take 5 minutes for the diagnostic to run.
3. When DTCs P1133 and P1153 are set at the same time, it is a good indication that a fuel contamination condition is present.
4. An exhaust leak 6–12 inches away from the HO2S can cause a DTC to set.
5. This step tests whether a good ground circuit is available.
6. This step tests the integrity of the signal circuit to the PCM.
7. This step tests the integrity of the signal circuit to the PCM.
8. Certain RTV silicone gasket materials give off vapors that can contaminate the HO2S. There is also a possibility of silicone contamination caused by silicone in the fuel. If the sensors appear to be contaminated by silicone and all the silicone sealant is a non silicone base, advise the customer to try a different fuel company. A missing fuel filler restrictor indicates the customer may have used leaded fuel.

DTC P1153 HO2S Insufficient Switching Bank 2 Sensor 1

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	**Important:** If any DTCs are set (except P1133), refer to those DTCs before proceeding with this diagnostic table. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within the parameters specified under Conditions for Running the DTC in the supporting text. 4. Monitor the Diagnostic Trouble Code (DTC) Information using the scan tool. Did DTC P1153 fail this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	Did DTC P1133 also fail this ignition?	—	*Go to Step 8*	*Go to Step 4*
4	1. Inspect for an exhaust system leak. Refer to *Exhaust System Inspection* in Engine Exhaust. After you inspect the exhaust system, return to this diagnostic. 2. If you find an exhaust leak, repair the exhaust leak as necessary. Did you isolate an exhaust leak?	—	*Go to Step 14*	*Go to Step 5*
5	Visually/physically inspect the following items: • Ensure that the HO2S is securely installed. • Inspect for corrosion on the terminals. • Test the terminal tension at the HO2S and at the PCM. • Inspect for damaged wiring. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 6*

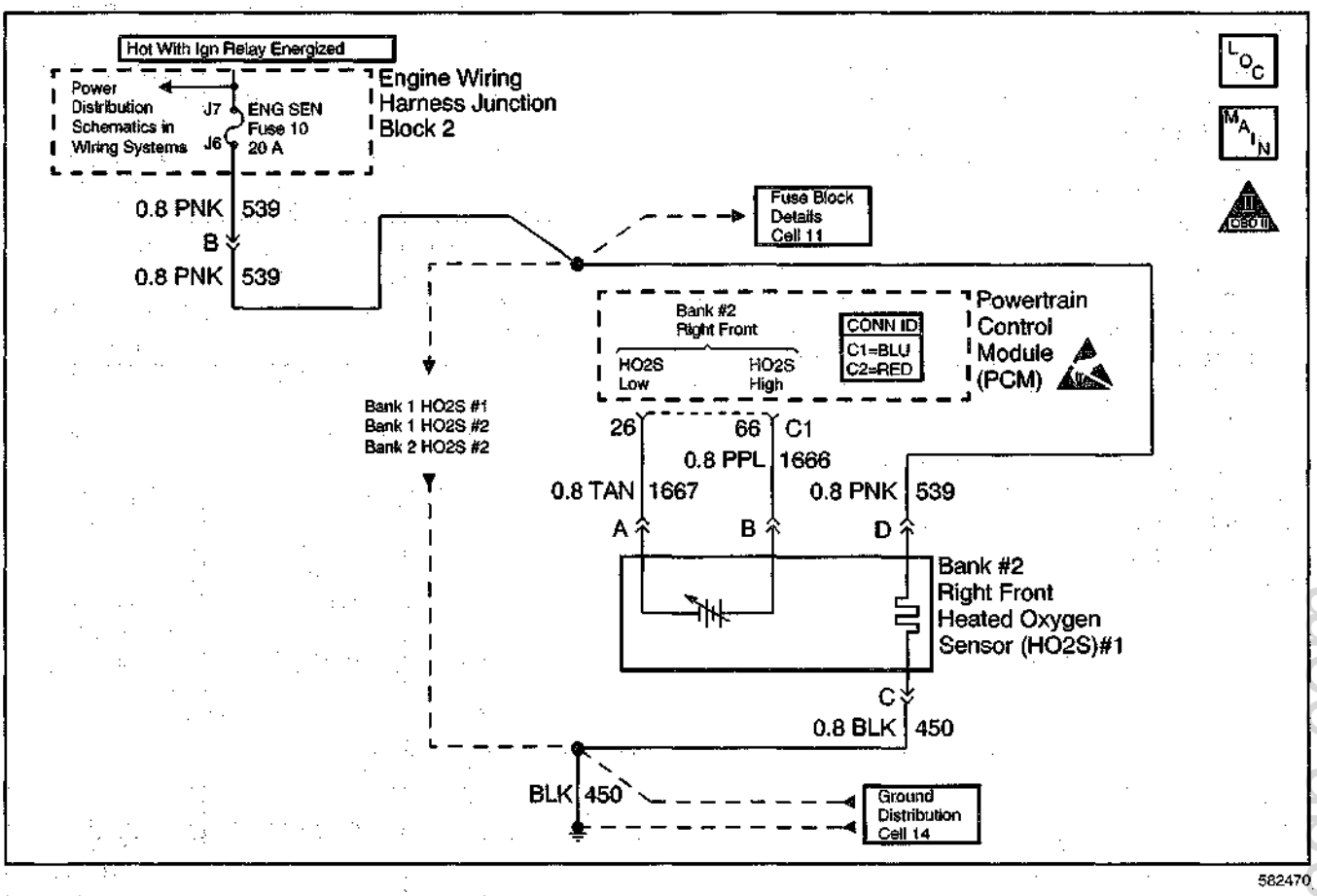
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DTC P1153 HO2S Insufficient Switching Bank 2 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
6	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage on the Engine 1 Data List using the scan tool. Does the scan tool indicate a voltage within the specified range?	350–550 mV	*Go to Step 7*	*Go to Step 10*
7	1. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 2. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate a voltage below the specified value?	200 mV	*Go to Step 13*	*Go to Step 9*
8	**Important:** Determine and correct the cause of the contamination before replacing a sensor. Inspect for the following conditions: • Fuel contamination • Use of improper RTV sealant • Engine oil/coolant consumption Replace the affected heated oxygen sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1* and/or *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1*. Is the action complete?	—	*Go to Step 14*	—
9	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Does the DMM indicate a voltage near the specified value?	5V	*Go to Step 12*	*Go to Step 11*
10	Repair the high signal circuit for a short to ground or shorted to a voltage. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
11	Repair the open HO2S low circuit or repair the faulty PCM connections. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Repair the HO2S high signal circuit for an open or repair the faulty PCM connections. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
13	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1*. Is the action complete?	—	*Go to Step 14*	—
14	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 15*	*Go to Step 2*
15	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	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 for 100 seconds. During the monitor period 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. 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. A DTC P1154 sets if the HO2S ratio is not within range.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0200, P0335, P0336, P0351–P0358, P0506, P0507, P1258 not set.
- The fuel system is operating in Closed Loop.
- The engine run time is more than 120 seconds.
- The engine speed is more than 1,000 RPM but less than 2,300 RPM.
- The ignition voltage is more than 9.0 volts.
- The engine coolant temperature is more than 50°C (122°F).
- The MAF is between 20 g/s and 50 g/s.
- The EVAP purge duty cycle is more than 0 percent.

Conditions for Setting the DTC

The PCM determines that the HO2S transition time ratio is not at the expected value.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

An oxygen supply inside the HO2S is necessary for proper operation. This supply of oxygen is provided through the HO2S wires. All HO2S wires and connections should be inspected for breaks or contamination. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step determines if the fault is present. This test may take 5 minutes for the diagnostic to run.
3. When DTCs P1134 and P1154 are set at the same time, it is a good indication that a fuel contamination condition is present.
4. An exhaust leak 6–12 inches away from the HO2S can cause a DTC to set.
5. This step tests whether a good ground circuit is available.
6. This step tests the integrity of the signal circuit to the PCM.
7. This step tests the integrity of the signal circuit to the PCM.
8. Certain RTV silicone gasket materials give off vapors that can contaminate the HO2S. There is also a possibility of silicone contamination caused by silicone in the fuel. If the sensors appear to be contaminated by silicone and all the silicone sealant is a non silicone base, advise the customer to try a different fuel company. A missing fuel filler restrictor indicates the customer may have used leaded fuel.

DTC P1154 HO2S Transition Time Ratio Bank 2 Sensor 1

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	**Important:** If any DTCs are set (except P1134), refer to those DTCs before proceeding with this diagnostic table. 1. Install a scan tool. 2. Idle the engine at the normal operating temperature. 3. Operate the vehicle within the parameters specified under Conditions for Running the DTC in the supporting text. 4. Monitor the Diagnostic Trouble Code (DTC) Information using the scan tool. Did DTC P1154 fail this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	Did DTC P1134 also fail this ignition?	—	*Go to Step 8*	*Go to Step 4*
4	1. Inspect for an exhaust system leak. Refer to *Exhaust System Inspection* in Engine Exhaust. After you inspect the exhaust system, return to this diagnostic. 2. If you find an exhaust leak, repair the exhaust leak as necessary. Did you isolate an exhaust leak?	—	*Go to Step 14*	*Go to Step 5*
5	Visually/physically inspect the following items: • Ensure that the HO2S is securely installed. • Inspect for corrosion on the terminals. • Test the terminal tension at the HO2S and at the PCM. • Inspect for damaged wiring. Did you find and correct the condition?	—	*Go to Step 14*	*Go to Step 6*

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DTC P1154 HO2S Transition Time Ratio Bank 2 Sensor 1 (cont'd)

Step	Action	Value(s)	Yes	No
6	1. Disconnect the HO2S. 2. Jumper the HO2S low circuit (PCM side) to a known good ground. 3. Monitor the HO2S voltage on the Engine 1 Data List using the scan tool. Does the scan tool indicate a voltage within the specified range?	350–550 mV	*Go to Step 7*	*Go to Step 10*
7	1. Jumper the HO2S high and low (PCM side) signal circuits to a battery ground. 2. Monitor the HO2S voltage using the scan tool. Does the scan tool indicate a voltage below the specified value?	200 mV	*Go to Step 13*	*Go to Step 9*
8	**Important:** Determine and correct the cause of the contamination before replacing a sensor. Inspect for the following conditions: • Fuel contamination • Use of improper RTV sealant • Engine oil/coolant consumption Replace the affected Heated Oxygen sensor. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1* and/or *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1.* Is the action complete?	—	*Go to Step 14*	—
9	1. Remove the jumper wire from the HO2S low circuit. 2. Measure the voltage from the HO2S low signal circuit to a battery ground using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Does the DMM indicate a voltage near the specified value?	5V	*Go to Step 12*	*Go to Step 11*
10	Repair the high signal circuit for a short to ground or shorted to a voltage. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
11	Repair the open HO2S low circuit or repair the faulty PCM connections. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
12	Repair the HO2S high signal circuit for an open or repair the faulty PCM connections. Refer to *Heated Oxygen Sensor (HO2S) Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
13	Replace the HO2S. Refer to *Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1.* Is the action complete?	—	*Go to Step 14*	—
14	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 15*	*Go to Step 2*
15	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1258 Engine Coolant Overtemperature - Protection Mode Active

Circuit Description

In order to reduce the engine temperature the PCM has the ability to disable a number of fuel injectors during an engine over temperature condition. The PCM considers the engine over temperature whenever the ECT reaches a predetermined temperature. This DTC sets in order to show that the PCM detected an over temperature condition and that the system engaged the protection mode.

Conditions for Running the DTC

- DTCs P0117, P0118, P0125 are not set.
- The engine is running.

Conditions for Setting the DTC

- The engine coolant temperature is more than 132°C (270°F).
- The above conditions present for more than 10 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the Malfunction Indicator Lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.
- The PCM alternately disables four fuel injectors.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The PCM enables the Engine Coolant Over temperature mode when coolant temperature exceeds 132°C (270°F). Engine damage still could occur if the customer operates the vehicle too long in an overheat condition. Ensure no engine mechanical conditions exists after the overheat condition is repaired.

If an overheating condition exists, repair the overheat condition and change the engine oil and filter. Refer to *Engine Overheating* in Engine Cooling, and *Engine Oil and Oil Filter Change* in Engine Mechanical 5.7L.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

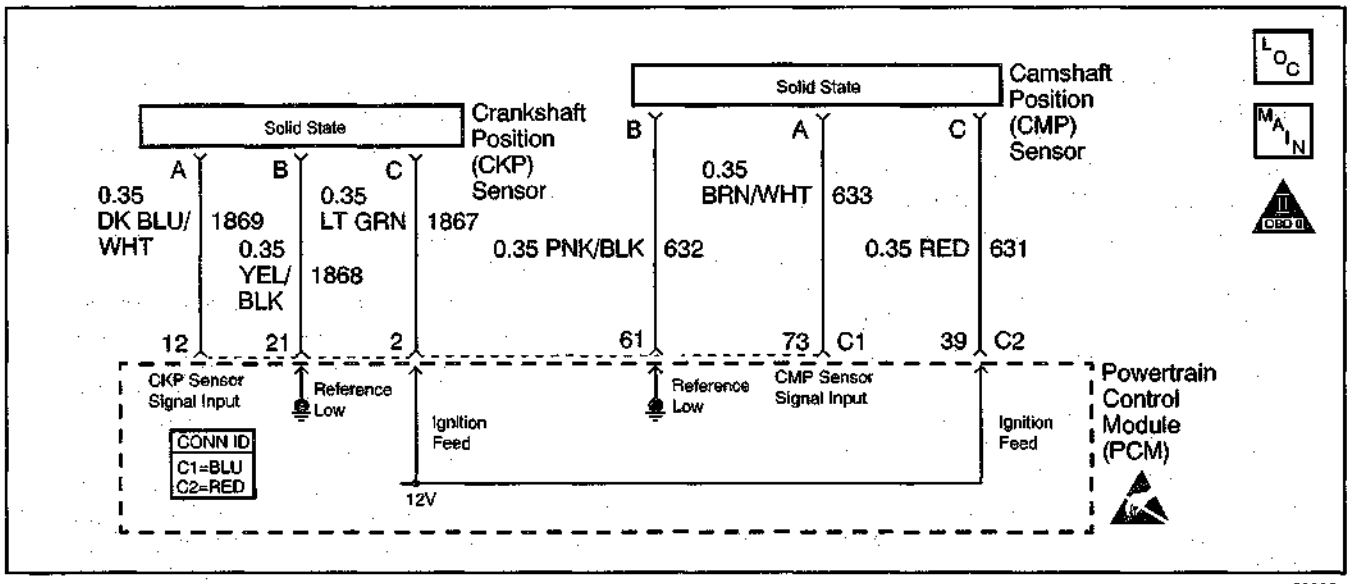
1. A cooling system over heating condition will enable the engine protection mode.

DTC P1258 Engine Coolant Overtemperature - Protection Mode Active

Step	Action	Value(s)	Yes	No
1	Did you perform the Powertrain On-Board Diagnostic (OBD) System Check?	—	Go to *Engine Overheating* in Engine Cooling	Go to *A Powertrain On Board Diagnostic (OBD) System Check*

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DTC P1336 Crankshaft Position (CKP) System Variation Not Learned



Circuit Description

The Crankshaft Position (CKP) sensor sends pulses to the PCM as the reluctor wheel teeth rotate past the CKP sensor. The PCM uses the CKP pulses to synchronize the ignition and fuel injector operation, and to time the interval between each CKP pulse. The PCM determines when an excessive change in crankshaft speed occurs by comparing each new time interval with the previous interval. A misfire causes an unexpected change in the crankshaft speed. A certain amount of acceleration/deceleration is expected between each firing stroke, but if the crankshaft speed changes more than an expected amount, the PCM interprets this as a misfire. The interval between CKP sensor pulses is extremely small. At high engine speeds, slight variations in the following components make misfire detection difficult:

- Crankshaft
- Reluctor wheel
- CKP sensor

The PCM learns variations during the Crankshaft Position System Variation Learning Procedure. The PCM compensates for these variations when performing detect misfire calculations. Only a scan tool can command the PCM to perform the Crankshaft Position System Variation Learning Procedure again.

Perform the learning procedure after the following actions:

- A PCM replacement
- Any operation or repair involving the crankshaft, the CKP sensor, or the CKP sensor to reluctor wheel gap relationship.
- An engine replacement.
- The ignition switch is in the ON position until the battery is drained.

Important: A PCM power disconnect with the ignition ON may erase the stored pulse value and set the DTC P1336.

Disconnecting the PCM will not erase the learned Crankshaft Position System Variation as long as the ignition switch is in the OFF position.

Important: Reprogramming the PCM does not require running the Crankshaft Position System Variation Learn Procedure unless the PCM is new or from another vehicle.

A DTC P1336 sets if the Crankshaft Position System Variation is not within an acceptable range, or can not be learned.

Conditions for Running the DTC

There are no crankshaft position (CKP) or camshaft position (CMP) sensor DTCs.

Conditions for Setting the DTC

The PCM has not learned the Crankshaft Position System Variation.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

  If the PCM receives an incorrect crankshaft to camshaft ratio the PCM will not allow the scan tool to enable the learn procedure.

If the Crankshaft Position System Variation Learn Procedure cannot be learned, inspect for the following conditions:

- A chipped or damaged reluctor wheel
- Incorrect alignment of the CKP sensor to the reluctor wheel
- Excessive crankshaft run-out
- Interference in the signal circuit to the CKP sensor
- Incorrect ratio of crankshaft to camshaft pulses

Engine diagnostic misfire is not operable when the engine is above 1000 RPM and DTC P1336 is set.

When the learn procedure is in progress and the engine speed is at 4000 RPM, a decrease in engine speed will occur. During the engine coastdown, the PCM monitors the CKP sensor signal and stores the pattern. This pattern is used to determine if the crankshaft speed variations are due to misfire.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The PCM enables the learn process after 65°C (150°F) is reached. Engine deceleration occurs when the learn procedure is in progress. The PCM monitors and records the CKP sensor signal during engine coast-down conditions.
3. Test in Progress on the scan tool indicates the PCM is performing the learn procedure. If the PCM receives an incorrect crankshaft to camshaft pulse ratio, an incorrect transmission range signal input, corrupted communication, or no change in the brake switch input, the learn procedure will not be allowed.
4. If a repair is necessary due to a condition which prevented the learn procedure from enabling, the Crankshaft Position System Variation Learning Procedure must be performed.
5. The ignition must be in the OFF position for at least 10 seconds after the learn procedure is complete and the engine RPM has returned to idle. The PCM saves the signal data after these conditions are met.

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DTC P1336 Crankshaft Position (CKP) System Variation Not Learned

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	Perform the Crankshaft Position System Variation Learning Procedure as follows. 1. Install the scan tool. 2. Apply the vehicle's parking brake. 3. Block the drive wheels. 4. Close the hood. 5. Place the vehicle's transmission in Park (A/T) or Neutral (M/T). 6. Idle the engine until the specified engine coolant temperature value is reached. 7. Turn OFF all the accessories. 8. Apply the brakes for the duration of the procedure. **Important:** While the learn procedure is in progress, release the throttle immediately when the engine starts to decelerate. The engine control is returned to the operator and the engine will respond to throttle position after the learn procedure is complete. 9. Enable the Crankshaft Position System Variation Learning Procedure with the scan tool. 10. Slowly raise the engine RPM to the specified value. 11. Immediately release the throttle when the engine speed decreases. Does the scan tool indicate Learn Status: Learned This Ignition?	65°C (150°F) 4000 RPM	*Go to Step 5*	*Go to Step 3*
3	Attempt the Crankshaft Position System Variation Learn Procedure as many times as the specified value. Refer to *CKP System Variation Learn Procedure.* Does the scan tool indicate Learn Status: Learned This Ignition?	3	*Go to Step 5*	*Go to Step 4*
4	Inspect the Crankshaft Position (CKP) sensor and the crankshaft reluctor wheel for damage. Refer to Diagnostic Aids. Did you find any damage?	—	*Go to Step 6*	Go to Diagnostic Aids
5	Turn OFF the ignition for 15 seconds. Is the action complete?	—	*Go to Step 7*	—
6	Replace the Crankshaft Position (CKP) sensor and/or reluctor wheel. Refer to *Crankshaft Position (CKP) Sensor Replacement.* Is the action complete?	—	*Go to Step 7*	—
7	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this diagnostic ran and passed?	—	*Go to Step 8*	*Go to Step 2*
8	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1380 Misfire Detected - Rough Road Data Not Available

Circuit Description

The PCM detects engine misfire by detecting variations in crankshaft deceleration between firing strokes. For accurate detection of engine misfire the PCM must distinguish between crankshaft deceleration caused by actual misfire and deceleration caused by rough road conditions. The ABS Brake System can detect if the vehicle is on a rough road based on wheel acceleration/deceleration data supplied by the wheel speed sensors. If the ABS system detects rough road above a predetermined threshold, this information is sent to the PCM via serial data. The PCM can then take the rough road into account when calculating misfire. Even if the ABS is malfunctioning and cannot detect rough roads, the misfire diagnostic will continue to run. However, if a misfire DTC sets, this additional DTC also sets indicating that rough road data was not available during the misfire calculation due to an ABS System malfunction.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0121, P0122, P0123, P0335, P0336, P0742 not set.
- The vehicle speed is greater than 10.0 mph.
- The engine load is less than 60 percent.
- The engine misfire is detected (DTC P0300 set).
- The engine speed is less than 3200 RPM.

Conditions for Setting the DTC

An ABS system malfunction exists preventing the PCM from receiving rough road detection data.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

For an intermittent condition, refer to *Symptoms*.

Test Description

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

1. Service the ABS system before diagnosing for a misfire, because an actual engine misfire may or may not exist. The following two examples illustrate how this DTC can be set with or without an actual engine misfire:
   - There was an actual engine misfire during an ABS system malfunction.
   - The vehicle operator drove on a rough road, the ABS system could not detect this due to a malfunction, and the PCM interpreted the variations in crankshaft speed caused by the rough road as a misfire.

DTC P1380 Misfire Detected - Rough Road Data Not Available

Step	Action	Value(s)	Yes	No
1	Did you perform the Powertrain On-Board Diagnostic (OBD) System Check?	—	Go to *A Diagnostic System Check - ABS* in Antilock Brake System.	Go to *A Powertrain On Board Diagnostic (OBD) System Check*

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DTC P1381 Misfire Detected - No Communication with Brake Control Module

Circuit Description

The PCM detects engine misfire by detecting variations in crankshaft deceleration between firing strokes. For accurate detection of engine misfire the PCM must distinguish between crankshaft deceleration caused by actual misfire and deceleration caused by rough road conditions. The ABS Brake System can detect if the vehicle is on a rough road based on wheel acceleration/deceleration data supplied by the wheel speed sensors. If the ABS system detects rough road above a predetermined threshold, this information is sent to the PCM via serial data. The PCM can then take the rough road into account when calculating misfire. Even if serial data communication between the ABS System and the PCM is malfunctioning and the PCM can not receive the rough road data, the misfire diagnostic continues to run. However, if a misfire DTC sets, this additional DTC also sets indicating that the rough road data was not available during the misfire calculation due to a serial data malfunction.

Conditions for Running the DTC

- The vehicle speed is above 10 mph.
- The engine speed is below 3200 RPM.
- The engine load is less than 60 percent.
- Engine misfire is detected (DTC P0300 set).

Conditions for Setting the DTC

- A serial data malfunction exists preventing the PCM from receiving rough road detection data.
- The above conditions met for 20 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

For an intermittent condition, refer to *Symptoms*.

Test Description

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

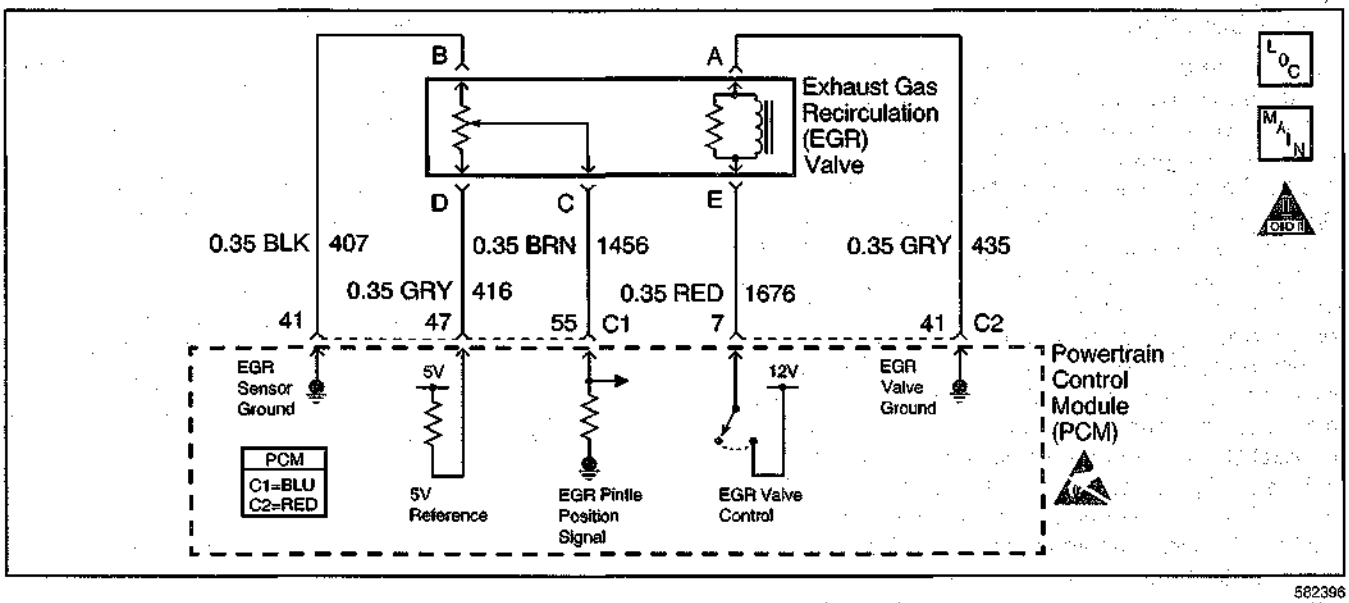
1. Service the ABS system before diagnosing for a misfire, because an actual engine misfire may or may not exist. The following two examples illustrate how this DTC can be set with or without an actual engine misfire:
   - There was an actual engine misfire during an ABS system malfunction.
   - The vehicle operator drove on a rough road, the ABS system could not detect this due to a malfunction, and the PCM interpreted the variations in crankshaft speed caused by the rough road as a misfire.

DTC P1381 Misfire Detected - No Communication with Brake Control Module

Step	Action	Value(s)	Yes	No
1	Did you perform the Powertrain On-Board Diagnostic (OBD) System Check?	—	Go to *A Diagnostic System Check - ABS* in Antilock Brake System.	Go to *A Powertrain On Board Diagnostic (OBD) System Check*

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DTC P1404 Exhaust Gas Recirculation (EGR) Closed Position Performance



Circuit Description

This diagnostic tests for an EGR valve that is stuck open. The PCM tests for a stuck open valve when the desired EGR position is at 0 percent. The PCM determines that the EGR valve is stuck open if the actual EGR position and the learned closed EGR position vary by more than a predetermined value. The PCM attempts to clear any obstructions from the valve. To clear the obstruction the PCM waits for the EGR desired position to be greater than 20 percent. Once the desired EGR position is more than 20 percent the PCM commands the EGR valve to 100 percent then back to 0 percent. The PCM does this three times. The PCM retests for a stuck EGR valve when the desired EGR position returns to 0 percent. A failure counter increments if the stuck EGR valve condition is still present. This DTC sets when the counter reaches a predetermined value.

Conditions for Running the DTC

The ignition voltage is more than 11.7 volts.

Conditions for Setting the DTC

The actual closed EGR pintle position voltage is 0.29 volts more than the desired closed EGR pintle position voltage

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Freeze Frame and/or the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

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Test Description

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

2. If DTC P1635 sets at the same time, this indicates that the 5 volt reference circuit is either shorted to ground or shorted to a voltage. The 5 volt reference circuit is internally connected within the PCM.
3. This step tests for open EGR valve when the valve should be closed.
6. Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicated 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 vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed.
5. This step tests for an EGR pintle position voltage that is out of range. The EGR pintle position voltage should be between 0.14 and 1.07 volts at idle.
8. This tests whether the ground circuit is available to the EGR valve. Inspect for poor electrical connections at the EGR valve.

DTC P1404 Exhaust Gas Recirculation (EGR) Closed Position Performance

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	**Important:** Inspect the EGR pintle position signal circuit for an intermittent condition before proceeding with this diagnostic table. An intermittent condition with the signal circuit causes this DTC to set. 1. Install the scan tool. 2. Idle the engine. 3. Monitor the Diagnostic Trouble Code (DTC) Information using the scan tool. Did DTC P1635 fail this ignition?	—	Go to *DTC P1635 5 Volt Reference 1 Circuit*	*Go to Step 3*
3	Idle the engine. Is the idle quality poor?	—	*Go to Step 4*	*Go to Step 5*
4	1. Idle the engine. 2. Disconnect the EGR valve electrical connector. Does the idle quality return to normal?	—	*Go to Step 13*	*Go to Step 15*
5	1. Turn ON the ignition leaving the engine OFF. 2. Observe the EGR pintle position voltage display on the scan tool. Is the EGR pintle position voltage within the specified value?	0.14–1.07 V	*Go to Step 6*	*Go to Step 7*
6	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and record the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number which was set using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 7*	Go to Diagnostic Aids

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DTC P1404 Exhaust Gas Recirculation (EGR) Closed Position Performance (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the EGR valve electrical connector. 2. Observe the EGR pintle position voltage display on the scan tool. Is the EGR pintle position voltage below the specified value?	0.14V	*Go to Step 8*	*Go to Step 10*
8	Probe the EGR pintle position ground circuit at the EGR valve harness connector with the *J 34142-B* test lamp connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 11*
9	Measure the voltage at the 5 volt reference circuit to ground using the DMM. Is the voltage greater than the specified value?	5V	*Go to Step 14*	*Go to Step 16*
10	**Important:** The short to voltage may be eliminated when the PCM is disconnected, if the signal circuit is shorted to another C1 circuit. 1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition leaving the engine OFF. 4. Test for a short to voltage on the EGR pintle position signal circuit. 5. If you find the EGR pintle position signal circuit shorted, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
11	1. Test for an open EGR pintle position ground circuit. 2. If you find the EGR pintle position ground circuit open, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 12*
12	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Inspect the EGR pintle position ground circuit for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 4. If you find a poor connection at the EGR valve ground circuit, repair the connection as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
13	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the EGR valve ground circuit for a short to voltage. 4. If you find the ground circuit shorted, repair the circuit as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 17*
14	Repair the 5 volt reference circuit for a short to voltage. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—

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DTC P1404 Exhaust Gas Recirculation (EGR) Closed Position Performance (cont'd)

Step	Action	Value(s)	Yes	No
15	1. Remove the EGR valve. 2. Inspect the EGR valve for debris that is interfering with the valve movement. Refer to *EGR System Cleaning*. 3. Repair as necessary if you find a condition. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 16*
16	Replace the EGR valve. Refer to *EGR Valve Replacement*. Is the action complete?	—	*Go to Step 18*	—
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
18	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 19*	*Go to Step 2*
19	Select the Capture Info option and the Review Info using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1415 Secondary Air Injection (AIR) System Bank 1

Circuit Description

An AIR pump is used on this vehicle to lower tail pipe emissions on start-up. The PCM supplies a ground to the AIR pump relay, which energizes the AIR pump.

The PCM monitors the HO2S voltages to diagnose the AIR system.

During the AIR test the PCM activates the AIR pump during closed loop operation. When the AIR is activated, the PCM monitors the HO2S voltages and short term fuel trim values for both banks of the engine. If the AIR system is operating properly, the HO2S voltages should go low and the short term fuel trim should go high.

If the PCM determines that the HO2S voltages for both banks did not respond as expected during the tests, DTC P0410 sets. If only one sensor responded, the PCM sets either a DTC P1415 or P1416 to indicate on which bank the AIR system is inoperative.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0171–P0175, P0200, P0300, P0325, P0327, P0332, P0335, P0336, P0351–P0358, P0420, P0430, P0500, P0502, P0503, and HO2S DTCs not set.
- The engine operates for more than 2 seconds.
- Engine run time is more than 20 seconds after closed loop operation.
- Engine speed is more than 850 RPM.
- Maximum air flow is 22 g/s.
- ECT is between 66°C (151°F) and 120°C (248°F).
- IAT is more than –10°C (14°F).
- Ignition voltage is more than 11.7 volts.
- Engine load is less than 30 percent.
- The air fuel ratio is 14.7:1
- Not operating in power enrichment mode OR deceleration fuel cut-off mode.
- In short term Fuel Trim cells 1, 2, 5 or 20.

Conditions for Setting the DTC

- HO2S voltage does not go below 222 mV for 0.9 seconds, when the AIR pump turns ON during closed loop operation.
- The short term fuel trim does not change more than a predetermined value, when the AIR pump turns ON during closed loop operation.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

- An obstruction in the exhaust manifold may restrict the amount of air flow necessary to affect the HO2S voltage. If you suspect this, remove the air pipe from the manifold and inspect the passage.
- For an intermittent condition, refer to *Symptoms*.

Test Description

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

3. A check valve that flows in both directions causes heat damage to the AIR system components.

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DTC P1415 Secondary Air Injection (AIR) System Bank 1

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	**Important:** Before proceeding with this diagnostic table, ensure that the AIR pump is operating and that air is present at the outlet of the AIR pump. If the AIR pump is inoperative refer to *DTC P0410 Secondary Air Injection (AIR) System* for further diagnosis. 1. Install a scan tool. 2. Idle the engine in Closed Loop. 3. Turn OFF all the accessories. 4. Monitor the Bank 1 Sensor 1 (Left Front) HO2S voltage display on the Engine 1 Data List using a scan tool. 5. Enable the AIR system using a scan tool. 6. Observe and record the Bank 1 Sensor 1 (Left Front) HO2S voltage, as the AIR system is enabled. Does the HO2S voltage drop below the specified value?	350 mV	Go to Diagnostic Aids	*Go to Step 3*
3	Visually/physically inspect all hoses and pipes for: • Being connected • Clamps are secure on pipes and hoses • No kinks, holes, or pinched hoses/pipes • Components with evidence of heat damage Did you locate the condition?	—	*Go to Step 6*	*Go to Step 4*
4	1. Disconnect the hose from the check valve at the left exhaust manifold. 2. Enable the AIR system using a scan tool. Is air present at the hose outlet?	—	*Go to Step 7*	*Go to Step 5*
5	Repair the restriction or blockage in AIR hoses/pipes between the left exhaust manifold and the point where the system branches to both sides of the engine. Is the action complete?	—	*Go to Step 8*	—
6	Repair the condition found. Is the action complete?	—	*Go to Step 8*	—
7	Replace the check valve. Refer to *AIR Check Valve/Pipe Replacement - Bank 1.* Is the action complete?	—	*Go to Step 8*	—
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1416 Secondary Air Injection (AIR) System Bank 2

Circuit Description

An AIR pump is used on this vehicle to lower tail pipe emissions on start-up. The PCM supplies a ground to the AIR pump relay, which energizes the AIR pump.

The PCM monitors the HO2S voltages to diagnose the AIR system.

During the AIR test the PCM activates the AIR pump during closed loop operation. When the AIR is activated, the PCM monitors the HO2S voltages and short term fuel trim values for both banks of the engine. If the AIR system is operating properly, the HO2S voltages should go low and the short term fuel trim should go high.

If the PCM determines that the HO2S voltages for both banks did not respond as expected during the tests, DTC P0410 sets. If only one sensor responded, the PCM sets either a DTC P1415 or P1416 to indicate on which bank the AIR system is inoperative.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0171–P0175, P0200, P0300, P0325, P0327, P0332, P0335, P0336, P0351–P0358, P0420, P0430, P0500, P0502, P0503, and HO2S DTCs not set.
- The engine operates for more than 2 seconds.
- Engine run time is more than 20 seconds after closed loop operation.
- Engine speed is more than 850 RPM.
- Maximum air flow is 22 g/s.
- ECT is between 66°C (151°F) and 120°C (248°F).
- IAT is more than −10°C (14°F).
- Ignition voltage is more than 11.7 volts.
- Engine load is less than 30 percent.
- The air fuel ratio is 14.7:1
- Not operating in power enrichment mode OR deceleration fuel cut-off mode.
- In short term Fuel Trim cells 1, 2, 5 or 20.

Conditions for Setting the DTC

- HO2S voltage does not go below 222 mV for 0.9 seconds, when the AIR pump turns ON during closed loop operation.
- The short term fuel trim does not change more than a predetermined value, when the AIR pump turns ON during closed loop operation.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

- An obstruction in the exhaust manifold may restrict the amount of air flow necessary to affect the HO2S voltage. If this is suspected, remove the air pipe from the manifold and inspect the passage.
- For an intermittent condition, refer to *Symptoms*.

Test Description

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

3. A check valve that flows in both directions causes heat damage to the AIR system components.

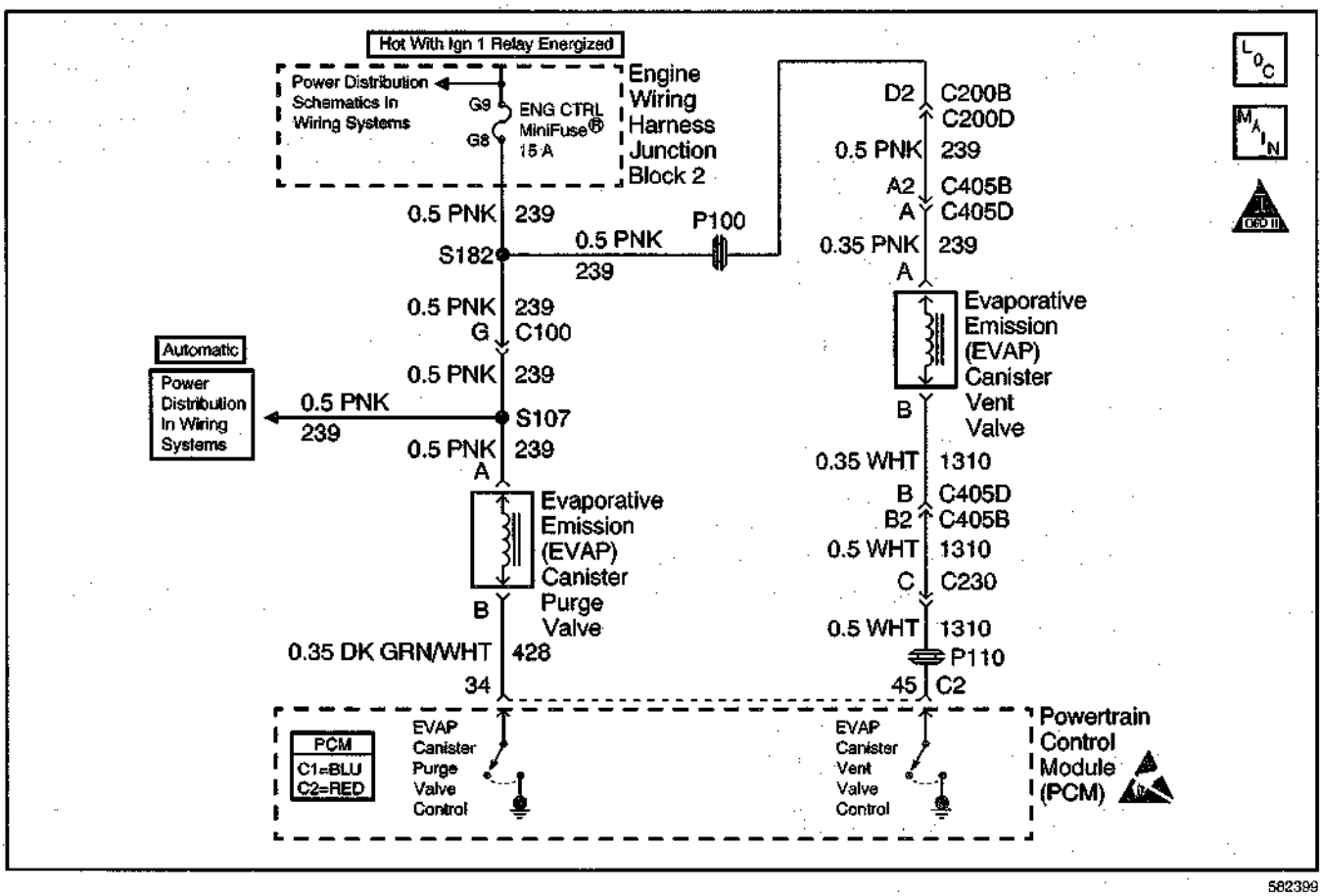
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DTC P1416 Secondary Air Injection (AIR) System Bank 2

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	**Important:** Before proceeding with this diagnostic table, ensure that the AIR pump is operating and that air is present at the outlet of the AIR pump. If the AIR pump is inoperative Refer to *DTC P0410 Secondary Air Injection (AIR) System* for further diagnosis. 1. Install scan tool. 2. Engine idling in Closed Loop. 3. Turn OFF all accessories. 4. Monitor the Bank 2 Sensor 1 (Right Front) HO2S voltage display on the Engine 1 Data List using a scan tool. 5. Enable the AIR system using a scan tool. 6. Observe and record the Bank 2 Sensor 1 (Right Front) HO2S voltage, as the AIR system is enabled. Does the HO2S voltage drop below the specified value?	350 mV	Go to Diagnostic Aids	*Go to Step 3*
3	Visually/physically inspect all hoses and pipes for: • Being connected • Clamps are secure on pipes and hoses • No kinks, holes, or pinched hoses/pipes • Components with evidence of heat damage Did you locate the condition?	—	*Go to Step 6*	*Go to Step 4*
4	1. Disconnect the hose from the check valve at the right exhaust manifold. 2. Enable the AIR system using a scan tool. Is air present at the hose outlet?	—	*Go to Step 7*	*Go to Step 5*
5	Repair the restriction or the blockage in the AIR hoses/pipes between the right exhaust manifold and the point where the system branches to both sides of the engine. Is the action complete?	—	*Go to Step 8*	—
6	Repair the condition found. Is the action complete?	—	*Go to Step 8*	—
7	Replace the check valve. Refer to *AIR Check Valve/Pipe Replacement - Bank 2.* Is the action complete?	—	*Go to Step 8*	—
8	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 9*	*Go to Step 2*
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1441 Evaporative Emission (EVAP) System Flow During Non-Purge



582399

Circuit Description

The PCM monitors the amount of vacuum/pressure in the EVAP system by monitoring the fuel tank pressure sensor signal. The PCM seals the EVAP system by commanding the EVAP Purge Solenoid OFF and the EVAP vent valve ON. The PCM monitors the fuel tank pressure sensor in order to determine if the EVAP Purge Solenoid is leaking vacuum to the EVAP system. This DTC sets if the vacuum in the EVAP system is more than a predetermined value within a predetermined time.

Conditions for Running the DTC

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0420, P0430, P0500, P0502, P0503, P0562, P0563 and HO2S DTCs are not set.
- The ignition voltage is between 10.0 volts and 17.0 volts.
- The barometric pressure is more than 75 kPa.
- The fuel level is between 15 percent and 85 percent of full capacity.
- The engine coolant temperature is between 4°C (39°F) and 30°C (86°F).
- The intake air temperature is between 4°C (39°F) and 30°C (86°F).
- The start up engine coolant and intake air temperatures are within 9°C (16°F) of each other.
- The TP sensor angle is less than 75 percent during the weak vacuum test.
- The vehicle speed is less than 90 mph during the weak vacuum test.

Conditions for Setting the DTC

The EVAP system develops a vacuum more than a predetermined value when purge is not commanded.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Before replacing any components, visually/physically inspect for the following:

- Mis-routed harness.
- Rubbed through wire insulation
- Broken wire inside the insulation
- Kinked or damaged vacuum hoses
- Physically damaged system components
- Inspect components and vacuum lines for traces of carbon or other contaminants. The presence of foreign material may be causing a restriction in the system or preventing the solenoid valve from closing properly. Either condition may cause a DTC to set.

For an intermittent condition, refer to *Symptoms*.

Test Description

The numbers below refer to the step numbers on the Diagnostic Table.

2. This step tests for a EVAP Purge Solenoid Valve that is leaking vacuum to the EVAP system when EVAP system purge is not commanded by the PCM.

   Inspect for possible carbon contamination of the EVAP Purge Solenoid Valve and the purge line.

DTC P1441 Evaporative Emission (EVAP) System Flow During Non-Purge

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	1. Disconnect the EVAP Purge line from the EVAP Purge Solenoid Valve. 2. Connect a vacuum gauge (in. Hg.) to the solenoid purge port. 3. Idle the engine. 4. Command the EVAP Purge Solenoid Valve OFF with a scan tool. Does the vacuum gauge indicate a vacuum?	—	*Go to Step 3*	Go to Diagnostic Aids
3	**Important:** Inspect for carbon contamination. Refer to *EVAP System Cleaning*. Replace the EVAP Purge Solenoid Valve. Refer to *EVAP Canister Purge Solenoid Valve Replacement*. Is the action complete?	—	*Go to Step 4*	—
4	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 5*	*Go to Step 2*
5	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1539 Air Conditioning (A/C) Clutch Feedback Circuit High Voltage

Refer to Engine Controls Schematics, *A/C Compressor Control* for complete circuit details.

Circuit Description

The PCM activates the A/C clutch relay when the PCM detects an A/C request. Voltage is present at both the A/C compressor clutch and the A/C clutch status terminal at the PCM when the relay is activated.

A DTC P1539 sets if the PCM detects a voltage on the A/C clutch status terminal when the system has not requested the A/C.

A short to voltage at any point in the A/C status circuit, or the A/C relay contacts are stuck, sets a DTC P1539.

Conditions for Running the DTC

The A/C is not requested.

Conditions for Setting the DTC

Voltage is detected on the A/C status circuit for more than 15 seconds after the PCM has disengaged the A/C clutch relay.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

- The A/C status circuit goes to the A/C compressor clutch and to the A/C clutch relay. Inspect all circuits going to these components.
- For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. If the PCM detects a voltage on the A/C status circuit with the A/C OFF the scan tool indicates the A/C status as ON.
3. If the scan tool displayed YES in the RAN column and INT in the FAIL column, this indicates an intermittent condition is present. Inspect the A/C status circuit for an intermittent short to B+. Using the Freeze Frame and/or the Failure Records data aids in locating an intermittent condition. If you can not duplicate the DTC, the information included in the Freeze Frame and/or Failure Records data determines how many miles since the DTC set. The Fail Counter and the Pass Counter can also be used to 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 the PCM recorded. This isolates when the DTC failed.
4. The relay is shorted internally if the scan tool indicates that the test passed.

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DTC P1539 Air Conditioning (A/C) Clutch Feedback Circuit High Voltage

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	**Important:** Diagnose DTC P0645 first if it is set. 1. Install a scan tool. 2. Idle the engine with the A/C OFF. 3. Monitor the A/C Status display on the Engine 1 Data List using a scan tool. Does the scan tool indicate the A/C Status is ON?	—	*Go to Step 4*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure Records as possible. Special operating conditions that need to be met before the PCM will run this diagnostic, where applicable, are listed in Conditions for Running the DTC. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	1. Turn OFF the ignition. 2. Remove the A/C clutch relay. 3. Idle the engine for 30 seconds. 4. Monitor the Diagnostic Trouble Code (DTC) Information using the scan tool. Does the scan tool indicate that DTC P1539 failed?	—	*Go to Step 5*	*Go to Step 6*
5	Repair the short to B+ on the A/C clutch status circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 7*	—
6	Replace the faulty A/C clutch relay. Refer to *Compressor Relay Replacement* in Heating, Ventillation, and Air Conditioning. Is the action complete?	—	*Go to Step 7*	—
7	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test failed?	—	*Go to Step 2*	*Go to Step 8*
8	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1546 Air Conditioning (A/C) Clutch Feedback Circuit Low Voltage

Refer to Engine Controls Schematics, *A/C Compressor Control* for complete circuit details.

Circuit Description

The PCM will activate the A/C clutch relay when the PCM detects that A/C has been requested. When the PCM activates the relay, voltage should be present at both the A/C compressor clutch and the A/C clutch status circuit at the PCM.

Conditions for Running the DTC

The A/C is requested.

Conditions for Setting the DTC

The PCM commands the A/C ON and the PCM does not detect a voltage on the A/C clutch status line for more than 5 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. This step tests the operation of the A/C compressor clutch. The PCM disables the A/C compressor clutch when this DTC is set.
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 vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the DTC failed.
4. This step tests whether the ignition voltage is available at the relay.
5. This step determines if the A/C relay is at fault or the A/C status circuit is at fault. If the A/C clutch engages, this indicates that the A/C Status circuit is OK.
6. If the A/C Status is displayed as OFF, this indicates the A/C status circuit is open between the splice and the PCM. If the A/C Status is displayed as ON, this indicates a faulty connection at the A/C compressor relay or a faulty relay.

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DTC P1546 Air Conditioning (A/C) Clutch Feedback Circuit Low Voltage

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	1. Install a scan tool. 2. Idle the engine with the A/C ON for the specified length of time. Does the A/C clutch operate properly?	5 minutes	*Go to Step 3*	*Go to Step 4*
3	1. Turn ON the ignition leaving the engine OFF. 2. Review Freeze Frame and/or Failure Records data for this DTC and note parameters. 3. Turn OFF the ignition for 15 seconds. 4. Idle the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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 Setting the DTC. 6. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 4*	Go to Diagnostic Aids
4	**Important:** For underhood electrical center relay terminal identification refer to *Electrical Center Identification Views* in Wiring Systems. 1. Turn OFF the ignition. 2. Disconnect the A/C clutch relay from the electrical center 2. 3. Turn ON the ignition leaving the engine OFF. 4. Probe the ignition feed circuit at the A/C relay terminal (switch side of relay) with the test lamp *J 34142-B* connected to ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 9*
5	**Important:** For underhood electrical center relay terminal identification refer to *Electrical Center Identification Views* in Wiring Systems. Jumper the ignition feed circuit to the A/C clutch status circuit (load) at the underhood electrical center 2 using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the A/C clutch engage?	—	*Go to Step 6*	*Go to Step 10*
6	Monitor the A/C Status display on the using the scan tool with the fused jumper still installed. Does the scan tool indicate the A/C Status as ON?	—	*Go to Step 7*	*Go to Step 8*
7	Repair the faulty A/C clutch relay connection or replace the faulty A/C clutch relay. Refer to *Repairing Connector Terminals* in Wiring Systems. Or *Compressor Relay Replacement* in Heating, Ventilation, and Air Conditioning. Is the action complete?	—	*Go to Step 12*	—
8	Repair the poor connection or open A/C clutch status circuit from the splice to the PCM. Refer to *Wiring Repairs* or *Repairing Connector Terminals* in Wiring Systems. Did you find and repair the condition?	—	*Go to Step 12*	*Go to Step 11*

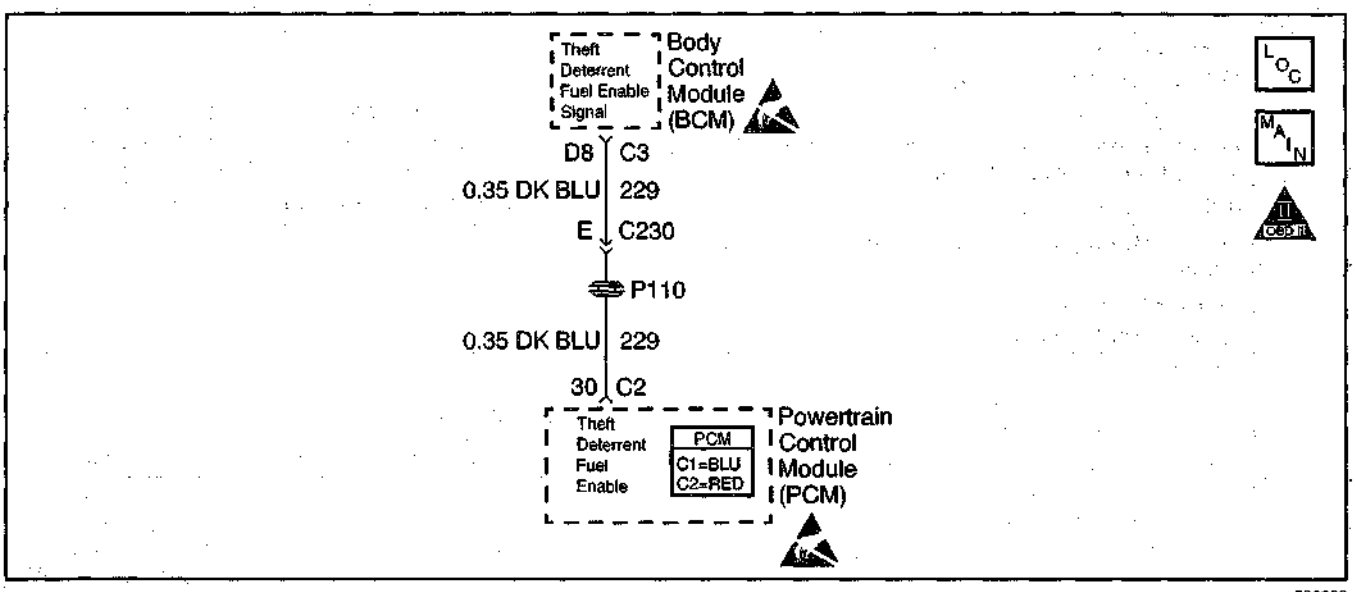
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DTC P1546 Air Conditioning (A/C) Clutch Feedback Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
9	Repair the open ignition feed circuit to A/C relay. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
10	Repair the open in A/C status circuit from A/C relay to splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 12*	—
11	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming* Replace the PCM. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this failed?	—	*Go to Step 2*	*Go to Step 13*
13	Select the Capture Info option and the Review Info option using the scan tool. Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1626 Theft Deterrent Fuel Enable Signal Lost



Circuit Description

The Vehicle Theft Deterrent system consists of the following components:

- Powertrain Control Module (PCM)
- Body Control Module (BCM)
- Ignition Lock and Key

The Vehicle Theft Deterrent system is designed to disable vehicle operation if the incorrect key or starting procedure is used. The Body Control Module (BCM) enables the crank circuit to the starter and sends a signal to the PCM if the correct key is being used. If the proper signal does not reach the PCM on the fuel enable circuit, the PCM will not pulse the injectors ON and thus not allow the vehicle to continue to operate, even if the crank circuit is bypassed. The proper signal is between 40–60 Hz and is measured using the DMM set to the DC scale.

If a condition with the circuit occurs after the engine is started and running the PCM will not disable the fuel injectors. The PCM will continue to enable the fuel injectors because a correct signal from the BCM was received by the PCM on startup.

Conditions for Running the DTC

The Engine is in the run or start position.

Conditions for Setting the DTC

- The PCM does not receive the 40–60 Hz signal from the Body Control Module
- Condition present for less than 1 second

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.
- The engine starts and then stalls or the starter does not engage.
- If a condition with the circuit occurs after the engine is started and running the engine will start on the next ignition cycle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Inspect the GAGE fuse for an open. An open GAGE fuse causes DTC P1626 to set and the starter does not operate. Refer to *Testing for Short to Ground* in Wiring Systems.

If the engine starts and then stalls, the Body Control Module is not suppling the appropriate signal or the theft deterrent fuel enable circuit is open, shorted to a ground, or shorted to a voltage.

For an intermittent condition, refer to *Symptoms*.

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Test Description

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

2. An engine that does not crank and a DTC P1626 is set, indicates that there is a theft deterrent system condition. An incorrect ignition key or an incorrect starting procedure causes a no crank condition.
3. An engine that does not crank indicates there is a condition with the Body Control Module.
4. This step determines if the Powertrain Control Module is capable of sending a 5 volt signal to the BCM.
5. This step determines if the Body Control Module is capable of sending a signal to the PCM. The Body Control Module sends the PCM a 40–60 Hz signal.
6. This step determines if the condition is intermittent. If the engine starts and continues to operate, you may have corrected the condition during diagnoses. Inspect all connections at the BCM and the PCM.

DTC P1626 Theft Deterrent Fuel Enable Signal Lost

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	1. Turn ON the ignition leaving the engine OFF. 2. Use a scan tool to clear DTCs. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate that this diagnostic failed this ignition?	—	*Go to Step 3*	Go to Diagnostic Aids
3	Does the engine crank?	—	*Go to Step 4*	Go to *A Diagnostic System Check - Theft Deterrent* in Theft Deterrent
4	1. Turn OFF the ignition. 2. Disconnect the BCM connector. Refer to *Body Control Module Replacement* in Body Control Systems. 3. Turn ON the ignition leaving the engine OFF. 4. Measure the voltage at the fuel enable circuit at the BCM harness connector using the DMM. Is the voltage near the specified voltage?	5 volts	*Go to Step 5*	*Go to Step 7*
5	1. Turn OFF the Ignition. 2. Reconnect the BCM. 3. Turn ON the Ignition leaving the engine OFF. 4. Select the DC volts and the Hertz (Hz) scale using the DMM. 5. Backprobe one lead of the DMM to the theft deterrent fuel enable circuit at the BCM harness connector and the other lead to ground using the DMM. Is the hertz signal within the specified range?	40–61 Hz	*Go to Step 6*	*Go to Step 8*
6	1. Capture Info using the scan tool. 2. Clear the DTCs. 3. Attempt to start the engine. Does the engine start and continue to operate?	—	Go to Diagnostic Aids	*Go to Step 9*

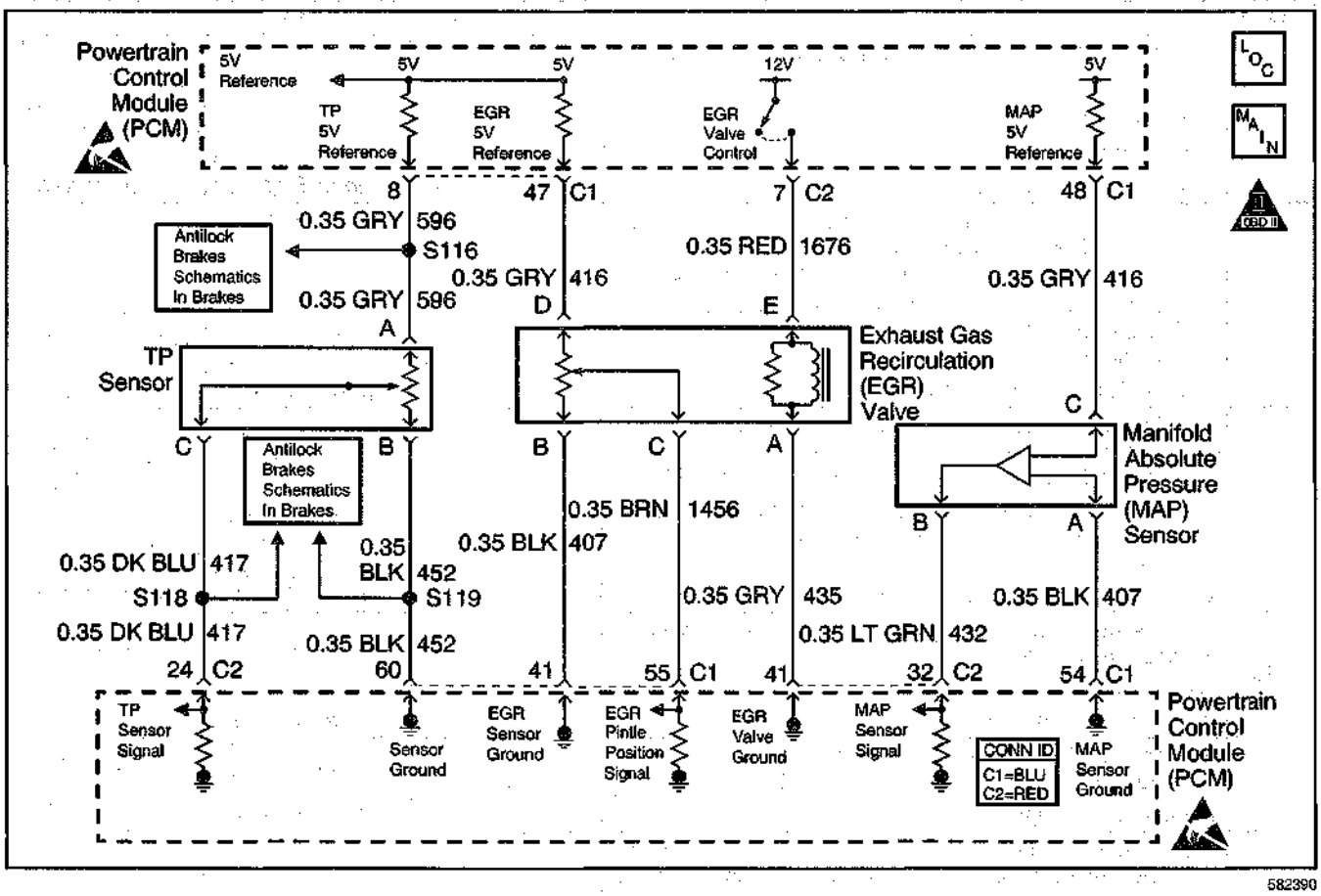
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DTC P1626 Theft Deterrent Fuel Enable Signal Lost (cont'd)

Step	Action	Value(s)	Yes	No
7	Test the theft deterrent fuel enable circuit for the following: • An open • A short to ground • A short to B+ Did you find and correct the condition?	—	*Go to Step 12*	*Go to Step 9*
8	1. Inspect the terminal tension for the fuel enable circuit at the BCM harness connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the terminal as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 12*	*Go to Step 11*
9	1. Inspect the terminal tension for the fuel enable circuit at the PCM harness connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the terminal as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 12*	*Go to Step 10*
10	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 12*	—
11	Replace the Body Control Module. Refer to *Body Control Module Replacement* in Body Control Systems. Is the action complete?	—	*Go to Step 12*	—
12	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
13	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1635 5 Volt Reference 1 Circuit



Circuit Description

The PCM uses a common 5.0 volt reference 1 circuit as a sensor feed. This circuit supplies 5 volts to the following sensors:

- The TP sensor
- The MAP sensor
- The EGR valve

The PCM monitors the voltage on the 5.0 volt reference 1 circuit. This DTC sets if the voltage is out of range.

Conditions for Running the DTC

The ignition switch is in the RUN position.

Conditions for Setting the DTC

- The 5.0 volt reference circuit is out of range.
- All above conditions are present for more than 2 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

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Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The 5 volt reference circuits for the sensors are connected together inside the PCM. Both DTCs P1635 and P1639 set at the same time, indicates a 5 voltreference circuit is shorted to a voltage.
3. The 5 volt reference circuits for the sensors are connected together inside the PCM. When only P1635 is set, this indicates a short to ground on one of the 5 volt reference circuits.
4. This step isolates the 5 volt reference circuit from the sensor signal circuit.
5. This step determines if the 5 volt reference circuits or the fuel level sensor signal circuit are only shorted when the fuel pump is enabled. You may have to enable the fuel pump a couple of times to see if the voltages increase. Inspect the fuel pump harness thoroughly for being shorted to the fuel tank pressure sensor and/or the fuel level sensor.
6. The Data list can be changed while in output controls. Select the MORE soft key to select the next Data list. This procedure is necessary to view all parameters. Refer to scan tool users guide for detailed information.
8. The 5 volt reference circuits may be shorted to another PCM circuit. The shorted circuit may not be apparent when the PCM harness connector is disconnected. Testing continuity from each 5 volt reference circuit isolates the shorted circuit. For detailed circuit information, refer to appropriate full page schematics.
9. For detailed circuit information, refer to appropriate full page schematics.
15. This step is testing for a component failure. Disconnecting each component individually isolates which component might be causing this DTC to set.

DTC P1635 5 Volt Reference 1 Circuit

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	1. Install a scan tool. 2. Start the engine. 3. Idle the engine for 2 minutes. 4. Monitor the DTCs using a scan tool. Did both DTCs P1635 and P1639 fail this ignition?	—	*Go to Step 5*	*Go to Step 3*
3	Did DTC P1635 fail this ignition?	—	*Go to Step 9*	*Go to Step 4*
4	**Important:** If DTCs P1635 and P1639 set go to step 5. If only DTC P1635 sets go to step 9. 1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option. Does the scan tool indicate that DTC P1635 or P1635 and P1639 set this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids

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DTC P1635 5 Volt Reference 1 Circuit (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Start and idle the engine. 2. Monitor the voltages for the following sensors using a scan tool: • The Fuel Level sensor • The Fuel Tank Pressure sensor • The EGR Pintle Position sensor • The TP sensor • The MAP sensor • The A/C refrigerant pressure sensor Does the scan tool display any of the voltages at or above the specified value?	5V	*Go to Step 18*	*Go to Step 6*
6	1. Turn OFF the engine leaving the ignition ON. 2. Monitor the following voltages using a scan tool: • MAP sensor • TP sensor • EGR position sensor • Fuel Tank Pressure sensor • Fuel Level sensor • The A/C refrigerant pressure sensor 3. Enable the fuel pump using the scan tool. Do any of the voltages increase when the fuel pump was turned ON?	—	*Go to Step 11*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Disconnect the PCM harness connectors. Refer to *PCM Replacement/Programming*. 3. Turn ON the ignition leaving the engine OFF. 4. Connect the DMM to ground. 5. Probe the other lead of the DMM to each 5 volt reference circuit at the PCM harness connector for the following components: • The MAP sensor • The EGR valve • The Fuel Tank Pressure sensor • The TP sensor • The A/C refrigerant pressure sensor Do any of the circuits measure greater than the specified value?	5.1V	*Go to Step 12*	*Go to Step 8*

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DTC P1635 5 Volt Reference 1 Circuit (cont'd)

Step	Action	Value(s)	Yes	No
8	**Important:** Before proceeding remove the following fuses: • PCM Ignition • PCM Battery 1. Disconnect the following component electrical connectors: • The MAP sensor • The TP sensor • The EGR valve • The Fuel Level sensor • The Fuel Tank Pressure sensor • The A/C refrigerant pressure sensor 2. Test continuity from each 5 volt reference circuit to all other PCM circuits at the PCM harness connectors using the DMM. Example: probe one lead to the MAP sensor 5 volt reference (at the PCM harness connector) circuit and probe the other lead to each terminal at the PCM harness connector. This must be performed for each 5 volt reference circuit. Refer to *Testing for Continuity* in Wiring Systems. Do any of the circuits indicate a resistance within the specified range?	0–2Ω	*Go to Step 13*	*Go to Step 15*
9	1. Turn OFF the ignition. 2. Disconnect the PCM connectors. Refer to *PCM Replacement/Programming.* 3. Connect the *J 34142-B* test lamp to B+. 4. Probe the *J 34142-B* test lamp to the PCM connector 5 volt reference circuits for the following components: • The MAP sensor • The EGR valve • The Throttle Position sensor Does the test lamp illuminate for any of the circuits?	—	*Go to Step 14*	*Go to Step 10*
10	Test continuity from each 5 volt reference circuit to all other PCM circuits at the PCM harness connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. This must be performed for each 5 volt reference circuit. Do any of the circuits indicate a resistance within the specified range?	0–2Ω	*Go to Step 13*	*Go to Step 15*
11	Repair the short between the fuel pump circuit and the appropriate 5 volt reference circuit or signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—
12	Repair the short to voltage on the appropriate 5 volt reference circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—
13	Repair the short between the appropriate 5 volt reference circuit and the PCM circuit that had continuity. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—
14	Repair the short to ground on the appropriate 5 volt reference circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—

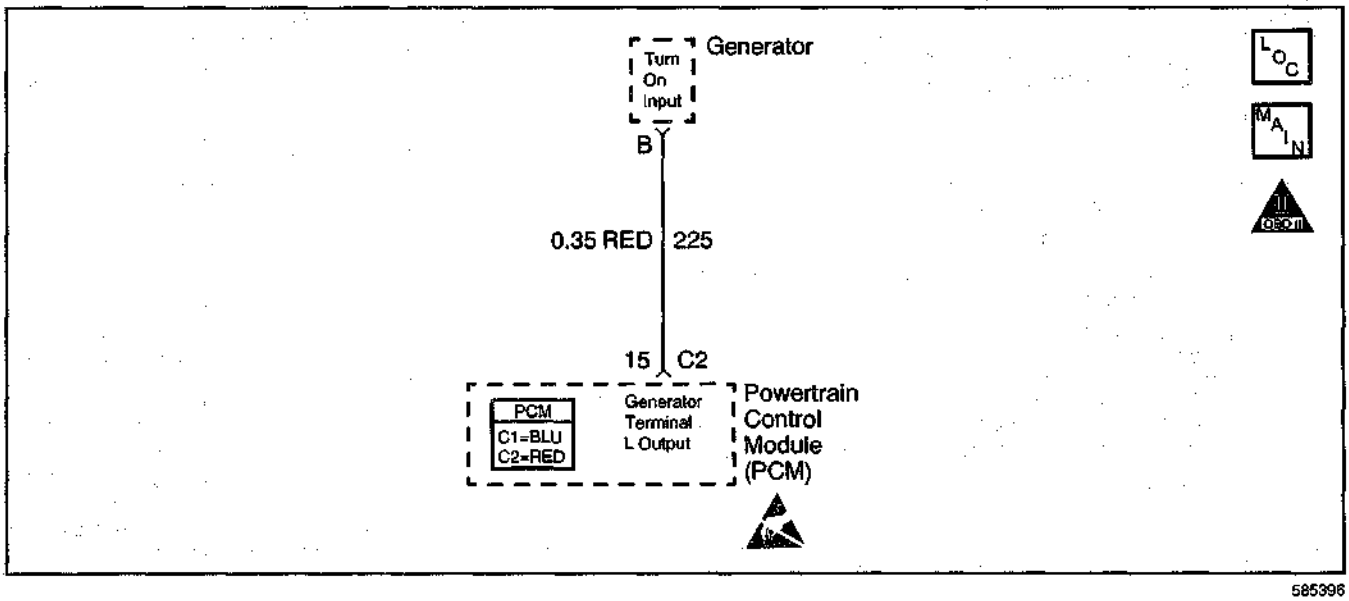
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DTC P1635 5 Volt Reference 1 Circuit (cont'd)

Step	Action	Value(s)	Yes	No
15	**Important:** Repeat this procedure for each component. 1. Reconnect the PCM harness connectors. 2. Clear the Diagnostic Trouble Codes using a scan tool. 3. Disconnect the following components (one at a time): • The MAP sensor • The TP sensor • The EGR valve • The Fuel Level sensor • The Fuel Tank Pressure sensor • The A/C refrigerant pressure sensor 4. Start and idle the engine. 5. Monitor the Diagnostic Trouble Codes using a scan tool. Does the scan tool indicate that DTC P1635/P1639 passed with the component disconnected?	—	*Go to Step 16*	*Go to Step 17*
16	Replace the component for which the Diagnostic Trouble Code passed. Refer to the appropriate replacement procedure. Is the action complete?	—	*Go to Step 19*	—
17	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 19*	—
18	Repair the short to voltage on the appropriate signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 19*	—
19	1. Select the Diagnostic Trouble Codes (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option using a scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 20*	*Go to Step 2*
20	Select the Capture Info option and the Review Info option using the scan tool. Are any DTCs displayed that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1637 Generator L-Terminal Circuit



585396

Circuit Description

The L-terminal circuit from the generator is a discrete circuit (a discrete circuit has no splices and only one source and one destination) into the PCM. The PCM applies ignition voltage to the generator L terminal circuit. A small amount of current flows from this circuit through the generator windings to create a magnetic field which starts the generator process. When the generator is at operating speed and producing voltage, a solid state switch for the L terminal circuit in the generator opens and the PCM detects that the initial startup current flow has stopped.

The PCM expects to detect low voltage on the L terminal circuit prior to the generator rotating at operating speed and conversely expects the circuit to be at ignition voltage potential when the generator is operational. When the PCM detects a fault (circuit shorted to ground, or circuit shorted to a voltage), this DTC will set.

Conditions for Running the DTC

Engine operating.

Conditions for Setting the DTC

The PCM detects an improper voltage on the generator L terminal circuit.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM stores this information in the Failure Records.

Conditions for Clearing the MIL/DTC

- A History DTC will clear after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- A last test failed (Current DTC) will clear when the diagnostic runs and does not fail.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

A generator fault, such as a shorted output diode, malfunctioning regulator, open or shorted rotor, or open sense lead may cause a low battery charge. Refer to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical for further information and generator diagnosis.

Use a scan tool in order to diagnosis the generator circuits. A scan tool displays Generator L-Terminal Inactive when there is a concern with the L-terminal circuit.

For an intermittent condition, refer to *Symptoms*.

Test Description

The numbers below refer to the step numbers on the Diagnostic Table.

2. This step determines if a fault is present.
12. A poor connection at the generator causes no output.

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DTC P1637 Generator L-Terminal Circuit

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	1. Start and idle the engine. 2. Install a scan tool. 3. Monitor the Generator L terminal parameter using a scan tool. Does the scan tool display the Generator L terminal as Inactive?	—	*Go to Step 3*	Go to Diagnostic Aids
3	Probe the Generator battery feed circuit using the *J 34142-B* test lamp connected to ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 4*	Go to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical
4	1. Disconnect the electrical connector from the generator. 2. Start the engine. 3. Measure the voltage to ground at the generator harness connector terminal B using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Is the voltage the same or more than the value specified?	10V	*Go to Step 11*	*Go to Step 5*
5	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2. Refer to *PCM Replacement/Programming.* 3. Test for continuity from the generator circuit at the PCM harness connector to the B terminal of the generator harness connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 6*	*Go to Step 8*
6	Test for continuity from terminal B at the generator harness connector to battery ground using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 9*
7	Repair the short to ground in the generator circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 13*	—
8	Repair the open/high resistance in the generator circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 13*	—
9	1. Inspect for poor connections at the PCM harness connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the condition as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 10*
10	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 13*	—

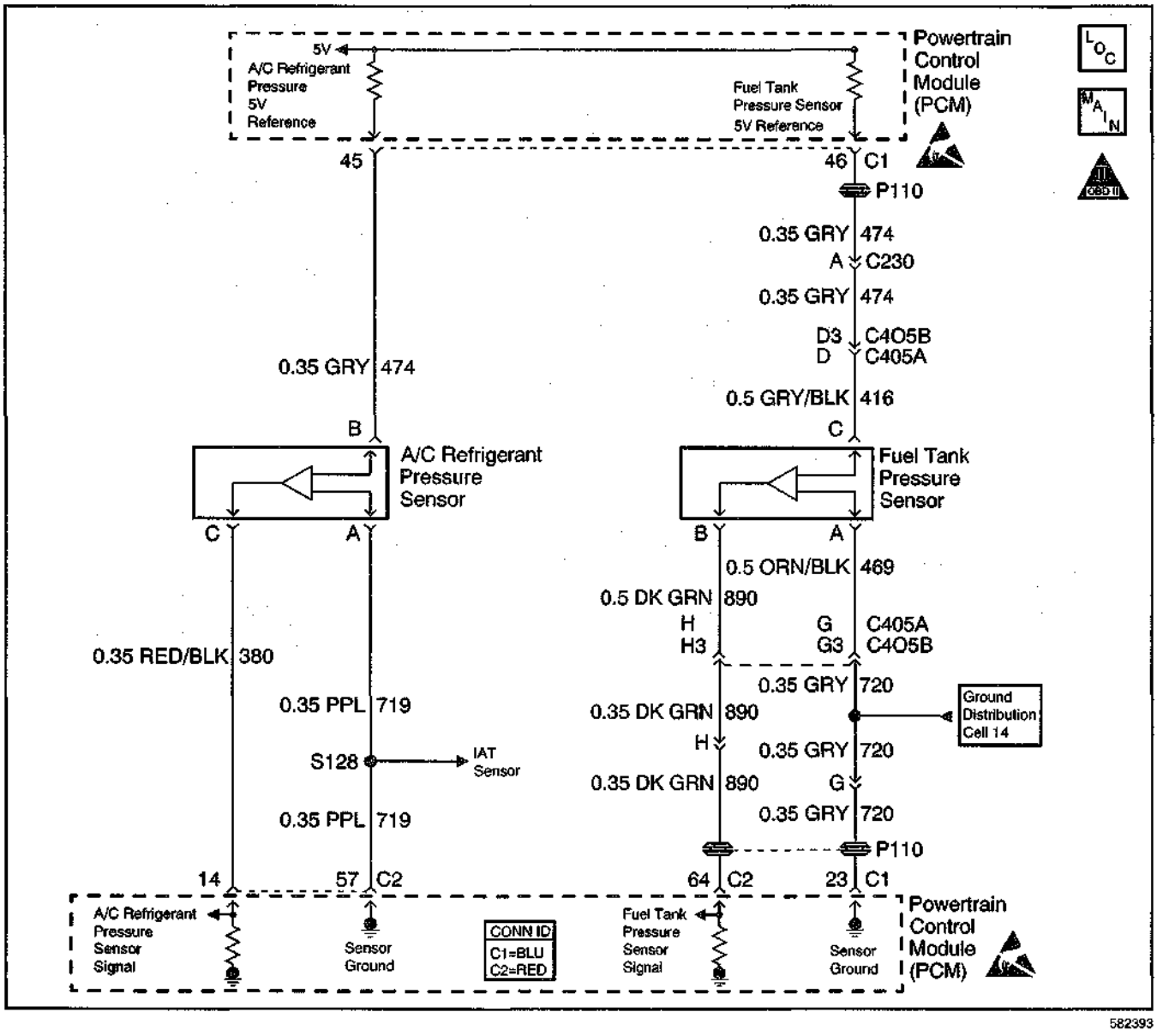
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DTC P1637 Generator L-Terminal Circuit (cont'd)

Step	Action	Value(s)	Yes	No
11	1. Inspect for poor connections at the generator electrical connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the connection as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 13*	*Go to Step 12*
12	Replace the generator. Refer to *Generator Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	*Go to Step 13*	—
13	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Diagnostic Trouble Code (DTC) option and the Specific DTC option, then enter the DTC number using the scan tool. 4. Operate the vehicle within the conditions for running this DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 14*	*Go to Step 2*
14	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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DTC P1639 5 Volt Reference 2 Circuit



582393

Circuit Description

The PCM uses a common 5.0 volt reference circuit as a sensor feed to the Fuel Tank Pressure sensor and the A/C Refrigerant Pressure sensor.

The PCM monitors the voltage on the 5.0 volt reference circuit. This DTC sets if the voltage is out of range.

Conditions for Running the DTC

The engine operating.

Conditions for Setting the DTC

- The 5.0 volt reference circuit is out of range.
- The above condition is present for more than 2 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

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Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

A fuel level sensor signal circuit that is shorted to B+ may set this DTC.

If no circuit conditions can be found, test the affected component.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

2. The 5 volt reference circuits for the sensors are connected together inside the PCM. Both DTCs P1635 and P1639 set at the same time, indicates a 5 volt reference circuit is shorted to a voltage.
5. This step determines if a 5 volt reference circuit is shorted to ground.
6. This step tests for a signal circuit shorted to voltage.
7. The 5 volt reference circuits may be shorted to another PCM circuit. The shorted circuit may not be apparent when the PCM harness connector is disconnected. Testing continuity from each 5 volt reference circuit isolates the shorted circuit.
11. This step is testing for a component failure. Disconnecting each component individually isolates which component might be causing this DTC to set.

DTC P1639 5 Volt Reference 2 Circuit

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	1. Install a scan tool. 2. Start the engine. 3. Idle the engine for 2 minutes. 4. Monitor the DTCs using a scan tool. Did both DTCs P1635 and P1639 fail this ignition?	—	Go to *DTC P1635 5 Volt Reference 1 Circuit*	*Go to Step 3*
3	Did DTC P1639 fail this ignition?	—	*Go to Step 5*	*Go to Step 4*
4	1. Turn ON the ignition leaving the engine OFF. 2. Review the Freeze Frame and/or Failure Records data for this DTC and observe the parameters. 3. Turn OFF the ignition for 15 seconds. 4. Start the engine. 5. Operate the vehicle within the conditions required for this diagnostic to run, and as close to the conditions recorded in Freeze Frame/Failure 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. 6. Select the Diagnostic Trouble Code (DTC) option, the Specific DTC option, then enter the DTC number using the scan tool. Does the scan tool indicate the DTC set this ignition?	—	*Go to Step 5*	Go to Diagnostic Aids

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DTC P1639 5 Volt Reference 2 Circuit (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the PCM connectors. Refer to *PCM Replacement/Programming.* 3. Connect the *J 34142-B* test lamp to B+. 4. Probe the PCM connector 5 volt reference circuits for the following components: • The A/C Refrigerant Pressure sensor • The Fuel Tank Pressure sensor. Does the test lamp illuminate for any of the circuits?	—	*Go to Step 8*	*Go to Step 6*
6	1. Turn ON the ignition leaving the engine OFF. 2. Connect the *J 34142-B* test lamp to battery ground. 3. Probe the PCM connector signal circuits for the following components: • The A/C Refrigerant Pressure sensor • The Fuel Tank Pressure sensor. Does the test lamp illuminate for any of the circuits?	—	*Go to Step 9*	*Go to Step 7*
7	Test continuity from each 5 volt reference circuit to all other PCM circuits at the PCM harness connector using the DMM. Example: probe one lead to the A/C refrigerant pressure sensor 5 volt reference (at the PCM harness connector) circuit and probe the other lead to each terminal at the PCM harness connector. This must be performed for each 5 volt reference circuit. Refer to *Testing for Continuity* in Wiring Systems. Do any of the circuits indicate a resistance within the specified range?	0–2Ω	*Go to Step 10*	*Go to Step 11*
8	Repair the short to ground on the appropriate 5 volt reference circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
9	Repair the short to voltage on the appropriate signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
10	Repair the short between the appropriate 5 volt reference circuit and the PCM circuit that had continuity. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 14*	—
11	**Important:** Repeat this procedure for each component. 1. Reconnect the PCM harness connectors. 2. Clear the Diagnostic Trouble Codes using a scan tool. 3. Disconnect the following components (one at a time): • The MAP sensor • The TP sensor • The EGR valve • The Fuel Level sensor • The Fuel Tank Pressure sensor • The A/C refrigerant pressure sensor 4. Start and idle the engine. 5. Monitor the Diagnostic Trouble Codes using a scan tool. Does the scan tool indicate that DTC P1635/P1639 passed with the component disconnected?	—	*Go to Step 12*	*Go to Step 13*

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DTC P1639 5 Volt Reference 2 Circuit (cont'd)

Step	Action	Value(s)	Yes	No
12	Replace the component for which the Diagnostic Trouble Code passed. Refer to the appropriate replacement procedure. Is the action complete?	—	*Go to Step 14*	—
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming*. Replace the PCM. Is the action complete?	—	*Go to Step 14*	—
14	1. Select the Diagnostic Trouble Codes (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Specific DTC option under the Diagnostic Trouble Code (DTC) option using a scan tool. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text if applicable. Does the scan tool indicate that this test ran and passed?	—	*Go to Step 13*	*Go to Step 2*
15	Select the Capture Info option and the Review Info option using the scan tool. Are any DTCs displayed that you have not diagnosed?	—	Go to the applicable DTC table	System OK

Symptoms

Important Preliminary Checks Before Starting

Perform *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 132°C (270°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 fuel off to four cylinders at a time to keep engine temperatures from reaching damaging levels. The customer perceives Engine Coolant Over temperature-Fuel Disabled Mode as a lack of power, miss, or rough idle. If the engine operates in Engine Coolant Over temperature-Fuel Disabled Mode, refer to *Engine Overheating* in Engine Cooling.
- The scan tool data is within the normal operating range.
- Verify the customers concern, and locate the correct symptom in the table of contents. Inspect the items indicated under that symptom.
- Several of the symptom procedures ask for a thorough Visual/Physical inspection. This step is extremely important – it can lead to correcting a condition without further inspections and can save valuable time.
- If the condition exists as a start and stall, search for DTCs related to the vehicle theft deterrent system. Inspect for improper installation of electrical options such as lights, cellular phones etc.
- Use the following tables when diagnosing a symptom concern.
- If you cannot isolate the condition with the appropriate table, refer to *Intermittent Conditions* for further diagnosis.
  - *Intermittent Conditions*
  - *Hard Start*
  - *Surges/Chuggles*
  - *Lack of Power, Sluggishness, or Sponginess*
  - *Detonation/Spark Knock*
  - *Hesitation, Sag, Stumble*
  - *Cuts Out, Misses*
  - *Poor Fuel Economy*
  - *Poor Fuel Fill Quality*
  - *Rough, Unstable, or Incorrect Idle and Stalling*
  - *Dieseling, Run-On*
  - *Backfire*

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Intermittent Conditions

Inspections	Action
Definition: The condition is not currently present but is indicated in DTC History. OR There is a customer concern, but the symptom can not currently be duplicated (if the condition is not DTC related).	
Visual/Physical Inspection	This step is an important aid for locating a condition without extensive testing. Perform a visual/physical inspection of the following items: • Wiring harness for damage or cuts. • A misrouted harness that is too close to high voltage/high current devices such as secondary ignition components, motors and generators. These components may induce electrical noise on a circuit that could interfere with normal circuit operation. • Vacuum hoses for proper routing, connections, splits or kinks. • Verify the Mass Air Flow (MAF) sensor is installed correctly. The arrows on the housing should point toward the engine. • Air leaks at the throttle body mounting area, MAF, and the intake manifold sealing surfaces. • PCM and body grounds for being clean and tight. • Battery connections are clean and tight. • Charging System for proper operation. Refer to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical.
Harness/Connector Inspection	• Many intermittent conditions occur with harness/connector movement caused by vibration, engine torque, rough pavement or component operation. Refer to *Testing for Electrical Intermittents* in Wiring Systems. • Excessive circuit resistance can cause a component to be inoperative. If the suspect component does not respond to scan tool commands, then inspect all related circuits for excessive resistance. Refer to *Testing for Continuity* in Wiring Systems.
Duplicating Failure Conditions	Freeze Frame/Failure Records data (where applicable) can be used to duplicate the conditions under which a DTC sets. 1. Review and record Freeze Frame/Failure Records data 2. Clear DTCs using the scan tool. 3. Turn Off the ignition for 30 seconds. 4. Operate the engine as close to the conditions that were noted in Freeze Frame/Failure Records. The engine must also be operating within the conditions for running the DTC, refer to Conditions for Running the DTC. 5. Monitor the DTC Status for the DTC being tested. The scan tool will indicate Ran, when the enabling conditions have been met. The scan tool will also indicate whether the DTC passed or failed. • The *J 42598* Vehicle Data recorder allows the customer, or the technician, to drive the vehicle and capture data as the intermittent condition occurs. Pressing a button on the Vehicle Data Recorder, while the intermittent condition is present, records PCM data which can be used to isolate the condition. • An alternate method is to drive the vehicle with the DMM *J 39200* connected to the suspected circuit. An abnormal reading on the DMM when the condition occurs, may help you locate the condition. • Compare the Freeze Frame/Failure Records with the typical values in the Scan Tool Data List.
Scan Tool Snapshot	The scan tool can be set up to take a 'snapshot' of the parameters available via serial data. The Snapshot function records live data over a period of time. The recorded data can be played back and analyzed. The scan tool can also graph parameters individually or in combinations of parameters for comparison. The snapshot can be triggered manually at the time the symptom is noticed, or set up in advance to trigger when a DTC sets. An abnormal value captured in the recorded data may point to a system or component that needs further investigation. Refer to the scan tool user instructions for more information on the Snapshot function.

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Intermittent Conditions (cont'd)

Inspections	Action
Intermittent Malfunction Indicator Lamp (MIL) with NO DTCs	The following conditions may cause an intermittent MIL and no DTCs: • Electrical system interference caused by a malfunctioning relay, PCM controlled solenoid or switch. • Improper installation of non-factory (aftermarket) add on accessories such as cellular phones, alarms, lights, or radio equipment. • The Malfunction Indicator Lamp (MIL) circuit intermittently shorted to ground. • Poor PCM grounds.
Additional Inspections	Test for an open diode across the A/C compressor clutch and for other open diodes. Inspect for improper installation of non-factory (aftermarket) add on accessories such as cellular phones, alarms, lights, or radio equipment. Excessive circuit resistance can cause a component to be inoperative. If the suspect component does not respond to scan tool commands, then inspect all related circuits for excessive resistance. Refer to *Testing for Continuity* in Wiring Systems. Test the generator for a bad rectifier bridge that may induce AC electrical noise to the electrical system. Refer to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical.

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 Important Preliminary Checks Before Starting in *Symptoms.* • Inspect the PCM grounds for being clean, tight and in the proper locations. Refer to *Engine Controls Schematics.* • Search for bulletins.
Sensor/System	• Test the Engine Coolant Temperature (ECT) sensor for being shifted in value. Connect a scan tool. Compare the Engine Coolant Temperature against the Intake Air Temperature (IAT) on a cold engine. The ECT and IAT sensor values should be within ± 3°C (5°F) of each other. If the ECT sensor is out of range with the IAT sensor, test the resistance of the ECT sensor. Refer to *Temperature vs Resistance* for resistance specifications. Replace the ECT sensor if the resistance is not within the specification. If the sensor is within the specification, repair ECT signal circuit for high resistance. • Inspect the Mass Air Flow sensor installation. A MAF sensor that is incorrectly installed may cause a hard start. Important: The embossed arrows on the MAF sensor indicate the direction of the intake air flow. The arrows must point toward the engine. Install the MAF in the proper direction. Refer to *MAF Sensor Replacement.* • The Camshaft Position Sensor (CMP) may cause a long engine crank time if the PCM does not receive a CMP signal. • Test the exhaust system for a restriction. Refer to *Restricted Exhaust.*
Fuel System	• Test the fuel pump relay operation. The fuel pump should turn ON for 2 seconds when you turn on the ignition. Refer to *Fuel Pump Electrical Circuit Diagnosis.* • A faulty in-tank fuel pump check valve allows the fuel in the lines to drain back to the tank after the engine stops. To test for this condition, refer to *Fuel System Diagnosis.* • Inspect both injector fuses for being open. An open injector fuse causes four injectors and four ignition coils not to operate. Replace the fuse. Inspect the injector circuits and the ignition coil circuits for an intermittent short to ground. • Test for incorrect fuel pressure. Refer to *Fuel System Diagnosis.* • Test for a restricted fuel filter. Refer to *Fuel System Diagnosis.* • Test for a contaminated fuel condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.*

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Hard Start (cont'd)

Checks	Action
Ignition System	• Inspect both injector fuses for being open. An open injector fuse causes four ignition coils and four injectors not to operate. Replace the fuse. Inspect the ignition coil circuits and the injector circuits for an intermittent short to ground. • Inspect for proper ignition voltage output with spark tester *J 26792*. Refer to *Electronic Ignition (EI) System Diagnosis*. • Remove the spark plugs and inspect for the following: – Correct heat range; refer to *Spark Plug Usage* in Engine Electrical. – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits Refer to *Spark Plug Visual Diagnosis* in Engine Electrical. • Determine the cause of the fouling before replacing the spark plugs. If the spark plugs are gas fouled, refer to *DTC P0172 Fuel Trim System Rich Bank 1* or *DTC P0175 Fuel Trim System Rich Bank 2*. If the spark plugs are coolant or oil fouled, refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L or *Loss of Coolant* in Engine Cooling. • Inspect for bare or shorted ignition wires. Refer to *Spark Plug Wire Resistance* in Engine Electrical. • Inspect for loose ignition coil grounds. Refer to *Electronic Ignition (EI) System Diagnosis*.
Engine Mechanical	• Excessive oil in combustion chamber-Leaking valve seals. Refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L. • Test for low cylinder compression. Refer to *Engine Compression Test* in Engine Mechanical-5.7L. • Combustion chambers for excessive carbon buildup. Clean the chambers using top engine cleaner. Follow the instructions on the can. • For incorrect basic engine parts. Inspect the following: – Cylinder heads – Camshaft – Pistons, etc. Refer to Engine Mechanical-5.7L.

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 position.	
Preliminary	• Refer to Important Preliminary Checks Before Starting in *Symptoms*. • Search for bulletins. • Inspect the PCM grounds for being clean, tight and in the proper locations. Refer to *Engine Controls Schematics*. • Be sure the driver understands the operation of the Transmission Torque Converter Clutch (TCC) and A/C compressor operation as explained in the owners manual. Inform the customer how the TCC and the A/C clutch operates.
Sensor/System	• Monitor the Heated Oxygen Sensors (HO2S) voltages. The Heated Oxygen Sensors (HO2S) should respond quickly to different throttle positions. If the sensors do not respond, inspect the HO2S for silicon or other contaminates from fuel or the use of improper RTV sealant. The sensors may have a white powdery coating and result in a high but false signal voltage (rich exhaust indication). The PCM then reduces the amount of fuel delivered to the engine causing a severe driveability condition. For more information, Refer to *Information Sensors/Switches Description*. • Inspect the MAF sensor connections. Repair or replace terminals. Refer to *Repairing Connector Terminals* in Wiring Systems.

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Surges/Chuggles (cont'd)

Checks	Action
Fuel System	• Test for incorrect fuel pressure. Refer to *Fuel System Diagnosis*. • Test for a restricted fuel filter. Refer to *Fuel System Diagnosis*. • Test for a contaminated fuel condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. • Inspect that each injector harness is connected to the correct injector/cylinder according to the firing order (firing order: 1–8–7–2–6–5–4–3). Relocate injector harnesses as necessary. • Inspect the items that cause an engine to run rich (long term fuel trim near –13%). For a rich condition, refer to *DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1* and *DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1*. • Inspect items that can cause an engine to run lean (long term fuel trim near 24%). For a lean condition, refer to *DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1* and *DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1*.
Ignition System	• Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as you apply the water. • Test for proper ignition voltage output with spark tester *J 26792*. Refer to *Electronic Ignition (EI) System Diagnosis*. • Remove the spark plugs and inspect for the following: – Correct heat range; refer to *Spark Plug Usage* in Engine Electrical. – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits Refer to *Spark Plug Visual Diagnosis* in Engine Electrical. • An improper spark plug gap causes a driveability condition. Gap the spark plugs using a wire gauge gap tool (J 41319). Refer to *Spark Plug Replacement* in Engine Electrical. • Determine the cause of the fouling before replacing the spark plugs. If the spark plugs are gas fouled, refer to *DTC P0172 Fuel Trim System Rich Bank 1* or *DTC P0175 Fuel Trim System Rich Bank 2*. If the spark plugs are coolant or oil fouled, refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L or *Loss of Coolant* in Engine Cooling. • Inspect for loose ignition coil grounds. Refer to *Electronic Ignition (EI) System Diagnosis*.
Engine Mechanical	Ensure that the engine coolant temperature is not above 132°C (270°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 fuel off to four cylinders at a time to keep engine temperatures from reaching damaging levels. The customer perceives Engine Coolant Over temperature-Fuel Disabled Mode as a lack of power, miss, or rough idle. If the engine operates in Engine Coolant Over temperature-Fuel Disabled Mode, refer to *Engine Overheating* in Engine Cooling.
Additional Checks	• Visually/physically inspect vacuum hoses for splits, kinks, and proper connections and routing as shown on Vehicle Emission Control Information label. Refer to *Emission Hose Routing Diagram*. • Test the Transmission Torque Converter Clutch (TCC) operation. A TCC applying too soon can cause the engine to spark knock. Refer to *A Diagnostic Starting Point - Automatic Transmission* in Automatic Transmission–4L60-E.

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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 Important Preliminary Checks Before Starting in *Symptoms*. • Search for bulletins. • Inspect the PCM grounds for being clean, tight and in the proper locations. Refer to *Engine Controls Schematics*. • Remove the air filter element and inspect for dirt or for being restricted. Refer to *Air Cleaner Element Replacement* and replace as necessary.
Fuel System Checks	• Inspect both injector fuses for being open. An open injector fuse causes four ignition coils and four injectors not to operate. Replace the fuse. Inspect the ignition coil circuits and the injector circuits for an intermittent short to ground. • Test for incorrect fuel pressure. Refer to *Fuel System Diagnosis*. • Test for a restricted fuel filter. Refer to *Fuel System Diagnosis*. • Test for a contaminated fuel condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. • Inspect items that cause an engine to run rich (long term fuel trim near –13%). For a rich condition, refer to *DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1* and *DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1*. • Inspect items that can cause an engine to run lean (long term fuel trim near 24%). For a Lean condition, refer to *DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1* and *DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1*.
Sensor/System	Use a scan tool in order to monitor the KS system for excessive spark retard activity. Refer to *Knock Sensor (KS) System Description*.
Ignition System	• Inspect both injector fuses for being open. An open injector fuse causes four ignition coils and four injectors not to operate. Replace the fuse. Inspect the ignition coil circuit and the injector circuits for an intermittent short to ground. • Wet down the secondary ignition system with water from a spray bottle. Wetting the secondary ignition system may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as water is applied. • Test for proper ignition voltage output with spark tester *J 26792*. Refer to *Electronic Ignition (EI) System Diagnosis*. • Remove the spark plugs and inspect for the following: – Correct heat range; refer to *Spark Plug Usage* in Engine Electrical. – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits Refer to *Spark Plug Visual Diagnosis* in Engine Electrical. • An improper spark plug gap causes a driveability condition. Gap the spark plugs using a wire gauge gap tool. Refer to *Spark Plug Wire Harness Replacement (5.7 L)* in Engine Electrical. • Determine the cause of the fouling before replacing the spark plugs. If the spark plugs are gas fouled, refer to *DTC P0172 Fuel Trim System Rich Bank 1* or *DTC P0175 Fuel Trim System Rich Bank 2*. If the spark plugs are coolant or oil fouled, refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L or *Loss of Coolant* in Engine Cooling. • Inspect for loose ignition coil grounds. Refer to *Electronic Ignition (EI) System Diagnosis*.

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Lack of Power, Sluggishness, or Sponginess (cont'd)

Checks	Action
Engine Mechanical	• Ensure that the engine coolant temperature is not above 132°C (270°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 fuel off to four cylinders at a time to keep engine temperatures from reaching damaging levels. The customer perceives Engine Coolant Over temperature-Fuel Disabled Mode as a lack of power, miss, or rough idle. If the engine operates in Engine Coolant Over temperature-Fuel Disabled Mode, refer to *Engine Overheating* in Engine Cooling. • Excessive oil in combustion chamber-Leaking valve seals. Refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L. • Low cylinder compression. Refer to *Engine Compression Test* in Engine Mechanical-5.7L. • For incorrect basic engine parts. Inspect the following: – Camshaft – Cylinder heads – Pistons, etc.
Additional Checks	• Inspect the exhaust system for possible restrictions. Inspect for the following: – Inspect the exhaust system for damaged or collapsed pipes. Refer to *Restricted Exhaust* in Engine Exhaust. – Inspect the exhaust manifold for a collapsed inner wall. Refer to *Exhaust Manifold Clean and Inspect* in Engine Mechanical-5.7L. – Inspect the mufflers for heat distress or possible internal failure. Refer to *Internal Muffler Rattles/Loss of Power* in Engine Exhaust. – Inspect for possible plugged Three-Way catalytic converters by comparing exhaust system back pressure on each side of engine. Test the back pressure by removing AIR check valves near exhaust manifolds or the Heated Oxygen sensors. Refer to *Restricted Exhaust* in Engine Exhaust. • Test the Transmission Torque Converter Clutch (TCC) operation. Refer to *A Diagnostic Starting Point - Automatic Transmission* in Automatic Transmission–4L60-E.

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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 Important Preliminary Checks Before Starting in *Symptoms*. • Search for bulletins. • Inspect the PCM grounds for being clean, tight, and in the proper locations. Refer to *Engine Controls Schematics*. • If the scan tool readings are normal (refer to supporting text of the Powertrain On-Board Diagnostic (OBD) System Check) and there are no engine mechanical faults, fill the fuel tank with a known high quality fuel that meets the vehicle's minimum octane requirements. Refer to *Fuel System Specifications*. Road test the vehicle and re-evaluate the vehicle's performance.
Fuel System	• Test for incorrect fuel pressure. Refer to *Fuel System Diagnosis*. • Test for a restricted fuel filter. Refer to *Fuel System Diagnosis*. • Test for a contaminated fuel condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. • Inspect the items that can cause an engine to run lean (long term fuel trim near 24%). For a lean condition, refer to *DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1* and *DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1*.
Ignition System	Inspect the spark plugs for the proper heat range. Refer to *Spark Plug Usage* in Engine Electrical.
Engine Cooling System	Inspect for obvious overheating conditions: • Low engine coolant. Refer to *Draining and Filling Cooling System (5.7 L)* and *Coolant Concentration Testing* in Engine Cooling for the type and amount of engine coolant to be used. • Restricted air flow to the radiator or restricted coolant flow through the radiator. Refer to *Radiator Cleaning* in Engine Cooling. • Inoperative electric cooling fan. Refer to *Electric Cooling Fan Diagnosis*.
Engine Mechanical	Inspect for the following engine mechanical conditions: • Excessive oil in combustion chamber-Leaking valve seals. Refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L. • Low cylinder compression. Refer to *Engine Compression Test* in Engine Mechanical-5.7L. • Combustion chambers for excessive carbon buildup. Clean the combustion chamber by using top engine cleaner. Follow the instructions on the can. • Inspect for incorrect basic engine parts. Inspect the following: – Camshaft – Cylinder heads – Pistons, etc. Refer to Engine Mechanical-5.7L.
Additional Checks	• Test the Park/Neutral Position (PNP) switch operation. Refer to *PNP Switch Diagnosis*. • Test the Transmission Torque Converter Clutch (TCC) operation. A TCC applying too soon can cause the engine to spark knock. Refer to *A Diagnostic Starting Point - Automatic Transmission* in Automatic Transmission–4L60-E.

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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. May cause the engine to stall if severe enough.	
Preliminary	• Refer to Important Preliminary Checks Before Starting in *Symptoms*. • Search for bulletins. • Inspect the PCM grounds for being clean, tight, and in the proper locations. Refer to *Engine Controls Schematics*.
Sensor/System	Test the MAP sensor operation.
Fuel System	• Test for incorrect fuel pressure. Refer to *Fuel System Diagnosis*. • Test for a restricted fuel filter. Refer to *Fuel System Diagnosis*. • Test for a contaminated fuel condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. • Inspect both injector fuses for being open. An open injector fuse causes four ignition coils and four injectors not to operate. Replace the fuse. Inspect the ignition coil circuits and the injector circuits for an intermittent short to ground. • Test the fuel injectors. Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)*. • Inspect the items that cause an engine to run rich (long term fuel trim near –13%). For a rich condition, refer to *DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1* and *DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1*. • Inspect the items that can cause an engine to run lean (long term fuel trim near 24%). For a lean condition, refer to *DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1* and *DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1*.
Ignition System	• Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as you apply water. • Test for proper ignition voltage output with spark tester *J 26792*. Refer to *Electronic Ignition (EI) System Diagnosis* for the procedure. • Remove the spark plugs and inspect for the following: – Correct heat range; refer to *Spark Plug Usage* in Engine Electrical. – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits Refer to *Spark Plug Visual Diagnosis* in Engine Electrical. • An improper spark plug gap causes a driveability condition. Gap the spark plugs using a wire gauge gap tool. Refer to *Spark Plug Replacement* in Engine Electrical. • Determine the cause of the fouling before replacing the spark plugs. If the spark plugs are gas fouled, refer to *DTC P0172 Fuel Trim System Rich Bank 1* or *DTC P0175 Fuel Trim System Rich Bank 2*. If the spark plugs are coolant or oil fouled, refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L or *Loss of Coolant* in Engine Cooling. • Inspect for loose ignition coil grounds. Refer to *Electronic Ignition (EI) System Diagnosis*.
Engine Cooling System	Inspect the engine thermostat for proper operation and heat range. Refer to *Thermostat Diagnosis* in Engine Cooling.
Additional Checks	Test the generator output voltage. Refer to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical for the procedure. Repair the charging system if the generator output voltage is less than 9 volts or more than 16 volts.

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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. This condition is not normally felt above 1500 RPM or 48 km/h (30 mph). The exhaust has a steady sputtering sound at idle or low speed.	
Preliminary	• Refer to Important Preliminary Checks Before Starting in *Symptoms*. • Search for bulletins. • Inspect the PCM grounds for being clean, tight and in the proper locations. Refer to *Engine Controls Schematics*. • Remove the air filter element and inspect for dirt or for being restricted. Refer to *Air Cleaner Element Replacement*. Replace as necessary.
Fuel System	• Inspect the fuel injectors. Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)*. • Test for incorrect fuel pressure. Refer to *Fuel System Diagnosis*. • Test for a restricted fuel filter. Refer to *Fuel System Diagnosis*. • Test for a contaminated fuel condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. • Inspect items that cause an engine to run rich (long term fuel trim near –13%). For a rich condition, refer to *DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1* and *DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1*. • Inspect items that can cause an engine to run lean (long term fuel trim near 24%). For a lean condition, refer to *DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1* and *DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1*.
Sensor/System	Use a scan tool in order to monitor the KS system for excessive spark retard activity. Refer to *Knock Sensor (KS) System Description*.
Ignition System	• Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as you apply water. • Test for proper ignition voltage output with spark tester *J 26792*. Refer to *Electronic Ignition (EI) System Diagnosis*. • Remove the spark plugs and inspect for the following: – Correct heat range—refer to *Spark Plug Usage* in Engine Electrical. – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits Refer to *DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1* in Engine Electrical. • An improper spark plug gap causes a driveability condition. Gap the spark plugs using a wire gauge gap tool. Refer to *Spark Plug Replacement* in Engine Electrical. • Determine the cause of the fouling before replacing the spark plugs. If the spark plugs are gas fouled, refer to *DTC P0172 Fuel Trim System Rich Bank 1* or *DTC P0175 Fuel Trim System Rich Bank 2*. If the spark plugs are coolant or oil fouled, refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L or *Loss of Coolant* in Engine Cooling. • Visually/Physically inspect the secondary ignition for the following: – Ignition wires arcing to ground – Ignition wires for proper routing – Ignition coils for cracks or carbon tracking

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Cuts Out, Misses (cont'd)

Checks	Action
Engine Mechanical	• Inspect engine mechanical for the following: – Test the engine compression. Refer to *Engine Compression Test* in Engine Mechanical-5.7L. – Sticking or leaking valves. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Worn camshaft lobes. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Valve timing. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Bent push rods. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Worn rocker arms. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Broken valve springs. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Excessive oil in combustion chamber-Leaking valve seals. Refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L. • For incorrect basic engine parts. Inspect the following: – Camshaft – Cylinder heads – Pistons, etc. Refer to Engine Mechanical-5.7L for diagnosis procedures.
Additional Checks	• Inspect exhaust system for possible restrictions. Inspect for the following: – Inspect the exhaust system for damaged or collapsed pipes, Refer to *Restricted Exhaust* in Engine Exhaust. – Inspect the mufflers for heat distress or possible internal failure. Refer to *Internal Muffler Rattles/Loss of Power* in Engine Exhaust. – Inspect for possible plugged Three-Way catalytic converters by comparing exhaust system back pressure on each side of engine. Test the back pressure by removing AIR check valves near exhaust manifolds or the Heated Oxygen sensors. Refer to *Restricted Exhaust* in Engine Exhaust. • Electromagnetic Interference (EMI) on the reference circuit can cause an engine miss condition A sudden increase in RPM with little change in actual engine RPM change indicates EMI is present. Inspect for high voltage components near Ignition Control circuits if a condition exists. • Inspect the intake manifold and the exhaust manifold passages for casting flash. Refer to *Exhaust Manifold Clean and Inspect* and *Intake Manifold Clean and Inspect* in Engine Mechanical-5.7L.

Poor Fuel Economy

Checks	Action
DEFINITION: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.	
Preliminary	• Refer to Important Preliminary Checks Before Starting in *Symptoms*. • Search for bulletins. • Check the PCM grounds for being clean, tight, and in the proper locations. Refer to *Engine Controls Schematics*. • Check the owners driving habits. – Is the A/C ON or the Defroster mode ON full time? – Are the tires at the correct pressure? – Is there excessively heavy loads being carried? – Is the acceleration rate too much, too often? • Remove the air filter element and check for dirt or for being restricted. Refer to *Air Cleaner Element Replacement*. Replace as necessary.

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Poor Fuel Economy (cont'd)

Checks	Action
Fuel System	• Check the type, quality and alcohol content of the fuel. Oxygenated fuels have lower energy and may deliver reduced fuel economy. Refer to *Fuel System Specifications* and *Alcohol/Contaminants-in-Fuel Diagnosis.* • Check the fuel injectors. Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F).* • Check for incorrect fuel pressure. Refer to *Fuel System Diagnosis.* • Check for a restricted fuel filter. Refer to *Fuel System Diagnosis.* • Check for a contaminated fuel condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis.* • Check that each injector harness is connected to the correct injector/cylinder according to the firing order (firing order: 1–8–7–2–6–5–4–3). Relocate injector harnesses as necessary. • Check for foreign material accumulation in the throttle bore, coking on the throttle valve, or on the throttle shaft. Also inspect for throttle body tampering. Refer to *Throttle Body Cleaning Procedure.* • Check items that cause an engine to run rich (long term fuel trim near –13%). For a rich condition, refer to *DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1* and *DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1.*
Sensor/System	• Check the air intake system and crankcase for air leaks. • Check the crankcase ventilation valve for proper operation. Place a finger over the inlet hole in the valve end several times. The valve should snap back. If not, replace the valve. • Check for proper calibration of speedometer. Connect Signal Generator *J 33431-B* to the VSS electrical connector. Turn ON the ignition with the tester ON and monitor the speedometer. The speedometer should indicate 86 km/h (54 mph). If not, refer to *A Diagnostic System Check - Instrument Cluster* in Instrument Panel, Gauges and Console. • Use a scan tool in order to monitor the KS system for excessive spark retard activity. Refer to *Knock Sensor (KS) System Description.*
Ignition System	• Check for proper ignition voltage output with spark tester *J 26792.* Refer to *Electronic Ignition (EI) System Diagnosis.* • Remove the spark plugs and check for the following: – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits Refer to *Spark Plug Visual Diagnosis* in Engine Electrical. • An improper spark plug gap will cause a driveability problem. Gap the spark plugs using a wire gauge gap tool (J 41319). Refer to *Spark Plug Replacement* in Engine Electrical. • Determine the cause of the fouling before replacing the spark plugs if the spark plugs are gas, coolant, or oil fouled. Refer to *DTC P0172 Fuel Trim System Rich Bank 1* or *DTC P0175 Fuel Trim System Rich Bank 2* for diagnosis of the rich condition. Refer to *Spark Plug Visual Diagnosis* in Engine Electrical for diagnosis of coolant or oil fouled spark plugs. • Visually/Physically inspect the secondary ignition for the following: – Ignition wires arcing to ground – Ignition wires for proper routing • Wetting down the secondary ignition system with water from a spray bottle may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as you apply water. • Check for loose ignition coil grounds. Refer to *Electronic Ignition (EI) System Diagnosis.*

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Poor Fuel Economy (cont'd)

Checks	Action
Engine Cooling System	• Check the engine coolant level for being low. Refer to *Draining and Filling Cooling System (5.7 L)* in Engine Cooling. • Check the engine thermostat for proper operation and heat range. Refer to *Thermostat Diagnosis* in Engine Cooling.
Engine Mechanical	• Check engine mechanical for the following: – Check compression. Refer to *Engine Compression Test* in Engine Mechanical. – Sticking or leaking valves. Refer to *Valve Train Diagnosis.* – Worn camshaft lobes. Refer to *Valve Train Diagnosis.* – Valve timing. Refer to *Valve Train Diagnosis.* – Bent push rods. Refer to *Valve Train Diagnosis.* – Worn rocker arms. Refer to *Valve Train Diagnosis.* – Broken valve springs. Refer to *Valve Train Diagnosis.* – Excessive oil in combustion chamber-Leaking valve seals. Refer to *Oil Consumption Diagnosis* in Engine Mechanical. • For incorrect basic engine parts. Inspect for the following: – Camshaft – Cylinder heads – Pistons, etc.
Additional Checks	• Visually (physically) check the vacuum hoses for splits, kinks, and proper connections and routing as shown on Vehicle Emission Control Information label. • Check the Transmission Torque Converter Clutch (TCC) operation. The scan tool should indicate a RPM drop, when the system commands the TCC ON. Refer to *A Diagnostic Starting Point - Automatic Transmission* in Automatic Transmission–4L60-E. • Check the exhaust system for a possible restriction. Check for the following: – Inspect the exhaust system for damaged or collapsed pipes. Refer to *Restricted Exhaust* in Engine Exhaust. – Inspect the exhaust manifold for a collapsed inner wall. Refer to *Exhaust Manifold Clean and Inspect* in Engine Exhaust. – Inspect the mufflers for heat distress or possible internal failure. Refer to *Internal Muffler Rattles/Loss of Power* in Engine Exhaust.*Internal Muffler Rattles/Loss of Power* – Inspect for possible plugged Three-Way catalytic converters by comparing the exhaust system back pressure on each side of the engine. Check the back pressure by removing the AIR check valves near the exhaust manifolds. Refer to *Restricted Exhaust.* • Electromagnetic Interference (EMI) on the reference circuit can cause an engine miss condition. A scan tool can usually detect EMI by monitoring the engine RPM. A sudden increase in RPM with little change in actual engine RPM change, indicates EMI is present. Check for high voltage components near Ignition Control circuits if a problem exists. • Check PNP switch circuit. Refer to *PNP Switch Diagnosis.* • Check for faulty motor mounts. Refer to *Engine Mount Inspection* in Engine Mechanical for inspection of mounts. • Check the intake and the exhaust manifold passages for casting flash. Refer to *Exhaust Manifold Clean and Inspect,* and *Exhaust Manifold Clean and Inspect* in Engine Mechanical. • Check the brake system for dragging or improper operation. Refer to *Hydraulic Brake Diagnostic System Check* in Hydraulic Brakes.

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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. • The fill limiter vent valve is stuck closed. • The EVAP canister is restricted. • The EVAP canister vent solenoid is stuck closed. • Restricted EVAP pipes. • High Reid vapor pressure. • High fuel temperature. • The fuel filler hose/pipe is pinched, kinked, or blocked.
Over fill	• The pressure relief valve in the fill limiter vent valve is stuck open. • The pressure relief valve in the fill limiter vent valve is leaking. • The fill limiter vent valve is stuck open. • The fill limiter vent valve is leaking.
Pre-mature shut-off of the fuel dispensing nozzle	• The check valve is stuck closed. • The fill limiter vent valve is stuck closed. • The EVAP canister is restricted. • The EVAP canister vent solenoid is stuck closed. • Restricted EVAP pipes. • High Reid vapor pressure. • High fuel temperature. • The fuel filter hose/pipe is pinched, kinked, or blocked.
Fuel Spit Back	• The check valve is stuck open. • The check valve is stuck closed. • The check valve is leaking. • High Reid vapor pressure. • High fuel temperature.
Liquid fuel in EVAP canister	• The fill limiter vent valve is stuck open. • The fill limiter vent valve is leaking.
Liquid fuel leak	• The pressure relief valve in the fill limiter vent valve is stuck open. • The pressure relief valve in the fill limiter vent valve is leaking. • The fuel filler hose is loose or torn. • The fill limiter vent valve is stuck open.
Fuel Odor	• The pressure relief valve in the fill limiter vent valve is stuck open. • The pressure relief valve in the fill limiter vent valve is leaking. • 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 Important Preliminary Checks Before Starting in *Symptoms*. • Search for bulletins. • Inspect the PCM grounds for being clean, tight and in the proper locations. Refer to *Engine Controls Schematics*. • Remove and Inspect the air filter element for dirt, or for being restricted. Refer to *Air Cleaner Element Replacement*. Replace as necessary.
Fuel System	• Test the fuel injectors. Refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)*. • Test for incorrect fuel pressure. Refer to *Fuel System Diagnosis*. • Test for a restricted fuel filter. Refer to *Fuel System Diagnosis*. • Test for a contaminated fuel condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. • Inspect that each injector harness is connected to the correct injector/cylinder according to the firing order (firing order: 1–8–7–2–6–5–4–3). Relocate injector harnesses as necessary. • Inspect items that cause an engine to run rich (long term fuel trim near –13%). For a rich condition, refer to *DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1* and *DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1*. • Inspect items that can cause an engine to run lean (long term fuel trim near 24%). For a lean condition, refer to *DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1* and *DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1*.
Sensor/System	• Test the crankcase ventilation valve for proper operation. Place a finger over the inlet hole of the valve end several times. The valve should snap back. If not, replace the valve. • Use a scan tool in order to monitor KS system for excessive spark retard activity. Refer to *Knock Sensor (KS) System Description*.
Ignition System	• Test for proper ignition voltage output with spark tester *J 26792*. Refer to *Electronic Ignition (EI) System Diagnosis* for the procedure. • Remove spark plugs and inspect for the following: – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits Refer to *Spark Plug Visual Diagnosis* in Engine Electrical. • An improper spark plug gap causes a driveability condition. Gap the spark plugs using a wire gauge gap tool. Refer to *Spark Plug Replacement* in Engine Electrical. • Determine the cause of the fouling before replacing the spark plugs. If the spark plugs are gas fouled, refer to *DTC P0172 Fuel Trim System Rich Bank 1* or *DTC P0175 Fuel Trim System Rich Bank 2*. If the spark plugs are coolant or oil fouled, refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L or *Loss of Coolant* in Engine Cooling. • Visually/Physically inspect secondary ignition for the following: – Ignition wires arcing to ground – Ignition wires for proper routing • Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as you apply water. • Inspect for loose ignition coil grounds. Refer to *Electronic Ignition (EI) System Diagnosis*.

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

Checks	Action
Engine Mechanical	• Inspect engine mechanical for the following: – Test the engine compression. Refer to *Engine Compression Test* in Engine Mechanical-5.7L. – Sticking or leaking valves. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Worn camshaft lobes. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Valve timing. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Bent push rods. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Worn rocker arms. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Broken valve springs. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Excessive oil in combustion chamber-Leaking valve seals. Refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L. • For incorrect basic engine parts. Inspect for the following: – Camshaft – Cylinder heads – Pistons, etc.
Additional Checks	• Inspect the exhaust system for possible restrictions. Inspect for the following: – Inspect the exhaust system for damaged or collapsed pipes. Refer to *Restricted Exhaust* in Engine Exhaust. – Inspect the mufflers for heat distress or possible internal failure. Refer to *Internal Muffler Rattles/Loss of Power* in Engine Exhaust. – Inspect for possible plugged Three-Way catalytic converters by comparing exhaust system back pressure on each side of engine. Test the back pressure by removing AIR check valves near exhaust manifolds or the Heated Oxygen sensors. Refer to *Restricted Exhaust* in Engine Exhaust. • Electromagnetic Interference (EMI) on the reference circuit can cause an engine miss condition A scan tool can usually detect EMI by monitoring the engine RPM. A sudden increase in RPM with little change in actual engine RPM change, this indicates that EMI is present. Inspect for high voltage components near Ignition Control circuits if a condition exists. • Test the PNP switch circuit. Refer to *PNP Switch Diagnosis*. • Inspect for faulty engine mounts. Refer to *Engine Mount Inspection* in Engine Mechanical-5.7L. • Inspect the intake and the exhaust manifold passages for casting flash. Refer to *Exhaust Manifold Clean and Inspect* and *Intake Manifold Clean and Inspect* in Engine Mechanical-5.7L.

Dieseling, Run-On

Checks	Action
DEFINITION: Engine continues to run after key is turned OFF, but runs very rough. If the engine runs smooth, test the ignition switch and the ignition switch adjustment.	
Preliminary Checks	• Refer to Important Preliminary Checks Before Starting in *Symptoms*. • Search for bulletins. • Inspect the PCM grounds for being clean, tight and in the proper locations. Refer to *Engine Controls Schematics*.
Fuel System	Inspect the injectors for a leaking condition. Refer to *Fuel System Diagnosis* for the proper procedure.

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Backfire

Checks	Actions
DEFINITION: Fuel ignites in the intake manifold or in the exhaust system, making a loud popping noise.	
Preliminary Checks	• Refer to Important Preliminary Checks Before Starting in *Symptoms*. • Search for bulletins. • Inspect the PCM grounds for being clean, tight and in the proper locations. Refer to *Engine Controls Schematics*.
Fuel System	• Test for incorrect fuel pressure. Refer to *Fuel System Diagnosis*. • Test for a restricted fuel filter. Refer to *Fuel System Diagnosis*. • Test for a contaminated fuel condition. Refer to *Alcohol/Contaminants-in-Fuel Diagnosis*. • Inspect that each injector harness is connected to the correct injector/cylinder according to the firing order (firing order: 1–8–7–2–6–5–4–3). Relocate injector harnesses as necessary.
Sensor/System	• Test the Secondary Air Injection (AIR) system. Refer to *DTC P0410 Secondary Air Injection (AIR) System*. • Inspect the air intake system and crankcase for air leaks. • Test the crankcase ventilation valve for proper operation. Place a finger over the inlet hole in the valve end several times. The valve should snap back. If not, replace the valve. • Verify proper calibration of speedometer. Connect Signal Generator *J 33431-B* to VSS electrical connector. Ignition ON, tester ON and monitor the speedometer. The speedometer should indicate 86 km/h (54 mph). Refer to *A Diagnostic System Check - Instrument Cluster* in Instrument Panel, Gauges and Console. • Use a scan tool in order to monitor the KS system for excessive spark retard activity. Refer to *Knock Sensor (KS) System Description*.
Ignition System	• Test for proper ignition voltage output with spark tester *J 26792*. Refer to *Electronic Ignition (EI) System Diagnosis*. • Inspect for an intermittent ignition system malfunction in the following circuits: – Ignition control circuit. – Power and ground to the ignition coils. • Remove spark plugs and inspect for the following: – Wet plugs – Cracks – Wear – Improper gap – Burned electrodes – Heavy deposits Refer to *Spark Plug Visual Diagnosis* in Engine Electrical. • An improper spark plug gap causes a driveability condition. Gap the spark plugs using a wire gauge gap tool. Refer to *Spark Plug Replacement* in Engine Electrical. • Determine the cause of the fouling before replacing the spark plugs. If the spark plugs are gas fouled, refer to *DTC P0172 Fuel Trim System Rich Bank 1* or *DTC P0175 Fuel Trim System Rich Bank 2*. If the spark plugs are coolant or oil fouled, refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L or *Loss of Coolant* in Engine Cooling. • Visually/Physically inspect secondary ignition for the following: – Ignition wires arcing to ground – Ignition coils arcing to ground • Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as you apply the water. • Inspect for loose ignition coil grounds. Refer to *Electronic Ignition (EI) System Diagnosis*.

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Backfire (cont'd)

Checks	Actions
Engine Cooling System	• Inspect the engine coolant level for being low. Refer to *Draining and Filling Cooling System (5.7 L)* in Engine Cooling. • Test the engine thermostat for proper operation and heat range. Refer to *Thermostat Diagnosis* in Engine Cooling.
Engine Mechanical	• Inspect engine mechanical for the following: – Test the engine compression. Refer to *Engine Compression Test* in Engine Mechanical-5.7L. – Sticking or leaking valves. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Worn camshaft lobes. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Valve timing. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Bent push rods. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Worn rocker arms. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Broken valve springs. Refer to *Valve Train Diagnosis* in Engine Mechanical-5.7L. – Excessive oil in combustion chamber-Leaking valve seals. Refer to *Oil Consumption Diagnosis* in Engine Mechanical-5.7L. • For incorrect basic engine parts. Inspect the following: – Camshaft – Cylinder heads – Pistons, etc.
Additional Checks	• Visually (physically) Inspect the vacuum hoses for splits, kinks, and proper connections and routing as shown on Vehicle Emission Control Information label. • Inspect the intake manifold and the exhaust manifold passages for casting flash. Refer to *Exhaust Manifold Clean and Inspect* and *Intake Manifold Clean and Inspect* in Engine Mechanical-5.7L. • Test the Transmission Torque Converter Clutch (TCC) operation. The scan tool should indicate an RPM drop when the TCC is commanded ON. Refer to *A Diagnostic Starting Point - Automatic Transmission* in Automatic Transmission–4L60-E. • Inspect the exhaust system for possible restrictions. Inspect the following: – Inspect the exhaust system for damaged or collapsed pipes. Refer to *Exhaust System Inspection* in Engine Exhaust. – Inspect the exhaust manifold for a collapsed inner wall. Refer to *Exhaust Manifold Clean and Inspect* in Engine Exhaust. – Inspect the mufflers for heat distress or possible internal failure. Refer to *Internal Muffler Rattles/Loss of Power* in Engine Exhaust. – Inspect for possible plugged Three-Way catalytic converters by comparing exhaust system back pressure on each side of engine. Test back pressure by removing AIR check valves near exhaust manifolds or the Heated Oxygen sensors. Refer to *Restricted Exhaust* in Engine Exhaust. • Electromagnetic Interference (EMI) on the reference circuit can cause an engine miss condition. A scan tool can usually detect EMI by monitoring the engine RPM. A sudden increase in RPM with little change in actual engine RPM change, may indicate that EMI is present. Inspect for high voltage components near Ignition Control circuits if a condition exists. • Test the PNP switch circuit. Refer to *PNP Switch Diagnosis.* • Inspect for faulty engine mounts. Refer to *Engine Mount Inspection* in Engine Mechanical-5.7L.

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A/C Request Circuit Diagnosis

For complete circuit details refer to *A/C Compressor Control.*

Circuit Description:

The A/C clutch relay is PCM controlled to delay A/C clutch engagement after the A/C is turned ON. This allows the PCM to adjust engine RPM before the A/C clutch engages. The PCM will engage the A/C clutch any time A/C has been requested unless any of the following conditions exist:

- High coolant temperature
- Low A/C system pressure
- High A/C system pressure
- Wide open throttle
- High engine RPM

When the heater and A/C control is placed in the A/C mode and the engine is operating, a 12 volt signal is sent to the PCM. When the PCM receives this signal the PCM will ground the A/C clutch relay control circuit to energize the A/C relay. This is shown on the scan tool as A/C request YES.

When a request for A/C has been detected by the PCM, the PCM will ground the A/C clutch relay control circuit, the relay contacts will close, and current will flow through the relay to the A/C compressor clutch.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Ensure no PCM DTCs are stored before using this table. The PCM will not activate the A/C clutch with a stored DTC.

Test Description

The numbers below refer to numbers on the diagnostic table.

2. A/C DTCs will disable the A/C system. Repair A/C DTCs before proceeding.
3. The request circuit is shorted to a voltage if the scan tool displays A/C request as YES.
5. A condition exists with the request circuit between the PCM and the HVAC Programmer, or the HVAC Programmer is malfunctioning if the test lamp did not illuminate.

A/C Request Circuit Diagnosis

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 A/C DTCs set?	—	Go to the applicable DTC table	*Go to Step 3*
3	1. Install the scan tool. 2. Idle the engine with the A/C OFF. 3. Monitor the A/C request status using the scan tool. Does the scan tool indicate A/C request as YES?	—	*Go to Step 8*	*Go to Step 4*
4	Turn ON the A/C. Does the scan tool indicate A/C request as YES?	—	System OK	*Go to Step 5*
5	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition leaving the engine OFF. 4. Probe the A/C request circuit at the PCM electrical harness connector using the DMM connected to ground. 5. Turn the A/C to the ON position. Does the DMM display near the specified value when the A/C is enabled?	B+	*Go to Step 10*	*Go to Step 6*

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A/C Request Circuit Diagnosis (cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Disconnect the HVAC Programmer. Refer to *Control Assembly Replacement* in HVAC Systems-Manual. 3. Test the A/C request circuit for continuity between the HVAC Programmer and the PCM using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 11*
7	Probe the A/C request circuit at the PCM harness connector using the *J 34142-B* test lamp connected to B+. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 12*	*Go to Step 9*
8	1. Inspect the A/C request circuit for a short to voltage. 2. If you find the A/C request circuit shorted repair the condition as necessary. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 9*
9	**Important:** Before replacing the HVAC Programmer, refer to *A Diagnostic Starting Point* in HVAC Systems-Manual. Replace the HVAC Programmer. Refer to *Control Assembly Replacement* in HVAC Systems-Manual. Is the action complete?	—	System OK	—
10	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 13*
11	Repair the open A/C request circuit between the HVAC Programmer and the PCM. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
12	Repair the grounded A/C request circuit between the HVAC Programmer and the PCM. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
13	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming* Replace the PCM. Is the action complete?	—	System OK	—

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A/C Refrigerant Pressure Sensor Circuit Diagnosis

Refer to Engine Controls Schematics, *A/C Compressor Control* for complete circuit details.

Circuit Description

The A/C system uses an A/C refrigerant pressure sensor mounted in the high side of the A/C system to monitor A/C refrigerant pressure. The PCM utilizes this information in order to disable the A/C compressor clutch when the A/C system pressure is out of range. The PCM also uses A/C refrigerant pressure sensor to enable the engine coolant fans when the A/C refrigerant pressure is high.

The PCM supplies a 5 volt reference, a signal circuit, and a ground circuit to the A/C refrigerant pressure sensor. As the A/C pressure increases or decreases, the resistance of the sensor changes and varies the amount of signal voltage detected by the PCM.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter Kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The following may cause an intermittent:

- Poor connections; Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
- Mis-routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

If the test did not fail this ignition cycle, move the related electrical harnesses and the connectors while monitoring a scan tool.

For an intermittent, refer to *Symptoms*.

Test Description

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

3. The normal A/C voltage is between 1.0 and 1.8 volts.
5. If the A/C pressure/voltage stays high after disconnecting the A/C refrigerant pressure sensor electrical connector, this indicates the signal circuit is shorted to a voltage.
7. This step tests for a good ground circuit.
8. This step verifies the integrity of the A/C refrigerant pressure sensor signal circuit.
11. If you have thoroughly inspected the 5.0 volt reference circuit (for opens, shorts to ground, PCM connections etc.) and is OK, then replace the PCM.
12. If you have thoroughly inspected the ground circuit for opens and the PCM connections are OK, then replace the PCM.

A/C Refrigerant Pressure Sensor Circuit Diagnosis

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	1. Install the scan tool. 2. Idle the engine. 3. Monitor the DTC Information using the scan tool. Did DTC P1639 fail this ignition cycle?	—	Go to *DTC P1639 5 Volt Reference 2 Circuit*	*Go to Step 3*
3	1. Turn ON the ignition leaving the engine OFF. 2. Monitor the A/C High Side parameter using the scan tool. Does the scan tool indicate the A/C High Side Pressure voltage within the specified range?	0.1–1.8V	*Go to Step 4*	*Go to Step 5*
4	Move related harnesses while monitoring the A/C High Pressure voltage. Does the scan tool indicate that the sensor values change while moving related electrical harnesses?	—	*Go to Step 16*	Go to Diagnostic Aids
5	Disconnect the A/C refrigerant pressure sensor electrical connector. Refer to *A/C refrigerant pressure sensor* in HVAC Systems with A/C-Manual or Automatic. Does the scan tool indicate the A/C High Side less than the specified value?	1V	*Go to Step 6*	*Go to Step 10*

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A/C Refrigerant Pressure Sensor Circuit Diagnosis (cont'd)

Step	Action	Value(s)	Yes	No
6	Measure the voltage from the A/C refrigerant pressure sensor 5 volt reference circuit to the battery ground using the DMM. Is the voltage near the specified value?	5V	*Go to Step 7*	*Go to Step 11*
7	Measure the voltage from the A/C refrigerant pressure sensor 5 volt reference circuit to the sensor ground circuit using the DMM. Is the voltage at the specified value?	5V	*Go to Step 8*	*Go to Step 12*
8	Jumper the 5 volt reference circuit to the A/C refrigerant pressure sensor signal circuit using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the scan tool indicate the A/C High Side voltage at the specified value?	5V	*Go to Step 9*	*Go to Step 13*
9	Repair the faulty A/C refrigerant pressure sensor connection or faulty sensor. Refer to *A/C Refrigerant Pressure Sensor Replacement* in Heating, Ventillation, and Air Conditioning. Is the action complete?	—	System OK	—
10	Repair the short to voltage in the A/C refrigerant pressure sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
11	Repair the A/C refrigerant pressure sensor 5 volt reference circuit. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 14*
12	Repair the A/C refrigerant pressure sensor ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 14*
13	Repair the A/C refrigerant pressure sensor signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 14*
14	1. Inspect for a poor sensor ground terminal connection at the PCM connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Is the action complete?	—	System OK	*Go to Step 15*
15	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	System OK	—
16	1. Inspect for a poor sensor connection or PCM connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a condition, repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Is the action complete?	—	System OK	—

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Electric Cooling Fan Diagnosis

Refer to Engine Controls Schematics, *Cooling Fans* for complete circuit details.

Circuit Description

The cooling fan system in this vehicle provides for two separate modes of operation. These are the low speed fan and the high speed fan operating modes. The low speed mode operates both fans at half speed by using a series circuit configuration. The high speed mode operates both fans at full speed by using a parallel circuit configuration. These two operating modes are accomplished using 3 fan control relays.

This system which uses three relays to control two fan motors appears complicated. To aid in better understanding this system it is suggested to follow the circuits in the schematic as you read the description. This will aid in understanding the two distinct modes of operating the relays and coolant fans.

Low speed fan operation is established when the PCM commands Fan Relay #1 ON by grounding circuit 335 with an internal driver (relays #2 and #3 are left OFF). This closes the relay switch and allows current to flow from the battery, through the switch contacts on circuit 409 to the Left Hand (LH) cooling fan. Current flow continues out of the fan motor on circuit 532 to relay #3. The unenergized relay #3 switch contacts allow current to flow to circuit 504. This provides power to the Right Hand (RH) cooling fan motor. The low side of the RH cooling fan completes the circuit to ground on circuit 150. This circuit is a series circuit which allows half speed operation for each fan since each fan motor will drop half of the supplied battery power.

High speed operation is established when all three relays are energized. Relays #2 and #3 share the same control circuit to the PCM. This is circuit 473. As in the low speed mode, Relay #1 supplies current flow to the LH cooling fan on circuit 409. Current flow continues through the motor on circuit 532 to relay #3 which is now energized. The switch has now provided a path for current to flow through circuit 150 directly to ground. This circuit now only has the LH fan motor to power and allows it to run at full speed. Relay #2 is also energized and provides current flow on circuit 504 to the RH cooling fan. This fan now has its own dedicated circuit and will operate at full speed. This mode is operating as a parallel circuit.

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* in Engine Cooling.

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).

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. The engine coolant temperature must be below 100°C (212°F) before proceeding with diagnosis.

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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	**Important:** Engine coolant temperature must be below the specified value for all of the cooling fan diagnoses. 1. Idle the engine. 2. Turn the A/C OFF. 3. Monitor the A/C Request parameter using the scan tool. Does the scan tool display the A/C request as YES?	100°C (212°F)	Go to *A/C Request Circuit Diagnosis*	*Go to Step 4*
4	1. Turn OFF the ignition. 2. Turn ON the ignition leaving the engine OFF. Are the cooling fans ON?	—	Go to Cooling Fan table #1	*Go to Step 5*
5	Command the cooling fan relay #1 ON using a scan tool. Are both cooling fans ON?	—	*Go to Step 6*	Go to Cooling Fan table #2
6	Command the cooling fan relays #1, #2 and #3 ON using a scan tool. Do both cooling fans switch to high speed?	—	*Go to Step 7*	Go to Cooling Fan table #3
7	1. Using a scan tool, exit outputs. 2. Idle the engine leaving the A/C OFF. Are the cooling fans ON?	—	Go to Cooling Fan table #1	*Go to Step 8*
8	Turn the A/C ON. Are the cooling fans ON?	—	System OK	*Go to Step 9*
9	Does the scan tool display A/C request as YES?	—	Go to *A Diagnostic Starting Point* in HVAC Systems.	Go to *A/C Request Circuit Diagnosis*

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Test Description

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

2. This step determines if the cooling fan relay contacts are stuck closed.
3. This step determines if there is a short to voltage on circuit 532.
4. Any test that requires probing a component or a component harness connector, use the Connector Test Adaptor Kit *J 35616-A*. Using this kit prevents damage to the harness connector terminals. Refer to *Using Connector Test Adapters*.
5. This step determines if the cooling fan relay contacts are stuck closed.

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 Cooling Fan Functional Check
2	1. Turn ON the ignition leaving the engine OFF. 2. Disconnect the cooling fan relay #1. Are both of the cooling fans OFF?	—	*Go to Step 6*	*Go to Step 3*
3	Disconnect the cooling fan relay #3. Are both of the cooling fans OFF?	—	*Go to Step 4*	*Go to Step 5*
4	1. Turn OFF the ignition. 2. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information. 3. Disconnect the left cooling fan electrical connector. 4. Probe the cooling fan electrical connector terminal B using the test lamp *J 34142-B* connected to ground. 5. Turn ON the ignition leaving the engine OFF. Does the test lamp illuminate?	—	*Go to Step 7*	*Go to Step 8*
5	Disconnect the cooling fan relay #2. Are both of the cooling fans OFF?	—	*Go to Step 10*	*Go to Step 9*
6	Replace the cooling fan relay #1. Refer to *Cooling Fan Relay Replacement* in Engine Cooling. Is the action complete	—	Go to Cooling Fan Functional Check	—
7	Repair circuit 409 for a short to B+. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete	—	Go to Cooling Fan Functional Check	—
8	Repair circuit 532 for a short to B+. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete	—	Go to Cooling Fan Functional Check	—
9	Repair circuit 504 for a short to B+. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	Go to Cooling Fan Functional Check	—
10	Replace the cooling fan relay #2. Refer to *Cooling Fan Relay Replacement* in Engine Cooling. Is the action complete?	—	Go to Cooling Fan Functional Check	—

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Test Description

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

2. Any test that requires probing a component or a component harness connector, use the Connector Test Adaptor Kit *J 35616-A*. Using this kit prevents damage to the harness connector terminals. Refer to *Using Connector Test Adapters.*
3. This step tests for an inoperative cooling fan relay.
5. This step tests for an open left cooling fan motor. When the left cooling fan terminals are connected, the right cooling fan should operate on high speed.
7. This step is testing for a short to ground between the left cooling fan motor and cooling fan relay #3.

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 Cooling Fan Functional Check
2	1. Turn ON the ignition leaving the engine OFF. 2. Disconnect cooling fan relay #1. 3. Probe the cooling fan relay #1 terminal B3 at the underhood electrical center using the test lamp *J 34142-B* connected to ground. Does the test lamp illuminate?	—	*Go to Step 3*	*Go to Step 11*
3	**Important:** Leave jumper in place for remainder of this table. Connect a fused jumper wire between the cooling fan relay #1 terminals B3 and C1 at the underhood electrical center. Refer to *Using Fused Jumper Wires* in Wiring Systems. Do both cooling fans turn ON?	—	*Go to Step 12*	*Go to Step 4*
4	1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information. 2. Disconnect the left cooling fan electrical connector. 3. Probe the left cooling fan electrical connector terminal B using the test lamp *J 34142-B* connected to ground. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 13*
5	1. Disconnect the cooling fan relay #3. 2. Probe the cooling fan relay #3 terminal C8 using the test lamp *J 34142-B* connected to B+. Does the test lamp illuminate?	—	*Go to Step 22*	*Go to Step 6*
6	1. Install the cooling fan relay #3. **Important:** Leave jumper in place for remainder of this table. 2. Connect a fused jumper wire between left cooling fan electrical connector terminals A and B. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the right cooling fan turn ON?	—	*Go to Step 14*	*Go to Step 7*
7	1. Disconnect the cooling fan relay #3. 2. Probe the cooling fan relay #3 terminal C8 at the underhood electrical center using the test lamp *J 34142-B* connected to ground. Does the test lamp illuminate?	—	*Go to Step 8*	*Go to Step 16*
8	**Important:** Leave the jumper in place for remainder of this table. Connect a fused jumper wire between the cooling fan relay #3 terminals C8 and B9 at the underhood electrical center. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the right cooling fan turn ON?	—	*Go to Step 17*	*Go to Step 9*

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Electric Cooling Fan Table #2 (cont'd)

Step	Action	Value(s)	Yes	No
9	1. Disconnect the right cooling fan electrical connector. 2. Probe the right cooling fan electrical connector terminal B using the test lamp *J 34142-B* connected to ground. Does the test lamp illuminate?	—	*Go to Step 10*	*Go to Step 21*
10	Probe the right cooling fan electrical connector terminal A using the test lamp *J 34142-B* connected to B+. Does the test lamp illuminate?	—	*Go to Step 18*	*Go to Step 20*
11	Repair the cooling fan relay B+ supply circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	Go to Cooling Fan Functional Check	—
12	Replace the #1 Cooling fan relay. Refer to *Cooling Fan Relay Replacement* in Engine Cooling. Is the action complete?	—	Go to Cooling Fan Functional Check	—
13	Repair the open circuit between the cooling fan relay #1 and the left cooling fan motor. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	Go to Cooling Fan Functional Check	—
14	1. Inspect for poor connections at the left cooling fan motor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	Go to Cooling Fan Functional Check	*Go to Step 15*
15	Replace the LH fan motor. Refer to *Cooling Fan Motor Replacement - Electric* in Engine Cooling. Is the action complete?	—	Go to Cooling Fan Functional Check	—
16	Repair the open circuit between the LH cooling fan electrical connector terminal A and the cooling fan relay #3 terminal C8. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	Go to Cooling Fan Functional Check	—
17	Replace the #3 cooling fan relay. Refer to *Cooling Fan Relay Replacement* in Engine Cooling. Is the action complete?	—	Go to Cooling Fan Functional Check	—
18	1. Inspect for poor connections at the right cooling fan motor. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	Go to Cooling Fan Functional Check	*Go to Step 19*
19	Replace the RH fan motor. Refer to *Cooling Fan Motor Replacement - Electric* in Engine Cooling. Is the action complete?	—	Go to Cooling Fan Functional Check	—
20	Repair the open ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	Go to Cooling Fan Functional Check	—
21	Repair the open circuit between the cooling fan relay #3 and the RH cooling fan motor. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	Go to Cooling Fan Functional Check	—
22	Repair the short to ground between the left cooling fan motor and relay #3. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	Go to Cooling Fan Functional Check	—

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Test Description

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

5. This step tests the cooling fan relay #3 control circuit.
9. This step tests the cooling fan relay #2 control circuit.

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 Cooling Fan Functional Check
2	1. Turn ON the ignition leaving the engine OFF. 2. Command the cooling fan relays #1, #2 and #3 ON using the scan tool. Is the right cooling fan operating at high speed?	—	*Go to Step 3*	*Go to Step 8*
3	Is the left cooling fan operating at high speed?	—	Go to Cooling Fan Functional Check	*Go to Step 4*
4	1. Remove the cooling fan relay #3. 2. Probe the cooling fan relay #3 terminal B8 at the underhood electrical center using the test lamp *J 34142-B* connected to ground. Does the test lamp illuminate?	—	*Go to Step 5*	*Go to Step 11*
5	1. Probe the cooling fan relay #3 terminal C10 at the underhood electrical center using the test lamp *J 34142-B* connected to B+. 2. Command the cooling fan relays #2 and #3 ON using the scan tool. Does the test lamp illuminate?	—	*Go to step 6*	*Go to Step 13*
6	Connect a fused jumper wire between the cooling fan relay #3 terminals C8 and B10 at the underhood electrical center. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the left cooling fan turn ON?	—	*Go to Step 16*	*Go to Step 7*
7	Probe the cooling fan relay #3 terminal B10 at the underhood electrical center using the test lamp *J 34142-B* connected to B+. Does the test lamp illuminate?	—	*Go to Step 17*	*Go to Step 15*
8	1. Turn ON the ignition leaving the engine OFF. 2. Disconnect the cooling fan relay #2. 3. Probe the cooling fan relay #2 terminals C4 and C6 at the underhood electrical center using the test lamp *J 34142-B* connected to ground. Does the test lamp illuminate for both terminals?	—	*Go to Step 9*	*Go to Step 11*
9	1. Probe the cooling fan relay #2 terminal B4 at the underhood electrical center using the test lamp *J 34142-B* connected to B+. 2. Command the cooling fan relays #2 and #3 ON using the scan tool. Does the test lamp illuminate?	—	*Go to Step 10*	*Go to Step 13*
10	Jumper the cooling fan relay #2 terminals C4 and B6 at the underhood electrical center using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the right cooling fan turn ON?	—	*Go to Step 12*	*Go to Step 14*
11	Repair the cooling fan relay B+ circuit for an open. Refer to *Wiring Repairs* in Wiring System. Is the action complete?	—	Go to Cooling Fan Functional Check	—

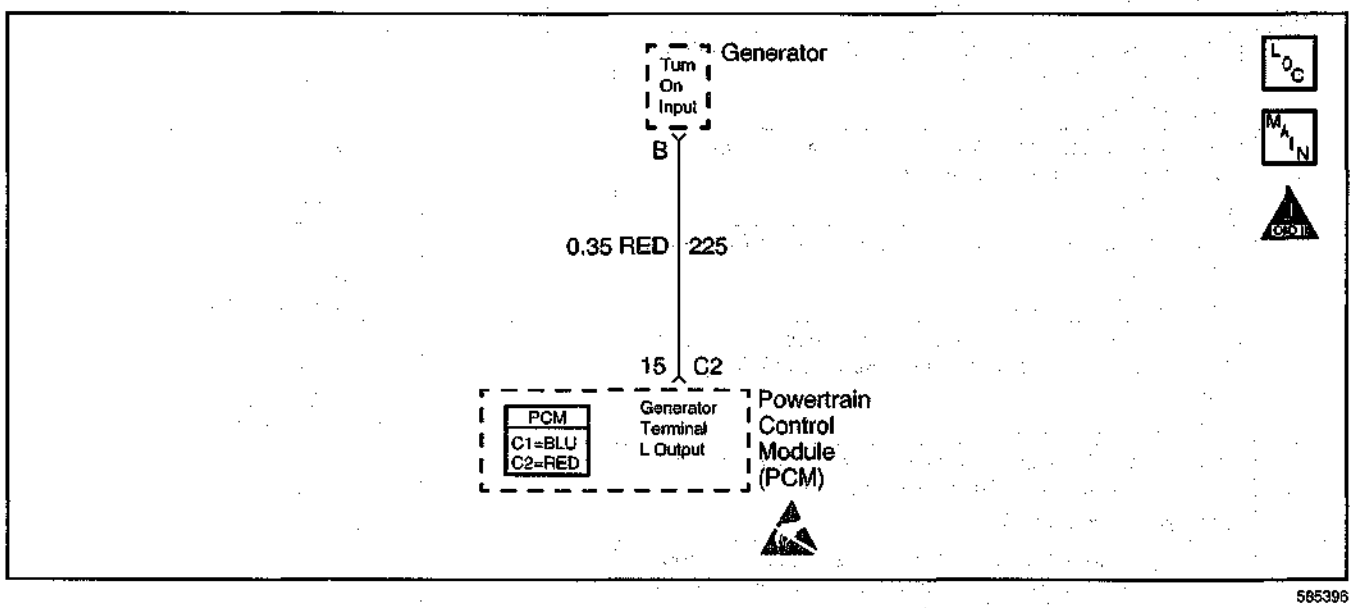
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Electric Cooling Fan Table #3 (cont'd)

Step	Action	Value(s)	Yes	No
12	Replace the #2 Cooling fan relay. Refer to *Cooling Fan Relay Replacement* in Engine Cooling. Is the action complete?	—	Go to Cooling Fan Functional Check	—
13	Repair the cooling fan relay control circuit for an open. Refer to *Wiring Repairs* in Wiring System. Is the action complete?	—	Go to Cooling Fan Functional Check	—
14	Repair circuit 504 for an open. Refer to *Wiring Repairs* in Wiring System. Is the action complete?	—	Go to Cooling Fan Functional Check	—
15	Repair the open ground circuit between cooling fan relay #3 and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	Go to Cooling Fan Functional Check	—
16	Replace the #3 cooling fan relay. Refer to *Cooling Fan Relay Replacement* in Engine Cooling. Is the action complete?	—	Go to Cooling Fan Functional Check	—
17	1. Inspect for poor relay connections at the underhood electrical. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Is the action complete?	—	Go to Cooling Fan Functional Check	—

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PCM Controlled Generator Diagnosis



585396

Circuit Description

The L-terminal circuit from the generator is a discrete circuit (a discrete circuit has no splices and only one source and one destination) into the PCM. The PCM applies ignition voltage to the generator L terminal circuit. A small amount of current flows from this circuit through the generator windings to create a magnetic field which starts the generator process. When the generator is at operating speed and producing voltage, a solid state switch for the L terminal circuit in the generator opens and the PCM detects that the initial startup current flow has stopped.

The PCM expects to detect low voltage on the L terminal circuit prior to the generator rotating at operating speed and conversely expects the circuit to be at ignition voltage potential when the generator is operational. When the PCM detects a fault (circuit shorted to ground, or circuit shorted to a voltage), the battery lamp will illuminate.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the Connector Test Adapter Kit *J 35616-A*. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

A generator fault, such as a shorted output diode, malfunctioning regulator, an open or shorted rotor, or an open sense lead may cause a low battery charge condition. Refer to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical.

Test Description

The numbers below refer to the step numbers on the Diagnostic Table.

2. This step determines if a fault is present.
11. A poor connection at the generator causes no output.

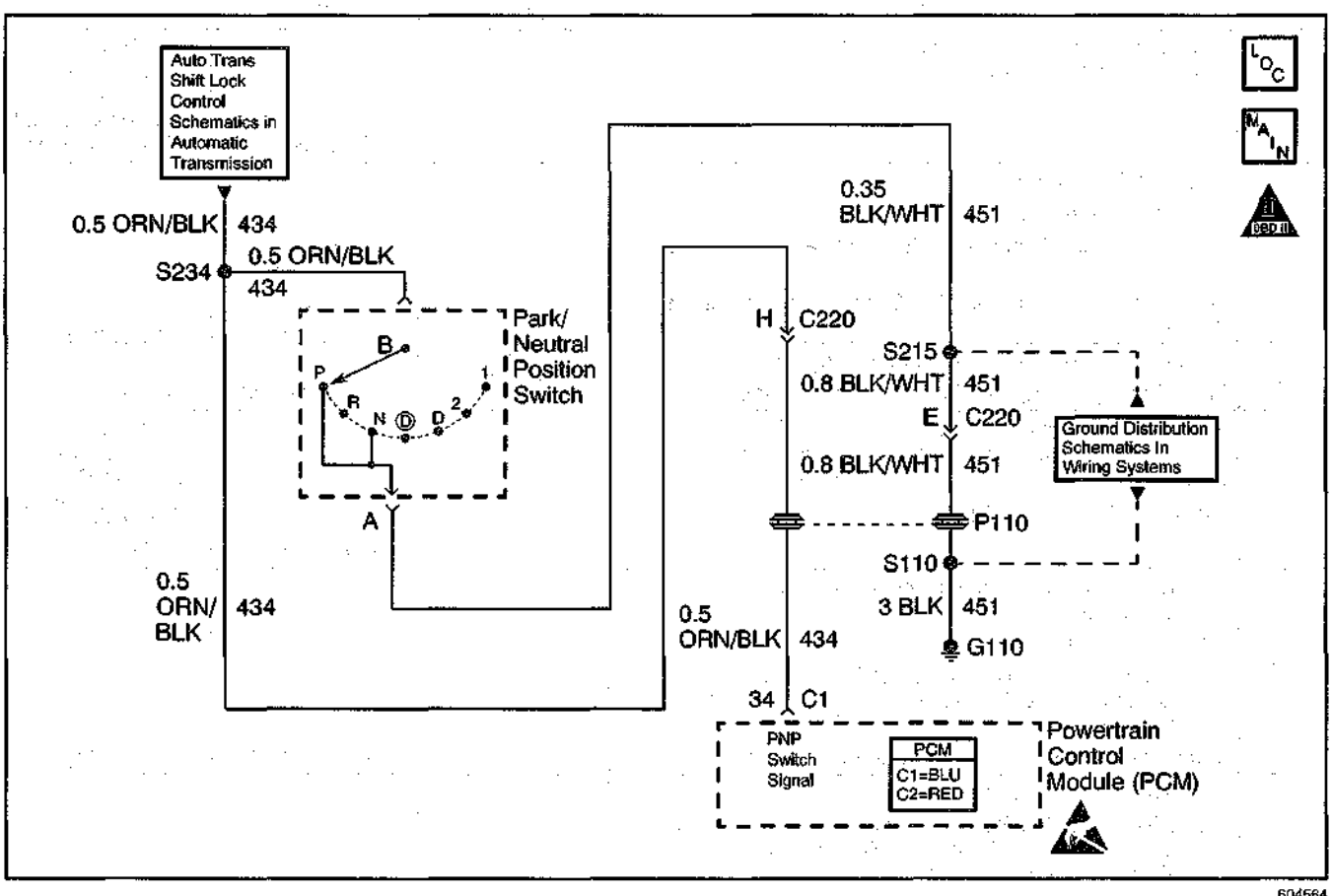
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PCM Controlled Generator Diagnosis

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	1. Install a scan tool. 2. Start the engine. 3. Monitor the Generator L terminal parameter using a scan tool. Does the scan tool display the Generator L terminal as Inactive?	—	Go to *DTC P1637 Generator L-Terminal Circuit*	*Go to Step 3*
3	Measure the voltage at the battery using the DMM. Is the battery voltage within the specified range?	13–15V	Go to Diagnostic Aids	*Go to Step 4*
4	Probe the Generator battery feed circuit using the *J 34142-B* test lamp connected to ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 5*	Go to *A Diagnostic Starting Point - Engine Electrical* in Engine Electrical
5	1. Disconnect the electrical connector from the generator. 2. Start the engine. 3. Measure the voltage to ground at the generator harness connector terminal B using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Is the voltage the same or more than the specified value?	10V	*Go to Step 10*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Test the continuity from the generator circuit at the PCM harness connector to the B terminal of the generator harness connector using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 8*	*Go to Step 7*
7	Repair the open/high resistance in the generator circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	System OK	—
8	1. Inspect the terminal contact tension at the PCM harness connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the connection as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 9*
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	System OK	—
10	1. Inspect the terminal contact tension at the generator electrical connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the connection as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 11*
11	Replace the generator. Refer to *Generator Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	System OK	—

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PNP Switch Diagnosis



Circuit Description

The Park/Neutral Position (PNP) switch contacts are closed to ground in park and neutral. The PCM applies a voltage (about 12.0 Volts) to the switch. When the gear selector is in the park or neutral position, the PNP switch is closed and the PCM senses low signal voltage. When the gear selector is in reverse or a drive range, the PNP switch opens, and the PCM senses high signal voltage. The PCM will increase the idle air rate to compensate for the additional load on the engine when the transmission is in gear.

Some of the PCMs other uses for the PNP signal are:

- Vehicle Speed Sensor (VSS) diagnostics
- Exhaust Gas Recirculation (EGR) operation

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

A PNP switch that does not close or an open circuit may cause the engine idle speed to drop when the vehicle is shifted into gear.

A switch that will not open or the signal circuit shorted to ground will cause the EGR system to be inoperative, possibly resulting in excessive spark knock.

Inspect all related wiring and connectors including the connections at the PCM. These may cause an intermittent malfunction. Inspect for damaged, corroded or pushed out terminals.

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PNP Switch Diagnosis

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	1. Install the scan tool. 2. Turn ON the ignition leaving the engine OFF. 3. Transmission in Park. Observe the scan tool parameter. 4. Place the transmission in Neutral. Observe the scan tool parameter. Does the scan tool indicate Park/Neutral for both positions?	—	*Go to Step 3*	*Go to Step 4*
3	Shift the transmission into Drive. Does the scan tool indicate Drive?	—	Go to Diagnostic Aids	*Go to Step 7*
4	1. Disconnect the Park/Neutral Position switch connector. Refer to *Park/Neutral Position Switch Replacement* in Automatic Transmission–4L60-E. 2. Jumper the PNP harness connector terminals A and B using a fused jumper wire. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the scan tool indicate Park/Neutral?	—	*Go to Step 10*	*Go to Step 5*
5	Probe terminal B in the PNP switch harness connector using a fused jumper wire connected to ground. Refer to *Using Fused Jumper Wires* in Wiring Systems. Does the scan tool indicate Park/Neutral?	—	*Go to Step 13*	*Go to Step 6*
6	1. Leave the fused jumper wire in place. 2. Turn OFF the ignition. 3. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 4. Probe the PNP circuit at the PCM harness connector using the test lamp *J 34142-B* connected to B+. Does the test lamp illuminate?	—	*Go to Step 9*	*Go to Step 11*
7	Disconnect the Park/Neutral Position switch connector. Does the scan tool indicate Drive (R–D321)?	—	*Go to Step 10*	*Go to Step 8*
8	1. Turn OFF the ignition. 2. Disconnect the PCM connector C1 located on the same side as the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition. Does the scan tool indicate Drive (R–D321)?	—	*Go to Step 12*	*Go to Step 15*
9	1. Inspect for a poor connection at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 16*	*Go to Step 15*

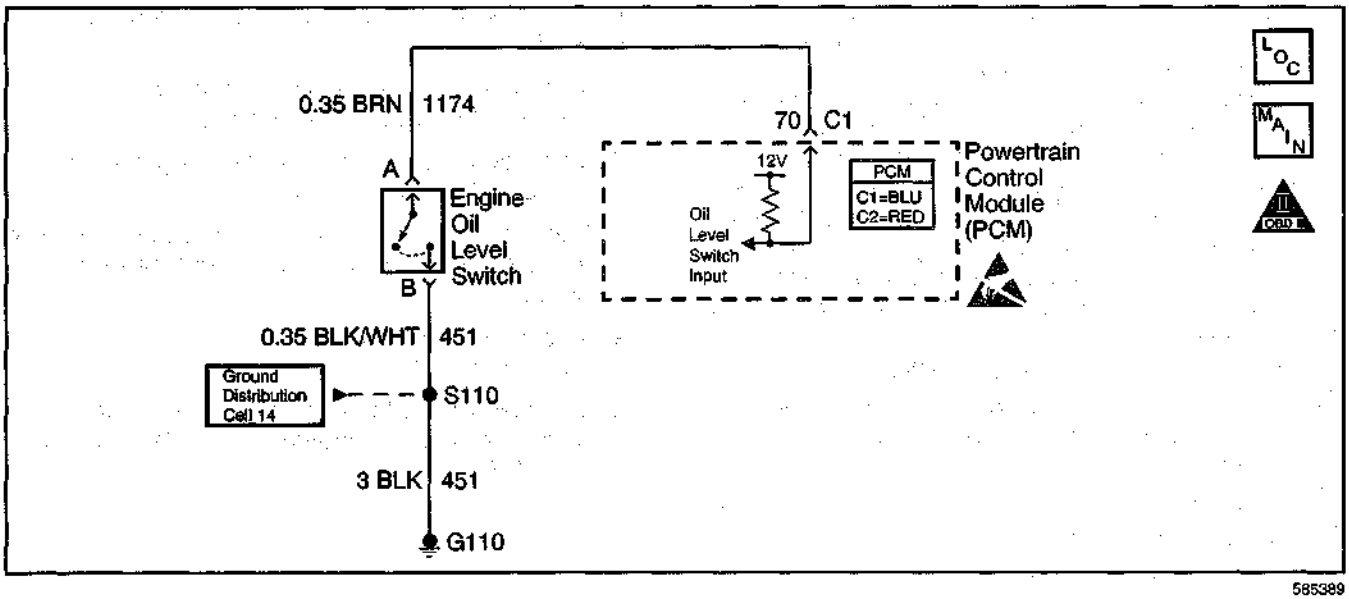
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PNP Switch Diagnosis (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Inspect for faulty connections at the PNP switch or PNP switch out of adjustment. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems and *Park/Neutral Position Switch Adjustment* in Automatic Transmission–4L60-E. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 16*	*Go to Step 14*
11	Repair the open PNP signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 16*	—
12	Repair the PNP signal circuit shorted to ground. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 16*	—
13	Repair the open PNP ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the repair complete?	—	*Go to Step 16*	—
14	Replace the PNP switch. Refer to *Park/Neutral Position Switch Replacement* in Automatic Transmission. Is the repair complete?	—	*Go to Step 16*	—
15	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 16*	—
16	Operate the vehicle within the conditions under which the original symptom was noted. Does the system now operate properly?	—	System OK	*Go to Step 2*

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Engine Oil Level Sensor/Switch Diagnosis



585389

Circuit Description

The Oil Level switch is a normally open switch. When the oil level is within an acceptable range the Oil Level switch closes. The switch opens when the engine oil level drops below a predetermined amount. The PCM tests the Engine Oil Level switch circuit with the ignition ON (engine OFF). The PCM monitors the engine coolant temperature to ensure proper engine oil drain back to the oil pan. When the engine is colder the engine oil drain back process takes a greater amount of time.

The PCM sends a message (via Class 2) to the IPC to turn ON the Oil Level indicator when the engine oil level drops below a predetermined value and the conditions for running the test are met.

Conditions for Testing for Low Engine Oil

- DTC P0117 and P0118 are not set.
- The ignition is ON with the engine OFF.
- The PCM compares the last ignition OFF engine coolant temperature (stored temperature) to the Ignition ON engine coolant temperature.
- If the PCM determines the Ignition ON engine coolant temperature is cooler then Ignition OFF engine coolant temperature by a predetermined amount, the PCM tests the Engine Oil Level sensor circuit. The following table illustrates the required temperatures to enable the Engine Oil Level test:

Low Engine Oil Level Coolant Temperature Enable Conditions		
Ignition ON Temperature	Minimum Stored Temperature to Run Test	Temperature Difference
–40°C (–40°F)	–15°C (5°F)	25°C (45°F)
–28°C (–18°F)	–15°C (5°F)	13°C (23°F)
–16°C to 140°C (3°F to 284°F)	–6°C to 130°C (21°F to 266°F)	10°C (18°F)

Conditions for Illuminating the Low Oil Level Indicator

The PCM detects a low oil level condition for 1 ignition cycle.

Conditions for Clearing the Low Engine Oil Level Indicator

- Repair the engine low oil level circuit or low oil level condition as necessary.
- Start and idle the engine.
- Allow the engine to reach operating temperature 90°C (194°F).
- Turn OFF the engine.
- The ignition must remain OFF for a minimum of 1 hour.
- The PCM tests the engine oil level circuit at ignition ON to determine the engine oil level is within range.
- The engine coolant temperature should decrease by 10°C (18°F). When you turn the ignition ON the conditions for performing the test should be met and the Low Engine Oil indicator clears.

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Diagnostic Aids

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the module. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The following may cause an intermittent:

- Inspect for poor connections; Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
- Corrosion
- Mis-routed harness
- Rubbed through wire insulation
- Broken wire inside the insulation

For an intermittent, refer to *Symptoms*.

Test Description

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

6. This step tests the Oil Level sensor signal circuit between the PCM and the sensor.
7. This step tests the Oil Level sensor ground circuit between the PCM and the sensor.
8. This step tests for an open in the Oil Level sensor signal circuit between the PCM and the Oil Level sensor.
9. This step tests the Oil Level signal circuit for a short to ground.
18. This step Clears the Low Oil Level message. The engine coolant temperature should decrease by 10°C (18°F).

Engine Oil Level Sensor/Switch Diagnosis

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	1. Ensure the vehicle is on a level surface. 2. Inspect the engine oil level. Is the oil level within range?	—	*Go to Step 3*	*Go to Step 17*
3	1. Install a scan tool. 2. Monitor the Engine Oil Level parameter using a scan tool. Does the scan tool display Low Oil Level as YES?	—	*Go to Step 6*	*Go to Step 4*
4	Is the customers concern that the engine oil level was low and the Low Oil Level indicator never illuminated?	—	*Go to Step 6*	*Go to Step 5*
5	Is the customers concern that oil was just added or that an oil change was just done and the Low Oil Level indicator did not clear?	—	*Go to Step 18*	Go to Diagnostic Aids
6	1. Turn ON the ignition leaving the engine OFF. 2. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information. 3. Disconnect the Oil Level sensor electrical connector. Refer to *Engine Oil Level Sensor Replacement (5.7 L)* in Instrument Panel, Gauges and Console. 4. Measure the voltage at the signal circuit at the Engine Oil Level sensor electrical connector to a known good ground using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Is the voltage at the specified value?	B+	*Go to Step 7*	*Go to Step 8*
7	Measure the voltage from the signal circuit to the ground circuit at the Engine Oil Level sensor electrical connector using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Is the voltage at the specified value?	B+	*Go to Step 10*	*Go to Step 11*

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Engine Oil Level Sensor/Switch Diagnosis (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn OFF the ignition. 2. Disconnect the PCM connectors. Refer to *PCM Replacement/Programming.* 3. Test continuity of the Engine Oil Level sensor signal circuit using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 9*	*Go to Step 12*
9	Probe the Engine Oil Level sensor signal circuit using the Test Lamp connected to B+. Does the test lamp illuminate?	—	*Go to Step 13*	*Go to Step 14*
10	1. Test the terminal tension of the Oil Level sensor electrical connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection, repair the connection as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 16*
11	Repair the open ground circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
12	Repair the open signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
13	Repair the short to ground in the signal circuit. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 18*	—
14	1. Inspect the PCM for faulty connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If faulty connections are found, repair as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 18*	*Go to Step 15*
15	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	*Go to Step 18*	—
16	Replace the Engine Oil Level sensor. Refer to *Engine Oil Level Sensor Replacement (5.7 L)* in Instrument Panel, Gauges and Console. Is the action complete?	—	*Go to Step 18*	—
17	Add the appropriate amount of oil. Is the action complete?	—	*Go to Step 18*	—
18	1. Start and idle the engine. 2. Allow the engine to reach the specified temperature. **Important:** The ignition must remain OFF for a minimum of one hour. 3. Turn OFF the ignition for one hour. Is the action complete?	90°C (194°F)	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

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, go to *Fuel System Diagnosis*.
6. The fuel pressure should reach a steady value. If the fuel pressure does not reach a steady value, go to *Fuel System Diagnosis*.
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.

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Fuel Injector Balance Test with Tech 2

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	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. 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.*** 1. Turn OFF the ignition. 2. Connect the *J 34730-1A* fuel pressure gauge to the fuel pressure test port. 3. Turn ON the ignition leaving the engine OFF. 4. Install the scan tool. 5. Energize the fuel pump using the scan tool. 6. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 7. Bleed the air out of the fuel pressure gauge. 8. Again energize the fuel pump using the scan tool. 9. Wait for the fuel pressure to build. **Important:** The fuel pump will run for approximately 2 seconds. Repeat step 8 as necessary in order to achieve the highest possible fuel pressure. 10. Observe the reading on the fuel pressure gauge while the fuel pump is running. Is the fuel pressure within the specified limits?	380–410 kPa (55–60 psi)	*Go to Step 6*	Go to *Fuel System Diagnosis*
6	After the fuel pump stops, the fuel pressure may vary slightly, then should hold steady. Does the fuel pressure remain constant within the specified value?	380–410 kPa (55–60 psi)	*Go to Step 7*	Go to *Fuel System Diagnosis*

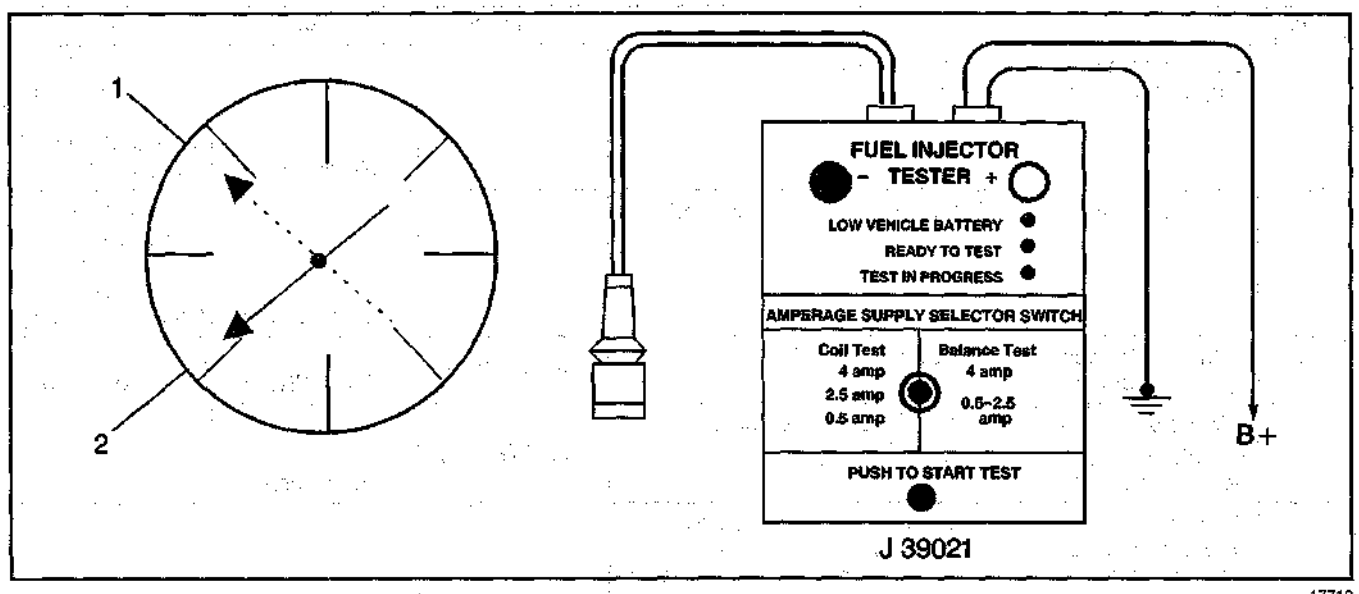
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Fuel Injector Balance Test with Tech 2 (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Turn OFF the ignition. 2. Turn ON the ignition leaving the engine OFF. 3. Select Special Functions from the scan tool menu. 4. Select Fuel Systems. 5. Select Injector Balance Test. 6. Select an injector to be tested. 7. Press Enter. This will prime the fuel pump. 8. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the 1st pressure reading. 9. Energize the fuel injector by depressing the Pulse Injector button on the scan tool. This will energize the injector and decrease the fuel pressure. 10. 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. 11. Press Enter again to bring you back to the Select Injector screen. 12. Repeat steps 6 through 11 for each fuel injector. 13. Subtract the 2nd pressure reading from the 1st pressure reading for one fuel injector. The result is the pressure drop value. 14. Obtain a pressure drop value for each fuel injector. 15. Add all of the individual pressure drop values. This is the total pressure drop. 16. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop. 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. Re-test any fuel injector that does not meet the specification. Refer to the procedure in step 7. 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 injector(s). Refer to *Fuel Injector Replacement.* Is the replacement complete?	—	System OK	—

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Fuel Injector Balance Test with Special Tool



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Legend

(1) First Reading

(2) Second Reading

Test Description

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, go to *Fuel System Diagnosis*.
6. The fuel pressure should reach a steady value. If the fuel pressure does not reach a steady value, go to *Fuel System Diagnosis*.
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 illustration above.

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Fuel Injector Balance Test with Special Tool

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	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. 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.*** 1. Turn OFF the ignition. 2. Connect the *J 34730-1A* fuel pressure gauge to the fuel pressure test port. 3. Turn ON the ignition leaving the engine OFF. 4. Install the scan tool. 5. Energize the fuel pump using the scan tool. 6. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 7. Bleed the air out of the fuel pressure gauge. 8. Again energize the fuel pump using the scan tool. 9. Wait for the fuel pressure to build. **Important:** The fuel pump will run for approximately 2 seconds. Repeat step 8 as necessary in order to achieve the highest possible fuel pressure. 10. Observe the reading on the fuel pressure gauge while the fuel pump is running. Is the fuel pressure within the specified limits?	380–410 kPa (55–60 psi)	*Go to Step 6*	Go to *Fuel System Diagnosis*
6	After the fuel pump stops, the fuel pressure may vary slightly, then should hold steady. Does the fuel pressure remain constant within the specified value?	380–410 kPa (55–60 psi)	*Go to Step 7*	Go to *Fuel System Diagnosis*

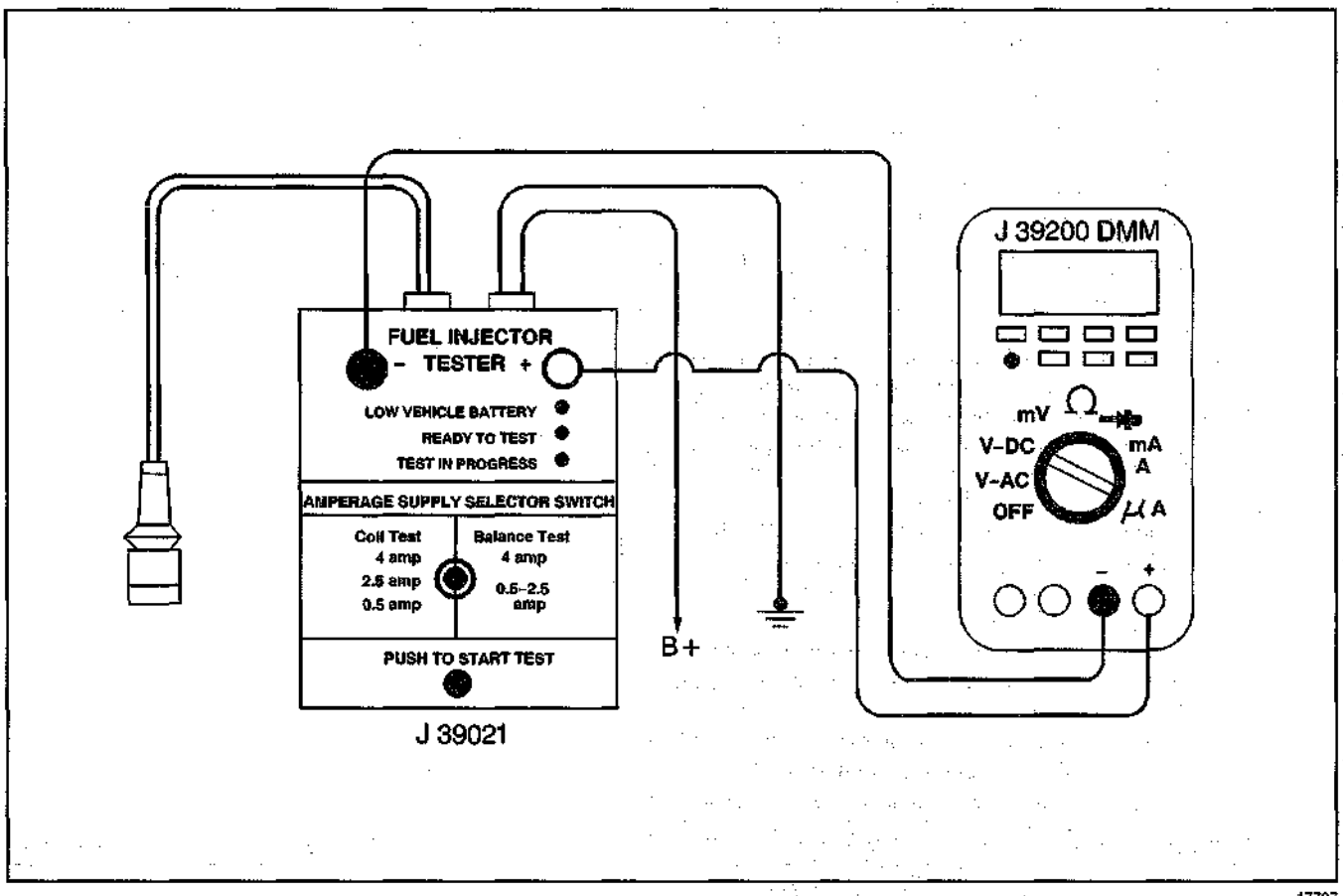
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Fuel Injector Balance Test with Special Tool (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Connect the J 39021 fuel injector tester to a fuel injector. 2. Set the amperage supply selector switch on the fuel injector tester to the Balance Test 0.5–2.5 amp position. 3. Energize the fuel pump using the scan tool in order to pressurize the fuel system. 4. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the 1st pressure reading (refer to (1) in the illustration). 5. Energize the fuel injector by depressing the Push to Start Test button on the fuel injector tester. 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 (refer to (2) in the illustration). 7. Repeat steps 1 through 6 for each fuel injector. 8. Subtract the 2nd pressure reading from the 1st pressure reading for one fuel injector. The result is the pressure drop value. 9. Obtain a pressure drop value for each fuel injector. 10. Add all of the individual pressure drop values. This is the total pressure drop. 11. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop. 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. Re-test any fuel injector that does not meet the specification. Refer to the procedure in step 7. 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 injector(s). Refer to *Fuel Injector Replacement*. Is the replacement complete?	—	System OK	—

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Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)



Test Description

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 and 35°C (50°F and 95°F), refer to *Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees 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	5.5–6.6V	
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
7	5.0	F
8	5.3	F

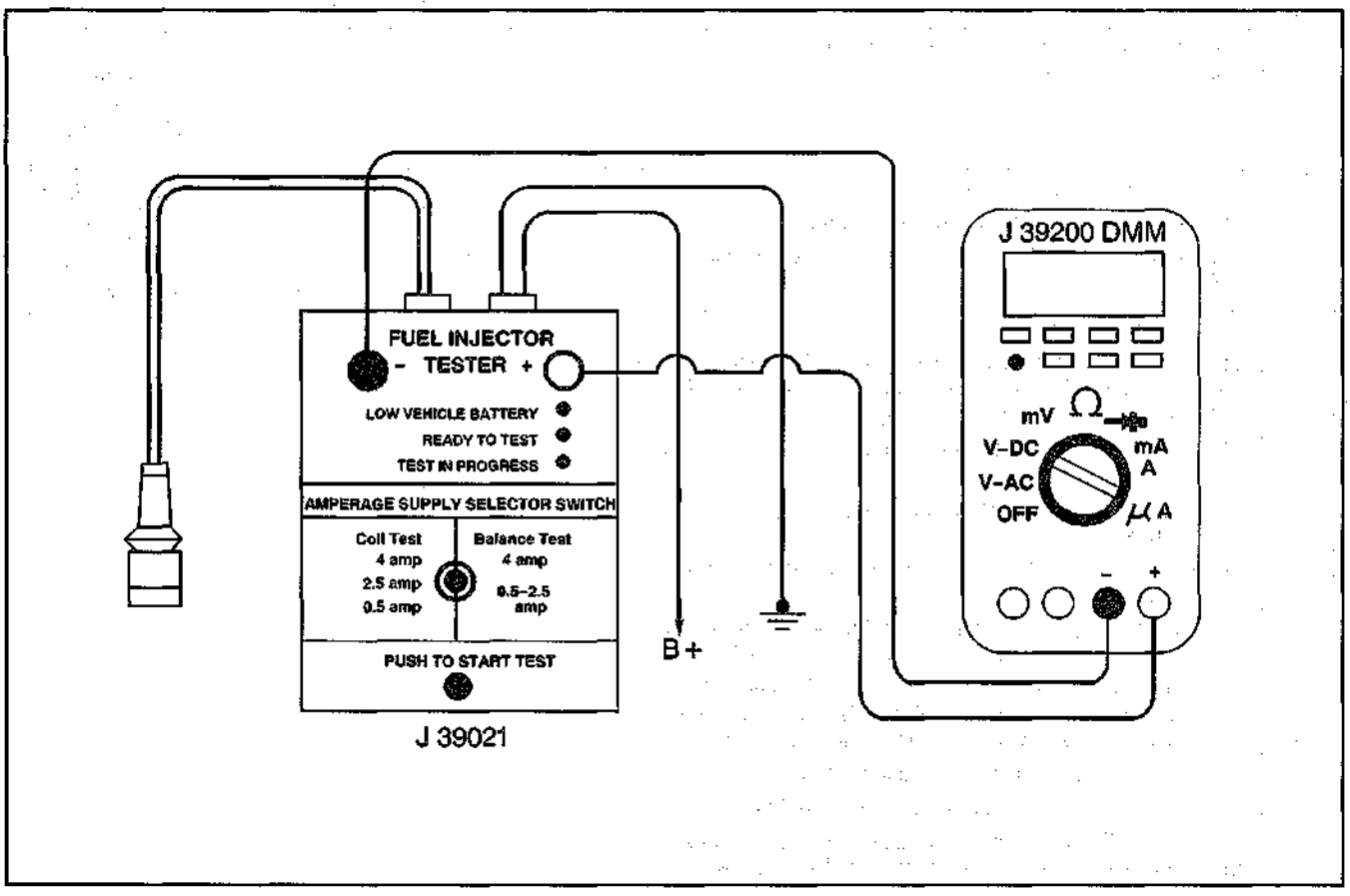
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Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees F)

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	1. Connect the scan tool. 2. Check the engine coolant temperature. Is the engine coolant temperature within 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. ***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. 2. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief Procedure.* 3. Access the fuel injector electrical connectors as required. 4. Connect the J 39021 fuel injector tester to B+ and ground. 5. Set the amperage supply selector switch on the fuel injector tester to the Coil Test 0.5 amp position. 6. Connect the leads from the *J 39200* Digital Multi Meter (DMM) to the fuel injector tester. Refer to the illustration associated with the test description. 7. Set the DMM to the tenths scale (0.0). 8. Connect the fuel injector tester to a fuel injector. **Important:** Check the engine coolant temperature again in order to ensure that the correct chart is being used. 9. Press the Push to Start Test button on the fuel injector tester. 10. Observe the voltage reading on the DMM. **Important:** The voltage reading may rise during the test. 11. Record the lowest voltage observed after the first second of the test. 12. Repeat steps 8 through 11 for each fuel injector. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that do not stabilize) or a voltage reading outside of the specified limits?	5.5–6.6V	*Go to Step 4*	Go to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool*
4	Replace the faulty fuel injector(s). Refer to *Fuel Injector Replacement.* Is the replacement complete?	—	Go to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool*	—

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Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)



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Test Description

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 between 10°C–35°C (50°F–95°F), refer to *Fuel Inj Coil Test - ECT Between 10-35 Degrees C (50-95 Degrees 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 greater than 0.6 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 V		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
7	9.6	—	F
8	6.0	1.1	F

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Fuel Inj Coil Test - ECT Outside 10-35 Degrees C (50-95 Degrees F)

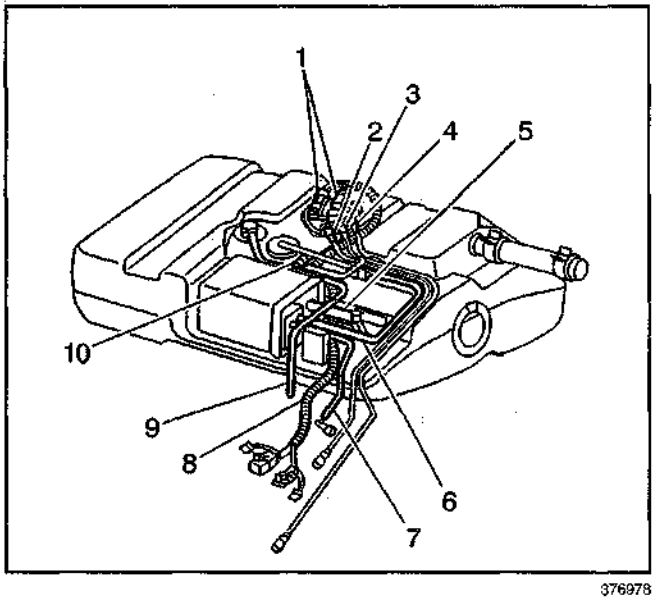
Step	Action	Value(s)	Yes	No
1	Did you perform the Powertrain On-Board Diagnostic (OBD) System Check?	—	*Go to Step 2*	Go to *A Powertrain On Board Diagnostic (OBD) System Check*
2	1. Connect the scan tool. 2. Check the engine coolant temperature. Is the engine coolant temperature outside the specified 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. ***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. 2. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief Procedure*. 3. Access the fuel injector electrical connectors as required. 4. Connect the J 39021 fuel injector tester to B+ and ground. 5. Set the amperage supply selector switch on the fuel injector tester to the Coil Test 0.5 amp position. 6. Connect the leads from the *J 39200* Digital Multi Meter (DMM) to the fuel injector tester. Refer to the illustration associated with the test description. 7. Set the DMM to the tenths scale (0.0). 8. Connect the fuel injector tester to a fuel injector. **Important:** Check the engine coolant temperature again in order to ensure that the correct chart is being used. 9. Press the Push to Start Test button on the fuel injector tester. 10. Observe the voltage reading on the DMM. **Important:** The voltage reading may rise during the test. 11. Record the lowest voltage observed after the first second of the test. 12. Repeat steps 8 through 11 for each fuel injector. 13. Identify the highest voltage reading recorded other than those above 9.5 volts. 14. Subtract any other voltage reading recorded from the highest voltage reading recorded. 15. Repeat step 14 for all the remaining fuel injectors. Is any value that resulted from subtraction greater than the specified value?	0.6V	*Go to Step 4*	Go to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool*
4	Replace any fuel injector that had any of the following: • A subtracted value exceeding 0.6 volts. • An initial reading above 9.5 volts. • An erratic reading. Refer to *Fuel Injector Replacement*. Is the replacement complete?	—	Go to *Fuel Injector Balance Test with Tech 2* or *Fuel Injector Balance Test with Special Tool*	—

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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 sender seal, a fuel fill pipe, a fuel fill hose, fuel fill hose clamps and a fuel filler cap to be installed in the fuel tank.



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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. Remove the EVAP vent valve. Refer to *EVAP Vent Valve Replacement.*
6. Remove the EVAP canister. Refer to *EVAP Canister Replacement.*
7. Remove the fuel feed pipe (4), the fuel return pipe (2), and the fuel sender EVAP pipe to fill limiter vent valve (3).
8. Plug the fuel feed pipe and the fuel return pipe on the fuel sender assembly.
9. Plug the fill limiter vent valve nipple (10).
10. Plug the over pressure relief valve hose (9).
11. Connect a piece of hose to the EVAP pipe (3) on the fuel sender assembly.

Notice: Do not submerge the fuel tank assembly in water in order to check for leaks in the fuel tank. Submerging the fuel tank in water may damage the electrical components mounted on the fuel tank.

12. Apply a soap solution to the outside of the fuel tank.
13. Apply 10 kPa (1½ psi) air pressure to the piece of hose on the fuel sender EVAP pipe. Air bubbles appearing from the fuel tank indicate a leak.
14. Replace the fuel tank if it is leaking. Refer to *Fuel Tank Replacement.*

Alcohol/Contaminants-in-Fuel Diagnosis

Alcohol-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. Commercial fuel uses various types and concentrations of alcohol. Some types of alcohol are more detrimental to fuel system components than others. If you suspect an excessive amount of alcohol in the fuel as the cause of a driveability condition, use the Alcohol-in-Fuel Testing Procedure to detect the presence of alcohol in the fuel.

Alcohol-in-Fuel Testing Procedure

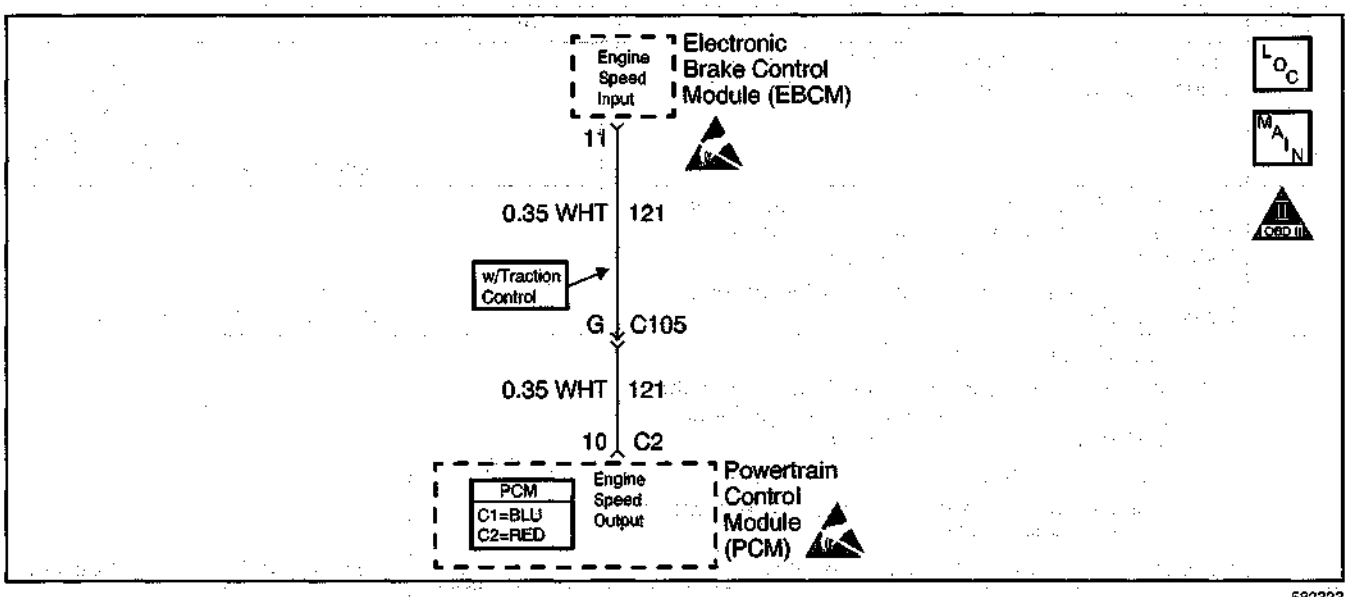
Draw the fuel sample from the bottom of the tank in order to detect any water present in the tank. The sample should be bright and clear. If the sample appears cloudy, or contaminated with water (as indicated by a water layer at the bottom of the sample), do not use this procedure. Refer to Fuel System Cleaning.

1. Fill a 100 ml cylinder with fuel to the 90 ml mark.
2. Add 10 ml of water to bring the total fluid volume to 100 ml. Install a stopper on the cylinder.
3. Shake the cylinder vigorously for 10 to 15 seconds.
4. Carefully loosen the stopper to release the pressure.
5. Close the stopper and shake the cylinder vigorously again for 10 to 15 seconds.
6. Put the graduated cylinder on a level surface for approximately 5 minutes 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 more than 10 ml. For example, if the volume of the lower layer increases to 15 ml, this indicates at least 5 percent alcohol in the fuel. The actual amount of alcohol may be somewhat more because this procedure does not extract all of the alcohol from the fuel.

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Engine Speed Output Circuit Diagnosis



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Circuit Description

The PCM creates the Engine Speed Output signal by rapidly grounding this circuit via an internal switch called a driver.

The driver supplies the ground for the component being controlled. Each driver has a fault line which the PCM monitors. When the PCM commands a component ON, the voltage of the control circuit should be low (near 0 volts). When the PCM commands the control circuit to a component OFF, the voltage potential of the circuit should be high (near battery voltage).

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure tht the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the Connector Test Adapter Kit *J 35616-A*. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

For an intermittent, refer to *Symptoms*.

Test Description

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

3. This step is verifying a voltage from the Instrument Cluster.
5. This step is testing for a short to ground.

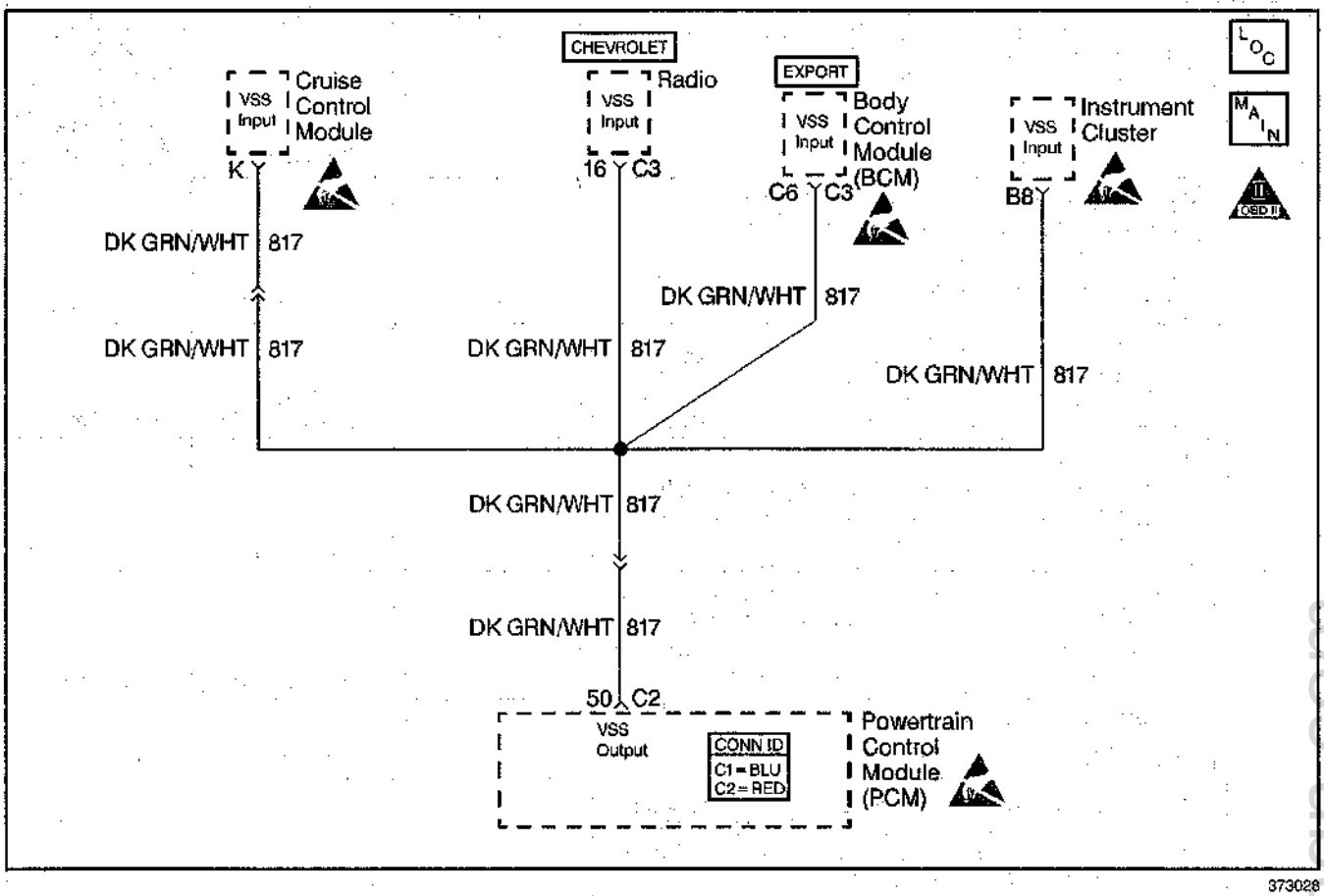
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Engine Speed Output Circuit Diagnosis

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	**Important:** If the I/P is completely inoperative, refer to *A Diagnostic System Check - Instrument Cluster* in Instrument Panel, Gauges and Console. With the engine running, does the vehicles tachometer indicate engine RPM?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming* 3. Turn ON the ignition. 4. Measure the Voltage from the engine speed circuit using the DMM *J 39200* Does the DMM display the specified value?	B+	*Go to Step 7*	*Go to Step 4*
4	1. Remove the Instrument Cluster. Refer to *IP Cluster Replacement* in Instrument Panel, Gauges and Console. 2. Test the continuity of the engine speed circuit using the DMM *J 39200*. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	—	*Go to Step 5*	*Go to Step 6*
5	Test the continuity of the engine speed circuit using the DMM *J 39200*. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM display continuity?	—	*Go to Step 6*	Go to *A Diagnostic System Check - Instrument Cluster* in Instrument Panel Gauges and Console.
6	Repair the engine speed circuit for an open or a short to ground. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	*Go to Step 9*	—
7	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the terminal as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	*Go to Step 9*	*Go to Step 7*
8	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming* Replace the PCM. Is the action complete?	—	*Go to Step 9*	—
9	Select the Capture Info option and the Review Info option using the scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to the applicable DTC table	System OK

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Vehicle Speed Output Circuit Diagnosis



Circuit Description

Various components apply a voltage to the Vehicle Speed Output circuit. The PCM creates the Vehicle Speed Output signal by rapidly grounding this circuit via an internal switch called a driver. The driver operates at the same rate as the VSS signal input. The various components recognize the voltage being pulled to ground as an indication of vehicle speed.

The driver supplies the ground for the component being controlled. When the PCM commands a component ON, the voltage of the control circuit should be low (near 0 volts). When the PCM commands the control circuit to a component OFF, the voltage potential of the circuit should be high (near battery voltage).

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the *J 35616-A* connector test adapter kit. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the condition, the information included in the Freeze Frame and/or Failure Records data can aid in determining how many miles since the condition occurred.

For an intermittent, refer to *Symptoms*.

Test Description

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

3. This step tests for a voltage to the PCM.
5. This step tests for a short to ground.

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Vehicle Speed Output Circuit Diagnosis

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	**Important:** If the IPC is completely inoperative, refer to *A Diagnostic System Check - Instrument Cluster* in Instrument Panel, Gauges and Console. 1. Turn OFF the ignition. 2. Raise the drive wheels. 3. Start the engine. 4. Disable the ASR/TCS systems (if so equipped). 5. Allow the engine to idle in gear. Does the vehicles speedometer indicate vehicle speed?	—	Go to Diagnostic Aids	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the PCM connector C2 located on the opposite side of the manufacturer's logo. Refer to *PCM Replacement/Programming.* 3. Turn ON the ignition leaving the engine OFF. 4. Measure the voltage from the Vehicle Speed Output circuit at the PCM harness connector, using the DMM. Refer to *Measuring Voltage* in Wiring Systems. Does the DMM indicate the specified value?	B+	*Go to Step 8*	*Go to Step 4*
4	1. Turn OFF the ignition. 2. Remove the IPC. Refer to *IP Cluster Replacement* in Instrument Panel, Gauges and Console. 3. Test the continuity of the Vehicle Speed Output circuit between the PCM harness connector and the I/P harness connector, using the DMM. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 5*	*Go to Step 7*
5	Test the continuity of the Vehicle Speed Output circuit between the PCM harness connector and the I/P harness connector, using the DMM connected to battery ground. Refer to *Testing for Continuity* in Wiring Systems. Does the DMM indicate continuity?	—	*Go to Step 7*	*Go to Step 6*
6	1. Inspect for a poor connection at the IPC. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	System OK	Go to *A Diagnostic System Check - Instrument Cluster* in Instrument Panel, Gauges and Console
7	Repair the Vehicle Speed Output circuit for an open or short to ground. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
8	1. Inspect for poor connections at the PCM. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If you find a poor connection repair the condition as necessary. Refer to *Repairing Connector Terminals* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 9*
9	**Important:** Program the replacement PCM. Refer to *PCM Replacement/Programming.* Replace the PCM. Is the action complete?	—	System OK	—

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Electronic Ignition (EI) System Diagnosis

Refer to Engine Controls Schematics, *Ignition Coils/Modules, Bank 1* or *Ignition Coils/Modules, Bank 2* for complete circuit details.

Circuit Description

A Crankshaft Position (CKP) sensor determines the engine crankshaft position. The sensor is mounted and protrudes into the rear of the engine block. The sensor is near a slotted wheel on the crankshaft. The rotation of the slotted wheel causes a magnetic flux change in the sensor. This produces a voltage signal from the electronic Ignition Control Module (ICM). The signal creates the reference pulses needed by the Powertrain Control Module (PCM). These signals trigger the correct ignition coil to fire, at the correct time.

The ignition system on this engine uses an individual ignition coil/module for each cylinder. The PCM controls the ignition system operation. There are eight Ignition Control (IC) circuits, one per cylinder, that connect the PCM and the ignition coil/modules. Each ignition coil/module has a power feed, a chassis ground circuit, and a reference low circuit. The PCM causes a spark to occur by grounding the IC circuit, which signals the ignition module to trigger the ignition coil and fire the spark plug. The PCM controls the sequencing and timing.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent water intrusion into the PCM.
- For any test that requires probing the PCM or component harness connectors, use the Connector Test Adapter Kit *J 35616-A*. Using this kit prevents any damage to the harness connector terminals. Refer to *Using Connector Test Adapters* in Wiring Systems.

The following may cause an intermittent:

- Inspect for poor connections. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems.
- Corrosion
- Mis-routed harness
- Rubbed through wire insulation
- Broken wire inside the insulation

Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the condition, the information included in the Freeze Frame and/or Failure Records data can help determine how many miles since the condition occurred. Operate vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that you observed. This will isolate when the condition occurred.

For an intermittent condition, refer to *Symptoms*.

Test Description

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

3. Monitoring the Misfire Current Counters determines if a fault is present.
4. A good indication that the fuse is open is more than 2 of the Misfire Current Counters are incrementing on one side of the engine. Inspect the ignition feed circuit for a grounded circuit.
8. If the fuse is open and no condition can be found with the ignition coil/module circuits, inspect the injector circuits for being grounded. The INJ1 fuse and INJ2 fuse feed the ignition coil/module circuits and injector circuits.

Electronic Ignition (EI) System Diagnosis

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 DTCs P0200, P0300, P0335, P0336, P0351 – P0358 set?	—	Go to the applicable DTC table	*Go to Step 3*

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Electronic Ignition (EI) System Diagnosis (cont'd)

Step	Action	Value(s)	Yes	No
3	**Important:** This table assumes that there are no injector circuit malfunctions or mechanical malfunctions. If you were not sent here from DTC P0300, refer to *DTC P0300 Engine Misfire Detected* before proceeding with this table. If more than one cylinder is misfiring on one side of the engine, inspect the ignition coil/module ground circuit for an open. 1. Install a scan tool. 2. Idle the engine. 3. Using a scan tool, monitor all the Misfire Current counters on the misfire data list. There are a total of 8 counters, one counter per cylinder. Are any of the Misfire Current counters incrementing?	—	*Go to Step 4*	Go to Diagnostic Aids
4	Are the Misfire Current Counters incrementing for 2 or more cylinders on one bank of the engine?	—	*Go to Step 8*	*Go to Step 5*
5	1. Turn OFF the ignition. 2. Disconnect the ignition coil/module electrical harness connector that corresponds to the Misfire Current Counter(s) that was incrementing. 3. Turn ON the ignition leaving the engine OFF. 4. Probe the ignition feed circuit at the ignition coil/module electrical connector using the test lamp *J 34142-B* connected to battery ground. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 6*	*Go to Step 10*
6	Using the test lamp *J 34142-B* probe the ignition feed circuit at the ignition coil/module electrical connector to the ignition coil/module ground circuit. Does the test lamp illuminate?	—	*Go to Step 7*	*Go to Step 13*
7	Using the test lamp *J 34142-B* probe the ignition feed circuit at the ignition coil/module electrical connector to the ignition coil/module reference low circuit. Does the test lamp illuminate?	—	*Go to Step 21*	*Go to Step 17*
8	1. Inspect for an open ignition coil/module fuse (INJ1 or INJ2). 2. Locate and repair the ignition feed circuit for grounded circuit if the fuse is open. Refer to *Wiring Repairs* in Wiring Systems. 3. Replace the fuse. Did you find and correct the condition?	—	System OK	*Go to Step 9*
9	Repair the open in the ignition feed circuit between the fuse block and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
10	1. Disconnect the main ignition coil/module 8-way connector. 2. Probe the ignition feed circuit at the ignition coil/module main 8-way connector using the test lamp *J 34142-B* connected to battery ground (fuse side of harness). Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 11*	*Go to Step 12*
11	Repair the open circuit between the main 8-way harness connector and the ignition coil/module connector. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—

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Electronic Ignition (EI) System Diagnosis (cont'd)

Step	Action	Value(s)	Yes	No
12	Repair the open ignition feed circuit between the fuse block (open fuse) and the main ignition coil/module 8-way harness connector. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
13	1. Disconnect the main ignition coil/module 8-way connector. 2. Using the test lamp *J 34142-B* probe the ignition feed circuit to the ignition coil/module ground circuit at the ignition coil/module main electrical 8-way connector. Refer to *Probing Electrical Connectors* in Wiring Systems. Does the test lamp illuminate?	—	*Go to Step 14*	*Go to Step 16*
14	1. Inspect for a poor connection at the main ignition coil/module electrical 8-way connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. Repair poor connections as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 15*
15	Repair the open ground circuit between the main 8-way connector and the ignition coil/module connector. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
16	Repair the open ground circuit between the ground and the main 8-way connector. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
17	1. Disconnect the main ignition coil/module 8-way connector. 2. Using the test lamp *J 34142-B* probe the ignition feed circuit at the ignition coil/module main electrical 8-way connector to the ignition coil/module reference low circuit. Does the test lamp illuminate?	—	*Go to Step 18*	*Go to Step 20*
18	1. Inspect for a poor connection at the main ignition coil/module electrical 8-way connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. If a poor connection is found, repair as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 19*
19	Repair the open reference low circuit between the main 8-way connector and the ignition coil/module connector. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
20	Repair the open reference low circuit between the PCM and the splice. Refer to *Wiring Repairs* in Wiring Systems. Is the action complete?	—	System OK	—
21	1. Inspect for poor connections at the ignition coil/module harness connector. Refer to *Testing for Intermittent and Poor Connections* in Wiring Systems. 2. Repair poor connections as necessary. Refer to *Connector Repairs* in Wiring Systems. Did you find and correct the condition?	—	System OK	*Go to Step 22*
22	Replace ignition coil/module. Refer to *Ignition Coil Replacement (5.7 L)* in Engine Electrical. Is the action complete?	—	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	DTC(s) Used to Set System Status
Catalyst	P0420, P0430
HO2S	P0133, P0153, P1133, P1134, P1153, and P1154
HO2S Heater	P0135, P0141, P0155, and P0161
EGR System	P0401
EVAP System	P0440, P0442, P0446, P1441, or the Service Bay Test
AIR System	P0410

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 the Service Bay Tests for important preliminary instructions.

Service Bay Test

Service Bay Tests are included on the scan tool for some EVAP systems depending upon the vehicle make and model. They may be used to test certain EVAP systems and reset the System Status to Complete. The EVAP Service Bay Test is included for this vehicle.

Important: Ensure the vehicle meets the following requirements before performing the EVAP Service Bay Test. Failure to meet the necessary requirements may cause inaccurate test results or a EVAP Service Bay Test which will not run completely. This could lead to mis-diagnosis and unnecessary parts replacement.

The EVAP Service Bay Test can be performed when the vehicle meets the following conditions:

- The Powertrain OBD System Check has been performed
- There are no DTCs set
- The battery voltage is between 10.5 and 17.5 volts
- The fuel level is between 15 percent and 85 percent.
- The powerup engine coolant temperature (ECT) is less than 80°C (176°F)

Use the scan tool to perform the EVAP Service Bay Test. The instructions for performing the EVAP Service Bay Test will be displayed on the scan tool.

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Repair Instructions

PCM Replacement/Programming

Service of the PCM should normally consist of either replacement of the PCM or EEPROM programming. If the diagnostic procedures call for the PCM to be replaced, the PCM should be checked first to see if it is the correct part. If it is, remove the faulty PCM and install the new service PCM.

THE SERVICE PCM EEPROM WILL NOT BE PROGRAMMED. DTC P0601 and P0602 indicates the EEPROM is not programmed or has malfunctioned.

Important: The following must be performed anytime the PCM is replaced:

1. Program the PCM
2. The Idle Learn Procedure
3. The CKP System Variation Learn Procedure
4. The Engine Oil Life Reset Procedure
5. The Functional Check

The following must be performed anytime the PCM is disconnected, reprogrammed or loses power:

1. The Idle Learn Procedure
2. The Functional Check

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: Ensure that the hood is free of contaminates (moisture) before servicing the PCM. The moisture flows into the PCM connector body when the PCM is disconnected and the hood is opened.

Removal Procedure

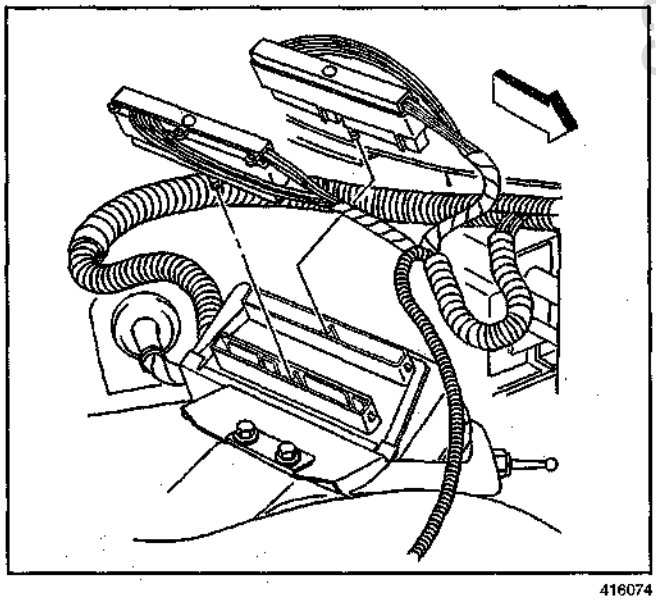
Important: Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM module connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.

1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.

Notice: Do not touch the connector pins or soldered components on the circuit board in order to prevent possible electrostatic discharge (ESD) damage to the PCM.

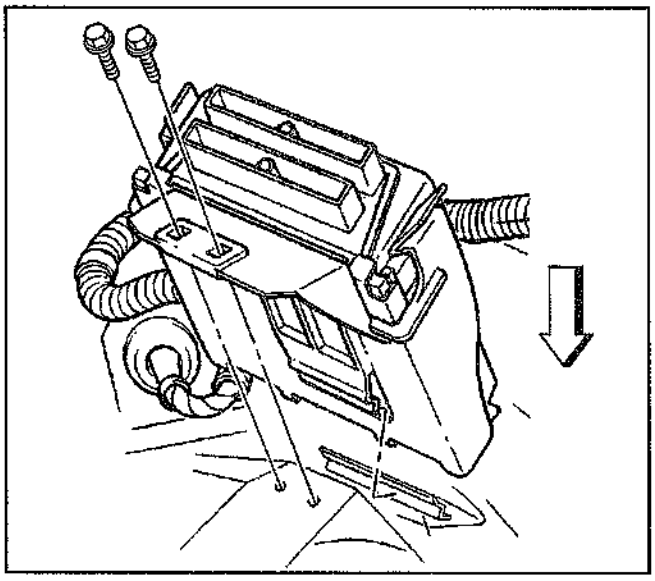
Notice: In order to prevent internal damage to the PCM, the ignition must be OFF when disconnecting or reconnecting the PCM connector.

2. Disconnect the PCM connectors.



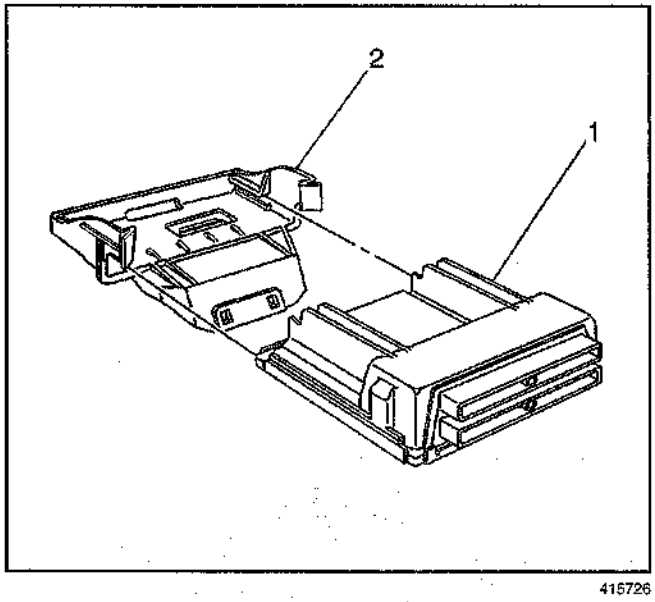
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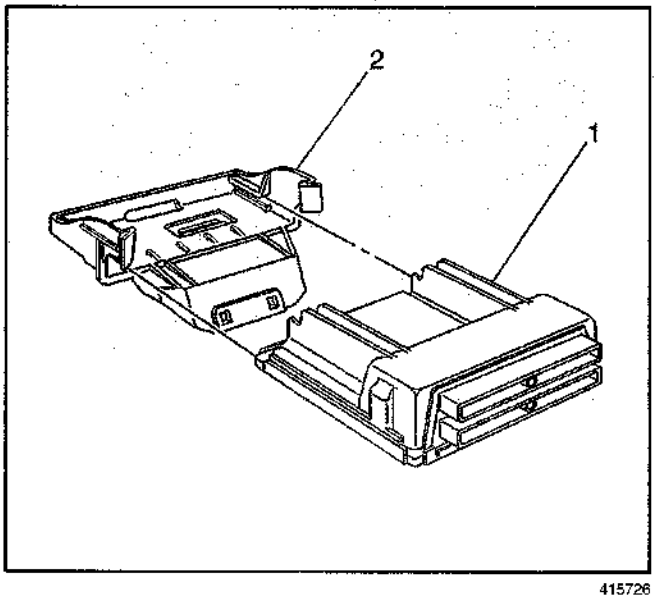
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3. Remove the mounting fasteners from the PCM bracket.



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4. Remove the PCM and mounting bracket assembly from the engine compartment.
5. Remove the PCM (1) from the mounting bracket (2).



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Installation Procedure

Notice: Do not touch the connector pins or soldered components on the circuit board in order to prevent possible electrostatic discharge (ESD) damage to the PCM.

Notice: In order to prevent internal damage to the PCM, the ignition must be OFF when disconnecting or reconnecting the PCM connector.

1. Install the PCM (1) to the mounting bracket (2).

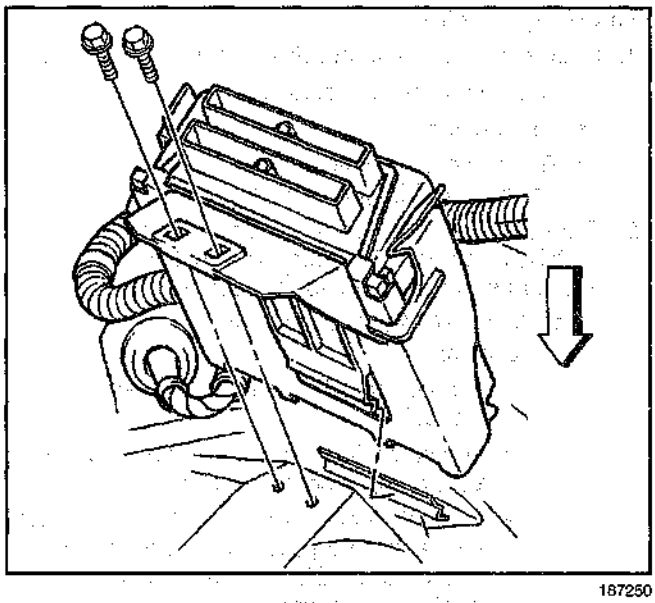
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Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the PCM and mounting bracket assembly into the vehicle.

   Tighten

   Tighten the mounting bracket fasteners to 7 N·m(62 lb in).



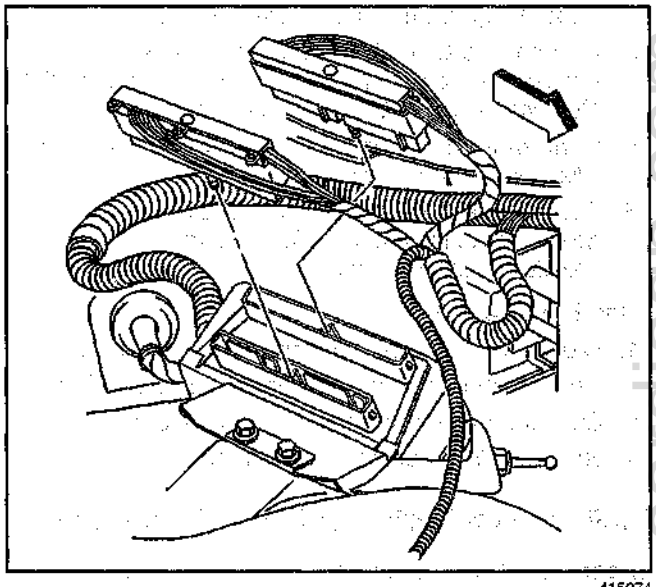
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3. Reconnect the PCM connectors.

   Tighten

   Tighten the PCM connector end fasteners to 8 N·m (70 lb in).

4. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
5. If a new PCM is being installed, program the PCM.



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PCM Programming

1. Ensure the following conditions have been met:
   - The battery is fully charged.
   - The ignition is ON.
   - The cable connection at the Data Link Connector (DLC) is secure.
2. Program the PCM using the latest software matching the vehicle. Refer to Techline terminal/equipment users instructions.
   2.1. If the PCM fails to program, proceed as follows:
      - Ensure that all PCM connections are OK.
      - Check the Techline terminal/equipment for the latest software version.
      - Attempt to program the PCM. If the PCM still cannot be programmed properly, replace the PCM. The replacement PCM must be programmed.

   2.2. Program the replacement PCM.
3. Perform the CKP System Variation Learn Procedure if a new PCM is installed. Refer to *CKP System Variation Learn Procedure.*
4. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure.*
5. Perform the Engine Oil Life Reset procedure if a new PCM is installed. Refer to *Engine Oil Life Monitor Reset Procedure.*

Functional Check

1. Clear the Diagnostic Trouble Codes (DTCs).
2. Perform the On-Board Diagnostic System Check.
3. Start the engine and idle for one minute.
4. Scan for DTCs using the scan tool.

CKP System Variation Learn Procedure

Important: While the learn procedure is in progress, release the throttle immediately when the engine starts to decelerate. The engine control is returned to the operator and the engine will respond to throttle position after the learn procedure is complete.

1. Install the scan tool.
2. Apply the vehicle's parking brake.
3. Block the drive wheels.
4. Close the vehicle's hood.
5. Place the vehicle's transmission in Park (A/T) or Neutral (M/T).
6. Idle the engine until the engine coolant temperature reaches 65°C (150°F).
7. Turn OFF all the accessories.
8. Apply the brakes for the duration of the procedure.

Important: If the CKP System Variation Learn Procedure cannot be completed successfully, refer to *DTC P1336 Crankshaft Position (CKP) System Variation Not Learned* for additional diagnostic information.

9. Enable the Crankshaft Position System Variation Learn Procedure with the scan tool.
10. Slowly raise the engine speed to 4000 RPM.
11. Immediately release the throttle when the engine speed decreases.
12. Turn OFF the ignition for 15 seconds after the learn procedure is completed successfully.

PCM Idle Learn Procedure

Idle Learn Procedure

Anytime the powertrain control module (PCM) or the battery is disconnected, the PCM loses power, or the PCM is reprogrammed, the PCM's learned idle position is lost. The engine idle is unstable when the learned idle position is lost.

Perform the following procedure in order to return the learned idle to the correct position:

Automatic Transmission

1. Turn OFF the ignition.
2. Restore the PCM battery feed.
3. Turn OFF the A/C controls.
4. Set the parking brake and block the drive wheels.
5. Start the engine.
6. Ensure that the engine coolant temperature is more than 80°C (176°F).
7. Shift the transmission into Drive.
8. Allow the engine to idle for 5 minutes.
9. Shift the transmission into Park.
10. Allow the engine to idle for 5 minutes.
11. Turn OFF the engine for 30 seconds.

Manual Transmission

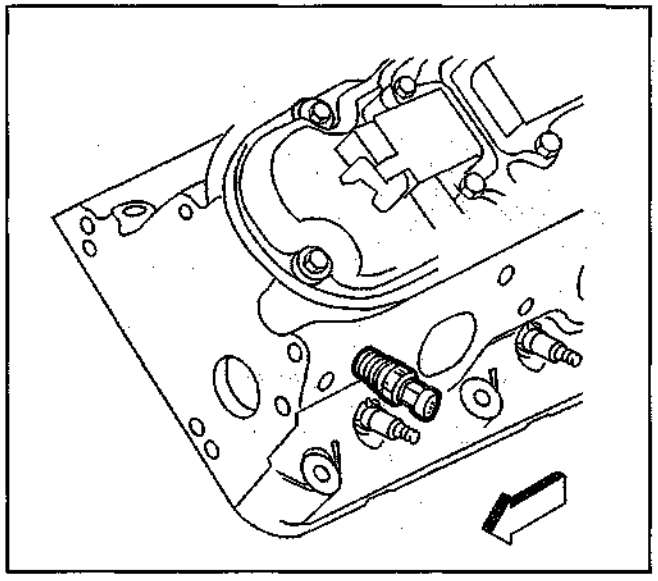
1. Turn OFF the ignition.
2. Restore the PCM battery feed.
3. Turn OFF the A/C controls.
4. Set the parking brake and block the drive wheels.
5. Place the transmission in Neutral.
6. Start the engine.
7. Ensure that the engine coolant temperature is more than 80°C (176°F).
8. Allow the engine to idle for 5 minutes.
9. Turn OFF the engine for 30 seconds.

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ECT Sensor Replacement

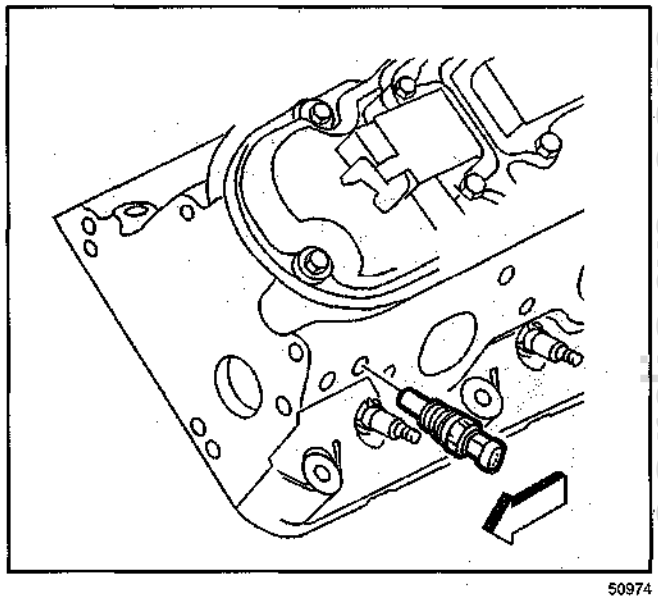
Removal Procedure

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Drain the engine coolant. Refer to *Draining and Filling Cooling System (5.7 L)* in Engine Cooling.
3. Lower the vehicle.
4. Disconnect the electrical connector from the ECT sensor.


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Notice: Use care when handling the coolant sensor. Damage to the coolant sensor will affect the operation of the fuel control system.

5. Remove the ECT sensor.


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Installation Procedure

Notice: Use care when handling the coolant sensor. Damage to the coolant sensor will affect the operation of the fuel control system.

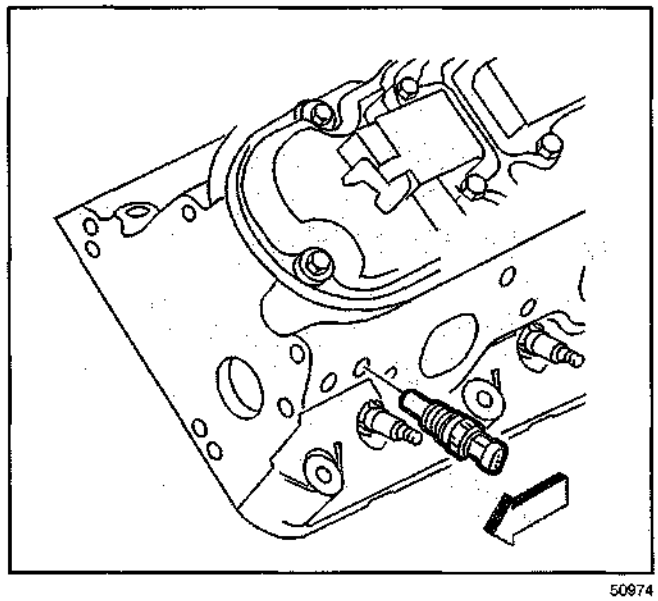
1. Coat the Engine Coolant Temperature (ECT) sensor threads with sealer P/N 12346004 or the equivalent.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

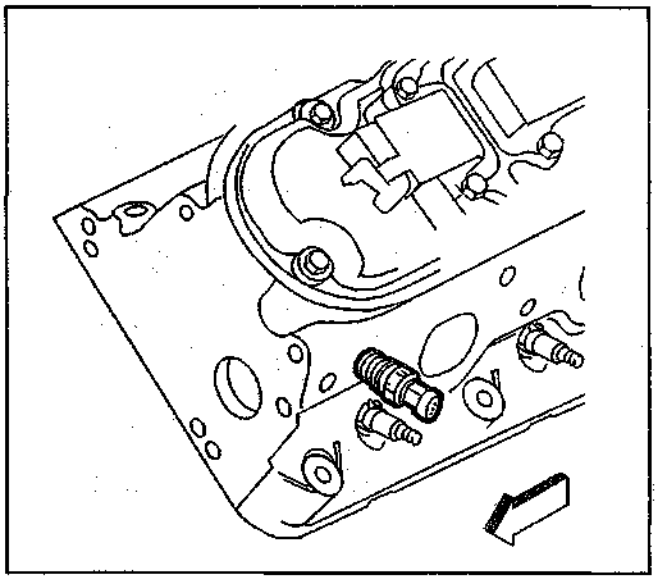
2. Install the ECT sensor.

   Tighten

   Tighten the ECT sensor to 23 N·m (17 lb ft).

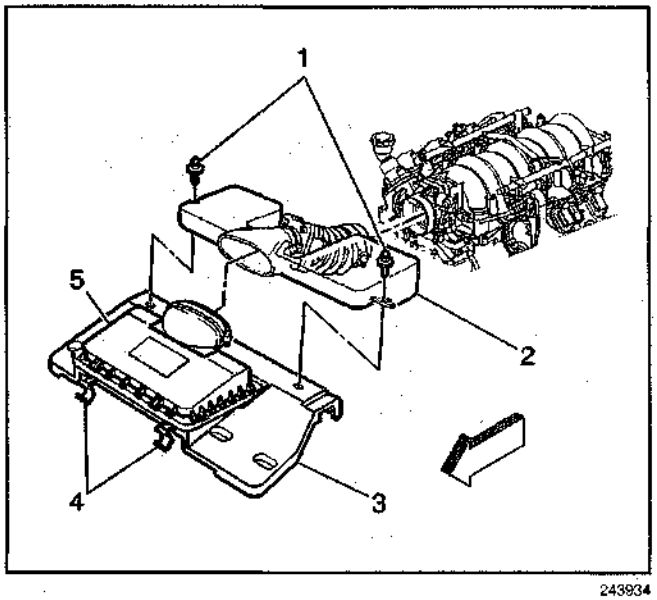

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3. Connect the ECT sensor electrical connector.
4. Refill the engine coolant. Refer to *Draining and Filling Cooling System (5.7 L)* in Engine Cooling.
5. Start the engine and inspect for leaks.
6. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure*.



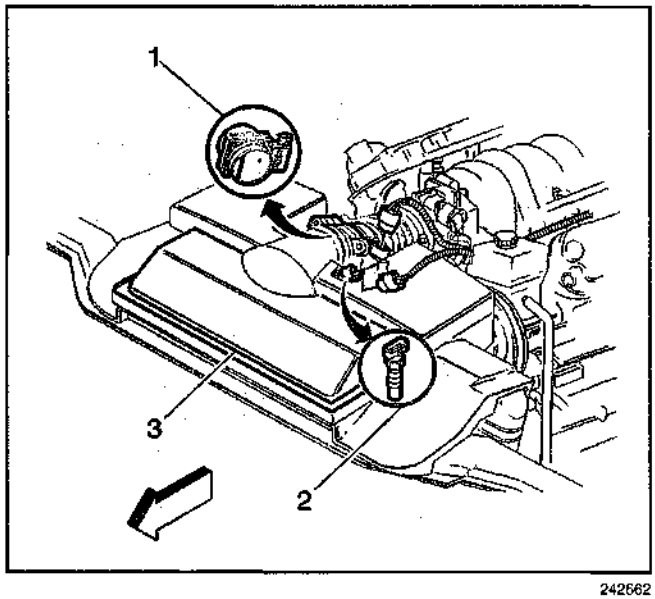
243934

MAF Sensor Replacement

Removal Procedure

Important: Take care when handling the MAF sensor. Do not dent, puncture, or otherwise damage the Honeycell located at the air inlet end of the MAF sensor. Do not touch the sensing elements or allow anything including cleaning solvents and lubricants to come in contact with them. Use a small amount of a non-silicone based lubricant on the air duct only, to aid in installation. Do not drop or roughly handle the MAF sensor.

1. Release Air Cleaner Housing front latches (4).
2. Remove the retainers (1) holding the resonator to radiator core support (3).



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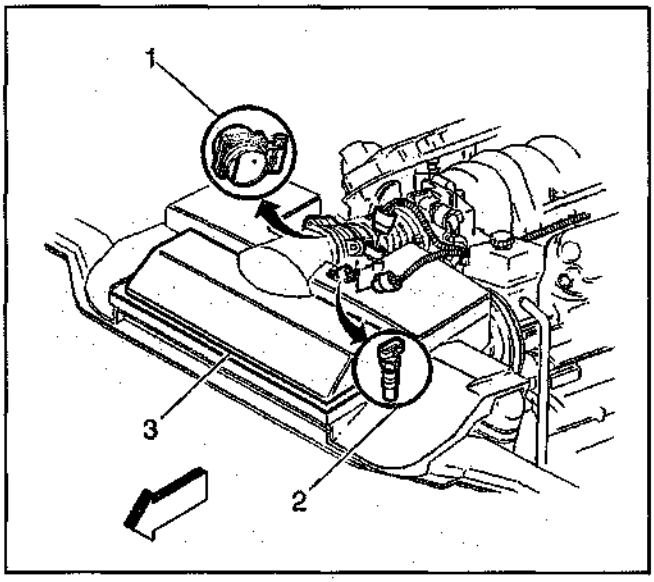
3. Disconnect the MAF sensor (1) electrical connector.
4. Remove the clamp from the MAF sensor (1) at the resonator.
5. Remove the clamp from the MAF sensor (1) at the air intake duct.
6. Remove the MAF sensor (1).

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Installation Procedure

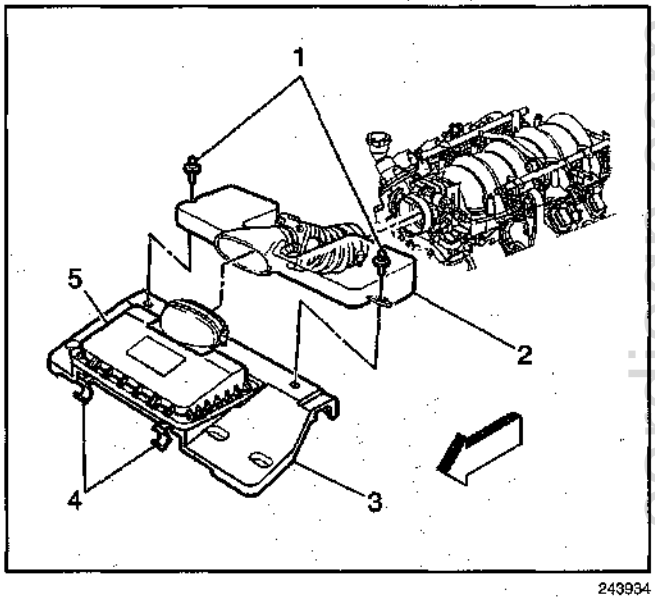
Important: The embossed arrows on the MAF sensor indicate the proper air flow direction. The arrows must point toward the engine.

1. Install the MAF sensor (1) into the air intake duct and resonator.
2. Install the clamp at the MAF sensor (1) to the air intake duct.
3. Install the clamp at the MAF sensor (1) to the resonator.



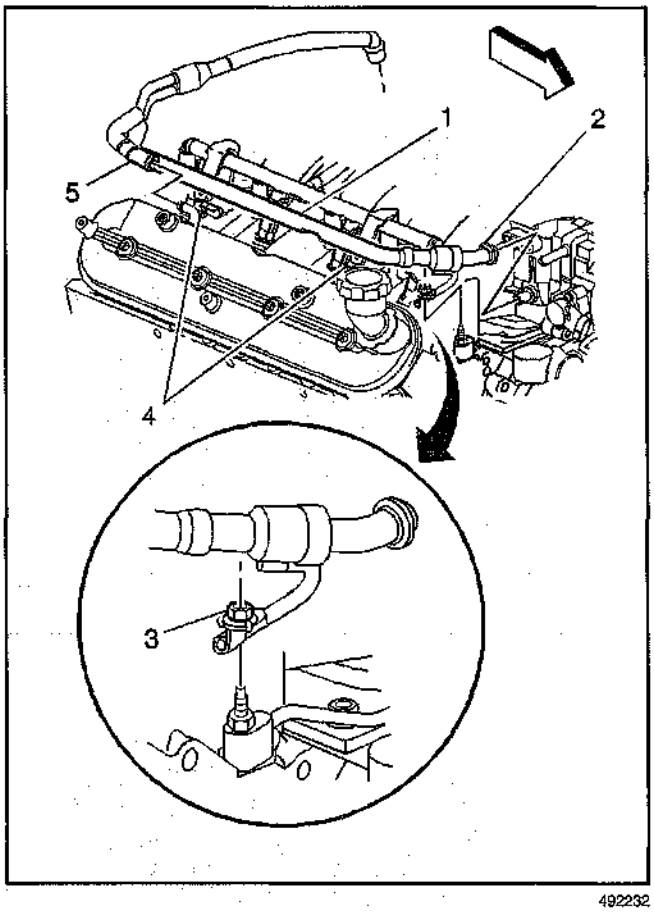
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4. Install the retainers (1) holding the resonator (2) to radiator core support (3).
5. Secure the Air Cleaner Housing front latches (4).
6. Connect the electrical connector.



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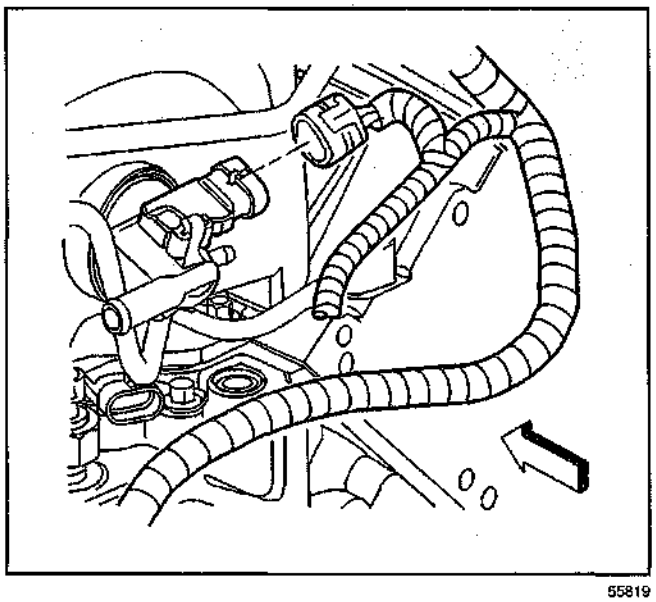


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MAP Sensor Replacement

Removal Procedure

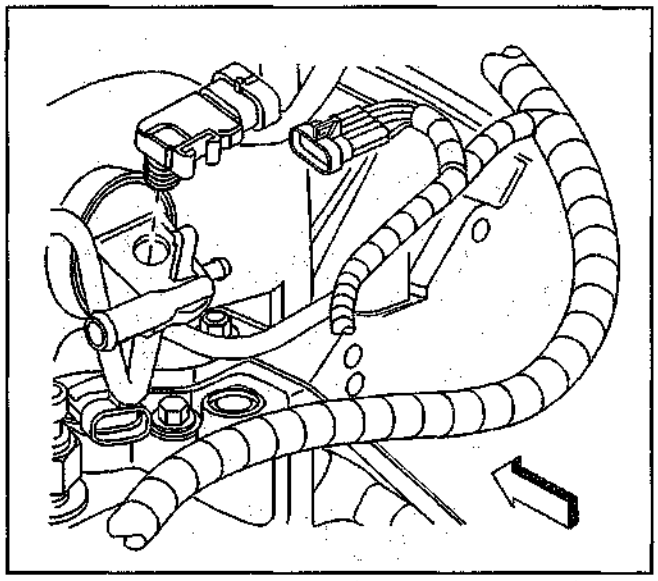
1. Remove the PCV heat exchange cable fastener (3).
2. Remove the PCV hose (2) from the throttle body.
3. Remove the PCV hose (5) from the right bank port.
4. Release the PCV hose assembly from the mounting brackets (4).
5. Move the PCV hose assembly (1) aside.


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6. Disconnect the MAP sensor electrical connector.

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7. Twist the MAP sensor forward in order to release the sensor from the retainer.
8. Pull the sensor upward.

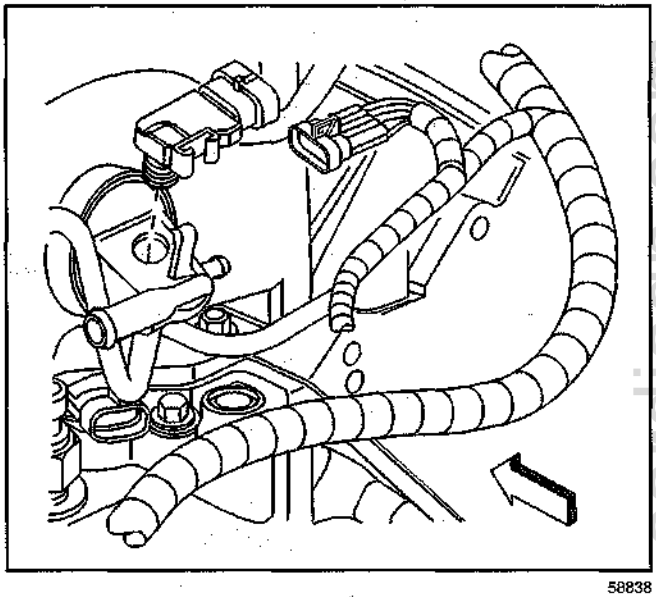


58836

Installation Procedure

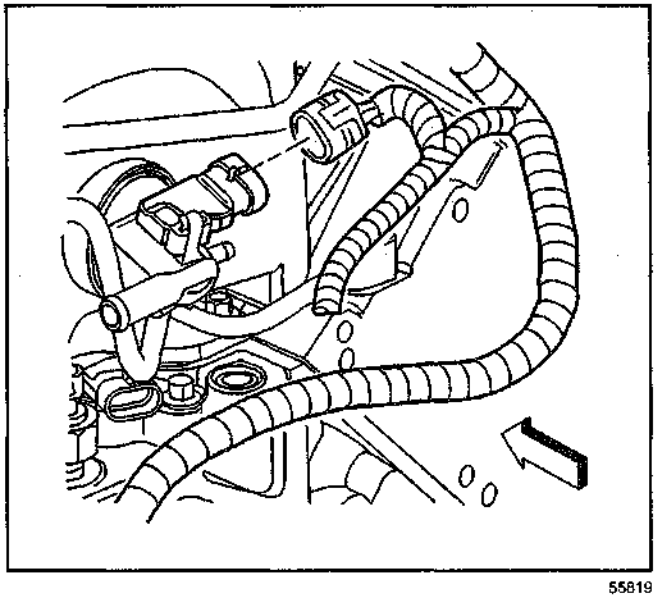
Important: Lightly coat the MAP sensor seal with clean engine oil before installing the sensor.

1. Install the MAP sensor. Push the MAP sensor down in order to engage the sensor into the retainer.



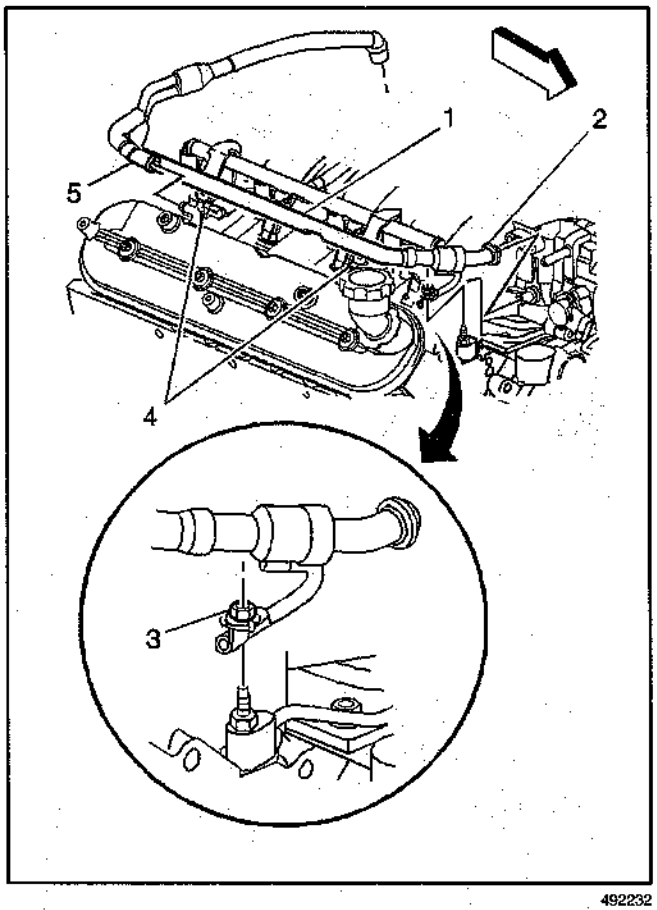
58838

2. Connect the MAP sensor electrical connector.



55819

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492232

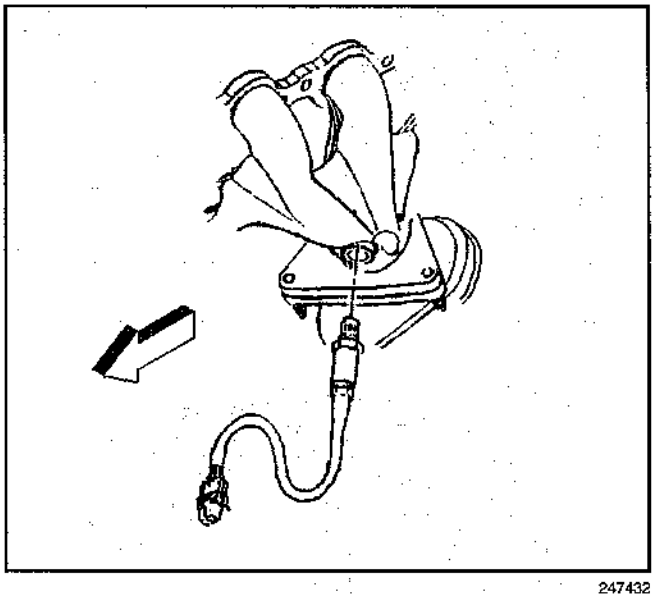
3. Position the PCV hose assembly (1) for reassembly.
4. Insert the PCV hose assembly to the mounting brackets (4).
5. Install the PCV hose (5) to the right bank port.
6. Install the PCV hose (2) to the throttle body.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

7. Install the PCV heat exchange cable fastener (3).

   Tighten

   Tighten the PCV heat exchange cable fastener to 12 N·m (106 lb in).



247432

Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1

Notice: The heated oxygen sensors each use a permanently attached pigtail and connector. Do not remove the pigtail from the heated oxygen sensor. Damage or removal of the pigtail or the connector affects proper operation of the heated oxygen sensor. Handle the oxygen sensor carefully. Do not drop the oxygen sensor. Keep the in-line connector and the louvered end free of grease, dirt, or other contaminants. Do not use cleaning solvents of any type. Do not repair the wiring, the connector, or the terminals. Replace the oxygen sensor if the pigtail wiring, the terminals, or the connector is damaged. Proper oxygen sensor operation requires an external air reference. This external air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, the connectors, or the terminals results in the obstruction of the air reference and degrades the oxygen sensor performance. A dropped oxygen sensor is a bad oxygen sensor.

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Removal Procedure

Important: The heated oxygen sensor may be difficult to remove when the engine temperature is below 48°C (120°F). Excessive force may damage the threads in the exhaust manifold or exhaust pipe. It may be necessary to lower the exhaust system to gain sufficient access to a HO2S and/or it's connector.

1. Raise 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.

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.

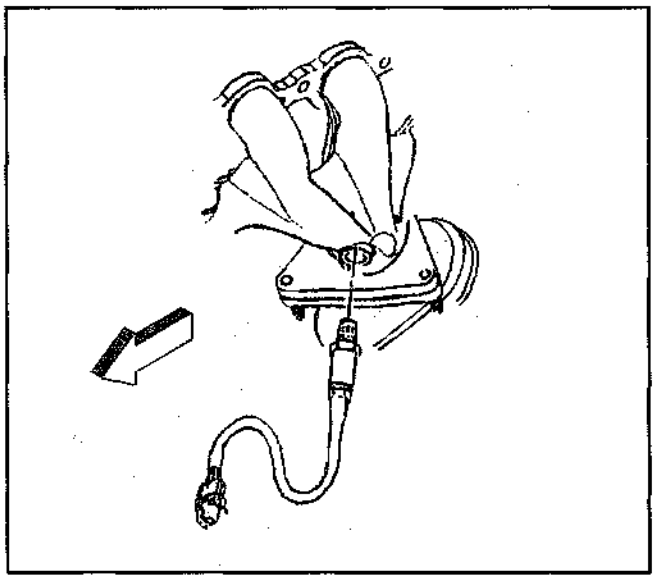
1. Coat the threads of the heated oxygen sensor with anti–seize compound P/N 5613695, or equivalent if necessary.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the heated oxygen sensor.

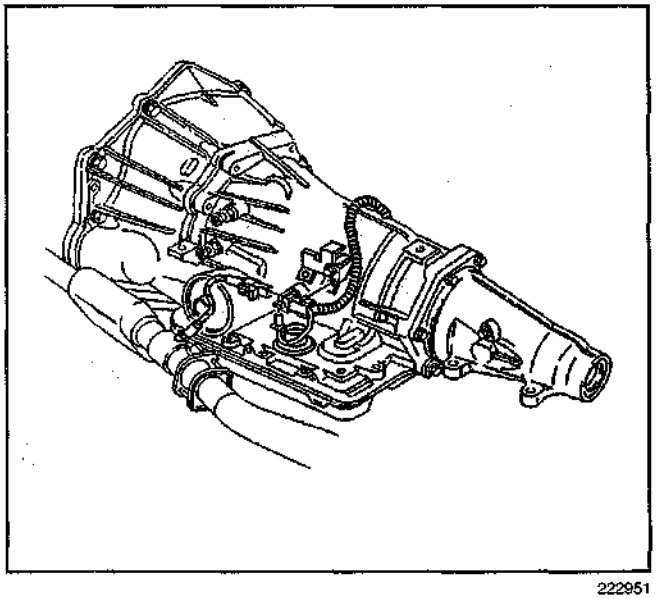
   Tighten

   Tighten the HO2S to 41 N·m (30 lb ft).
3. Connect the HO2S electrical connector.
4. Lower the vehicle.


247432

Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2

Notice: The heated oxygen sensors each use a permanently attached pigtail and connector. Do not remove the pigtail from the heated oxygen sensor. Damage or removal of the pigtail or the connector affects proper operation of the heated oxygen sensor. Handle the oxygen sensor carefully. Do not drop the oxygen sensor. Keep the in-line connector and the louvered end free of grease, dirt, or other contaminants. Do not use cleaning solvents of any type. Do not repair the wiring, the connector, or the terminals. Replace the oxygen sensor if the pigtail wiring, the terminals, or the connector is damaged. Proper oxygen sensor operation requires an external air reference. This external air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, the connectors, or the terminals results in the obstruction of the air reference and degrades the oxygen sensor performance. A dropped oxygen sensor is a bad oxygen sensor.

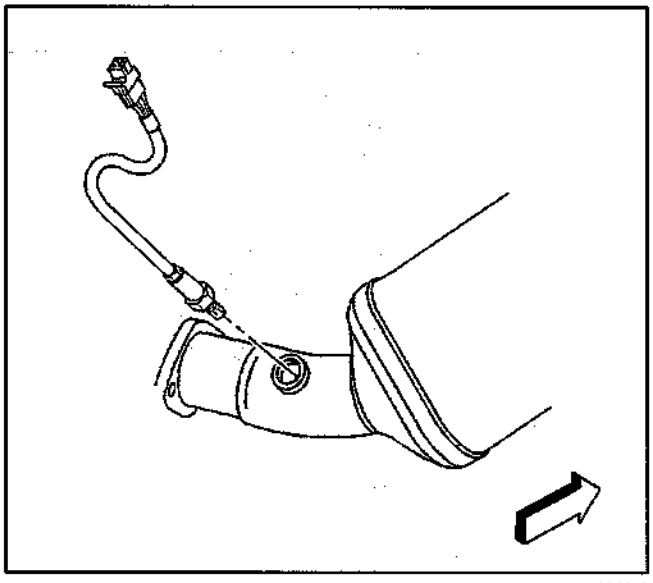

222951

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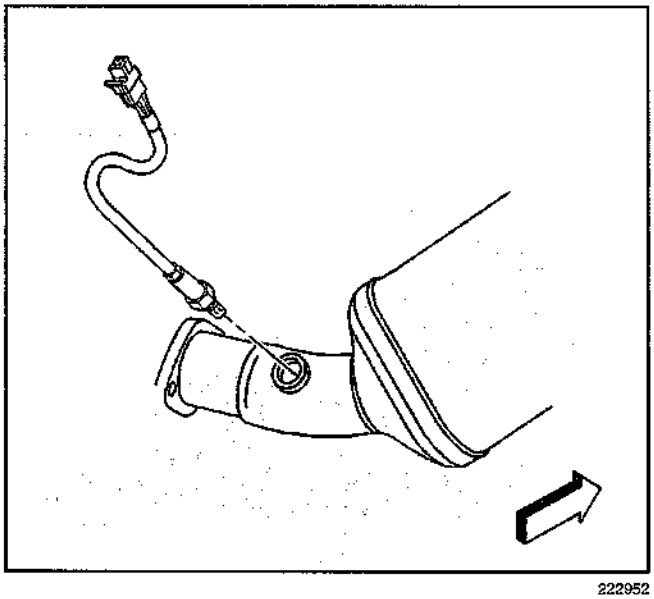
Removal Procedure

Important: The heated oxygen sensor may be difficult to remove when the engine temperature is below 48°C (120°F). Excessive force may damage the threads in the exhaust manifold or exhaust pipe. It may be necessary to lower the exhaust system to gain sufficient access to a HO2S and/or it's connector.

1. Raise 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.



222952



222952

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 the threads of the heated oxygen sensor with anti-seize compound P/N 5613695, or equivalent if necessary.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

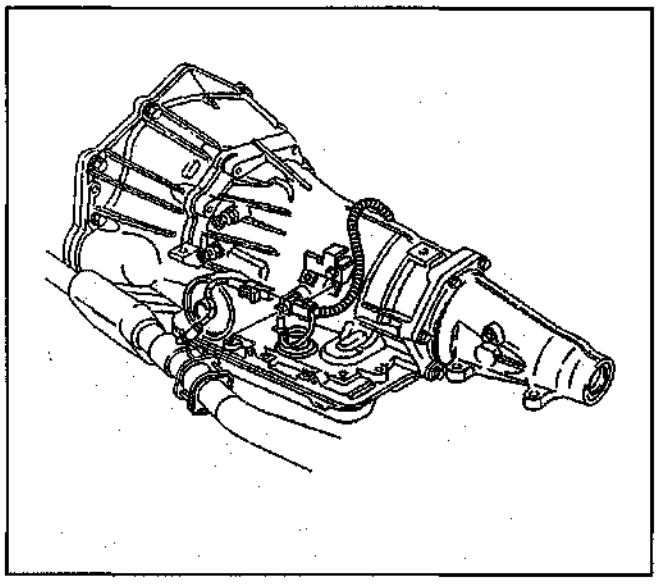
2. Install the heated oxygen sensor.

   Tighten

   Tighten the HO2S to 41 N·m (30 lb ft).

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3. Connect the HO2S electrical connector.
4. Lower the vehicle.

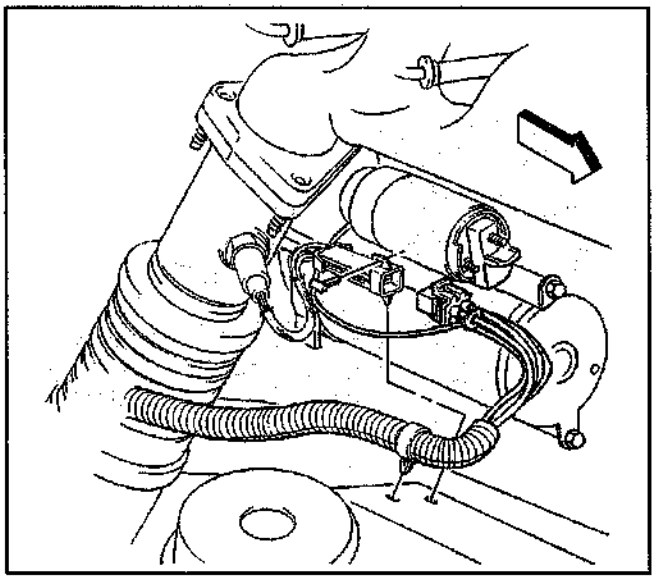


222951

Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1

Notice: The heated oxygen sensors each use a permanently attached pigtail and connector. Do not remove the pigtail from the heated oxygen sensor. Damage or removal of the pigtail or the connector affects proper operation of the heated oxygen sensor. Handle the oxygen sensor carefully. Do not drop the oxygen sensor. Keep the in-line connector and the louvered end free of grease, dirt, or other contaminants. Do not use cleaning solvents of any type. Do not repair the wiring, the connector, or the terminals. Replace the oxygen sensor if the pigtail wiring, the terminals, or the connector is damaged. Proper oxygen sensor operation requires an external air reference. This external air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, the connectors, or the terminals results in the obstruction of the air reference and degrades the oxygen sensor performance. A dropped oxygen sensor is a bad oxygen sensor.

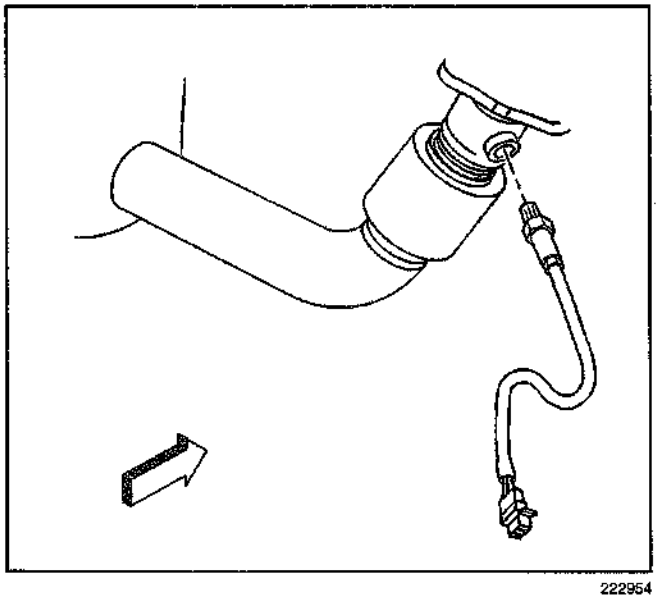
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222953

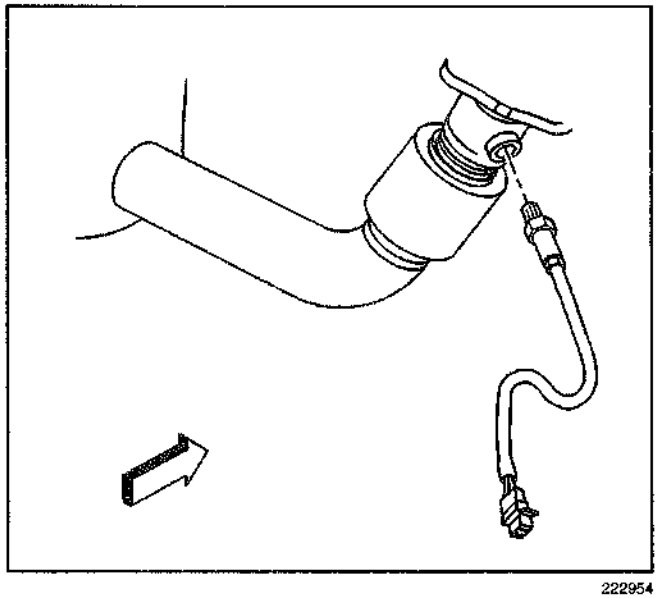
Removal Procedure

Important: The heated oxygen sensor may be difficult to remove when the engine temperature is below 48°C (120°F). Excessive force may damage the threads in the exhaust manifold or exhaust pipe. It may be necessary to lower the exhaust system to gain sufficient access to a HO2S and/or it's connector.

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Disconnect the HO2S electrical connector.


222954

3. Carefully back out the heated oxygen sensor.


222954

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 the threads of the heated oxygen sensor with anti-seize compound P/N 12377953, or equivalent if necessary.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

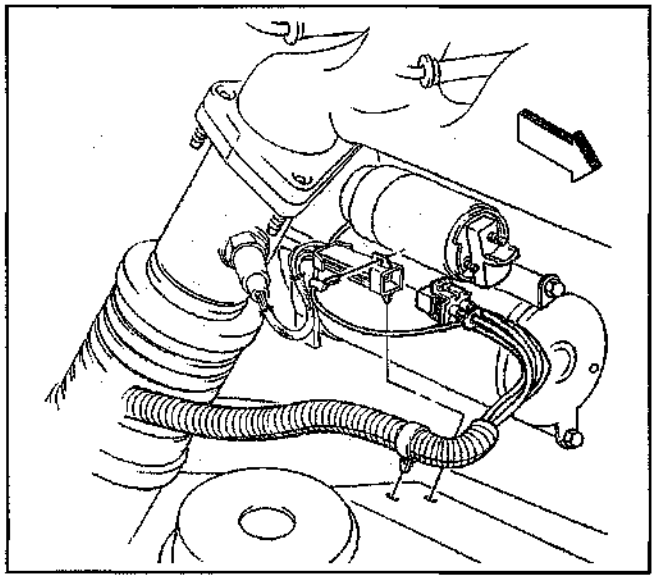
2. Install the heated oxygen sensor.

   Tighten

   Tighten the HO2S to 41 ·m (30 lb ft).

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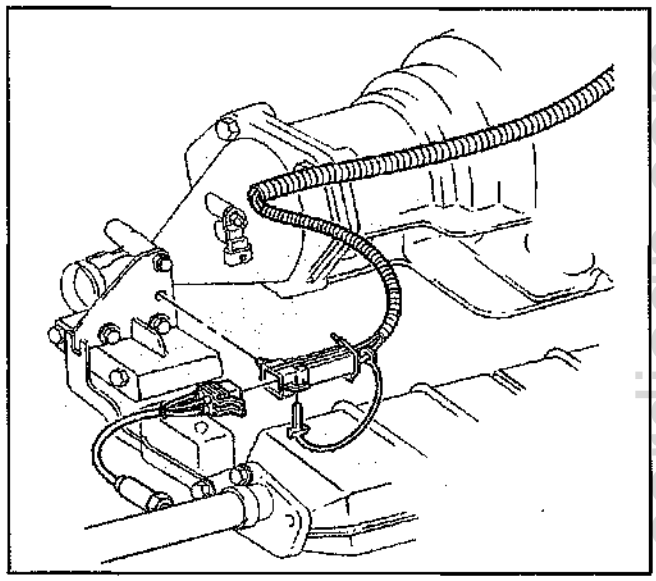
3. Connect the HO2S electrical connector.
4. Lower the vehicle.



222953

Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2

Notice: The heated oxygen sensors each use a permanently attached pigtail and connector. Do not remove the pigtail from the heated oxygen sensor. Damage or removal of the pigtail or the connector affects proper operation of the heated oxygen sensor. Handle the oxygen sensor carefully. Do not drop the oxygen sensor. Keep the in-line connector and the louvered end free of grease, dirt, or other contaminants. Do not use cleaning solvents of any type. Do not repair the wiring, the connector, or the terminals. Replace the oxygen sensor if the pigtail wiring, the terminals, or the connector is damaged. Proper oxygen sensor operation requires an external air reference. This external air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, the connectors, or the terminals results in the obstruction of the air reference and degrades the oxygen sensor performance. A dropped oxygen sensor is a bad oxygen sensor.



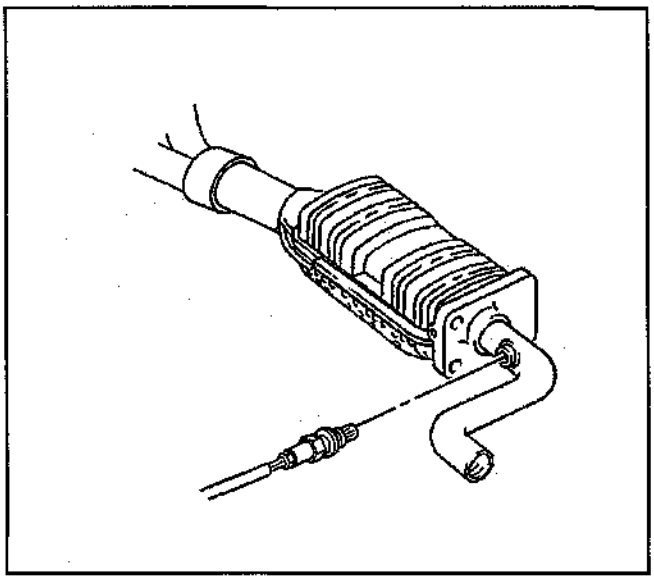
222946

Removal Procedure

Important: The heated oxygen sensor may be difficult to remove when the engine temperature is below 48°C (120°F). Excessive force may damage the threads in the exhaust manifold or exhaust pipe. It may be necessary to lower the exhaust system to gain sufficient access to a HO2S and/or it's connector.

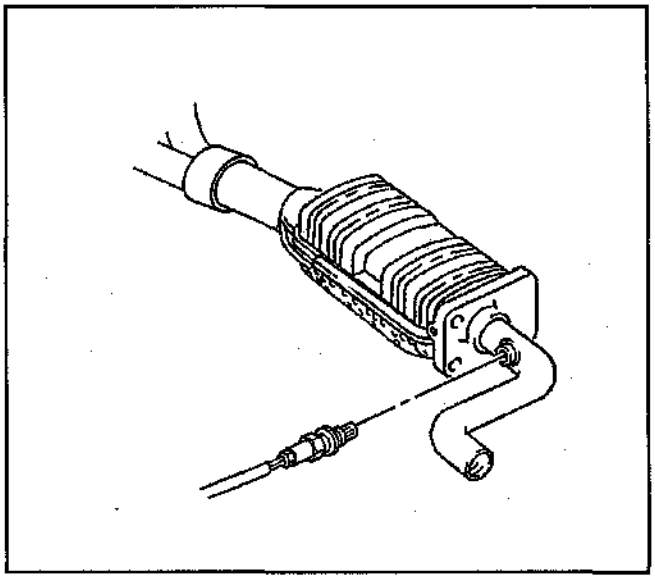
1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Disconnect the HO2S electrical connector.

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222948

3. Carefully back out the heated oxygen sensor.



222948

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.

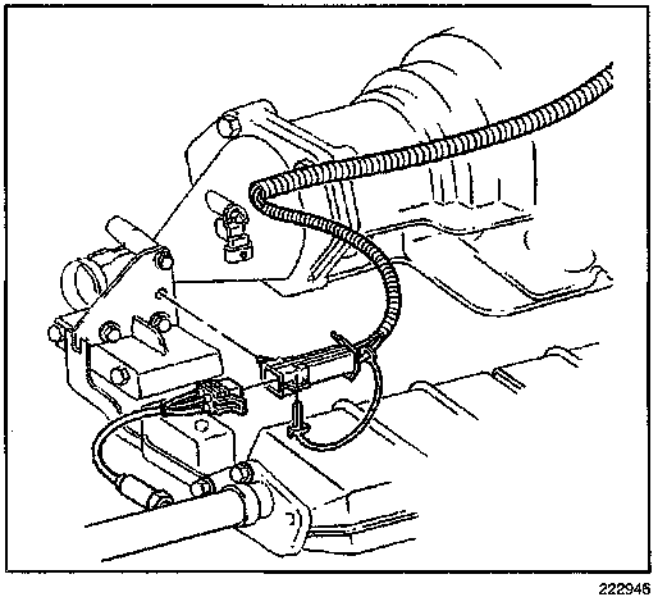
1. Coat the threads of the heated oxygen sensor with anti-seize compound P/N 12377953, or equivalent if necessary.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the heated oxygen sensor.

   Tighten

   Tighten the HO2S to 41 N·m (30 lb ft).
3. Connect the HO2S electrical connector.
4. Lower the vehicle.



222946

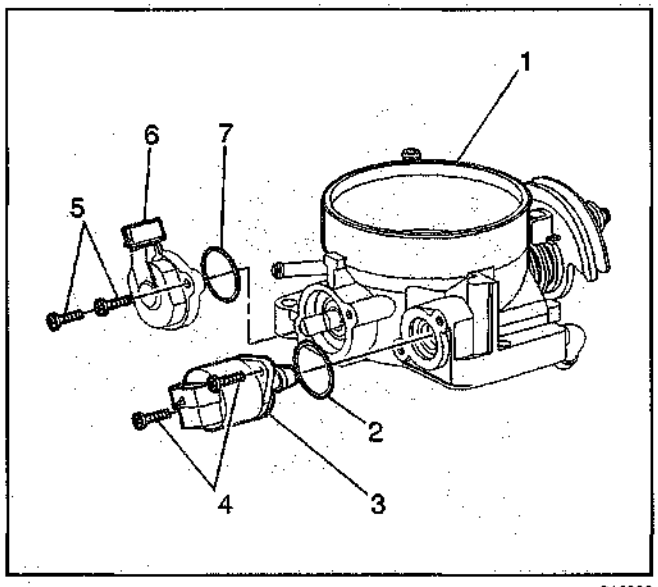
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TP Sensor Replacement

Removal Procedure

Notice: The TP sensor is an electrical component. Do not soak the TP sensor in any liquid cleaner or solvent as damage may result.

1. Disconnect the TP sensor electrical connector.
2. Remove the TP sensor attaching screws (5).
3. Remove the TP sensor (6).
4. Remove the TP sensor O-ring seal (7).



216230

Installation Procedure

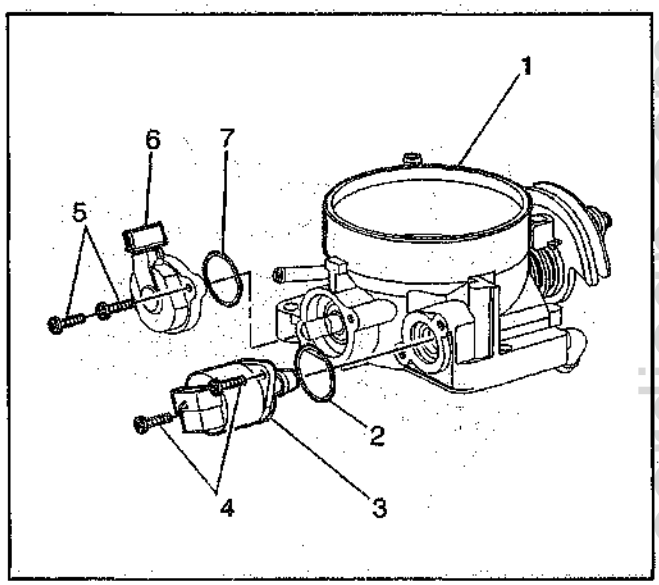
1. Install the TP sensor O-ring seal (7) on the TP sensor (6).
2. Install the TP sensor (6) on the throttle body (1) with the throttle valve in the closed position. Make sure the TP sensor lever lines up with the TP sensor drive lever on the throttle shaft.

Notice: Refer to the *Fastener Notice* in Cautions and Notices.

3. Install the TP sensor attaching screws (5).

   Tighten

   Tighten the TP sensor attaching screws to 2 N·m (18 lb in).
4. Connect the TP sensor electrical connector.
5. Perform the TP sensor learn procedure (traction control equipped vehicles only). Refer to *Scan Tool Diagnostics* in Antilock Brake System.

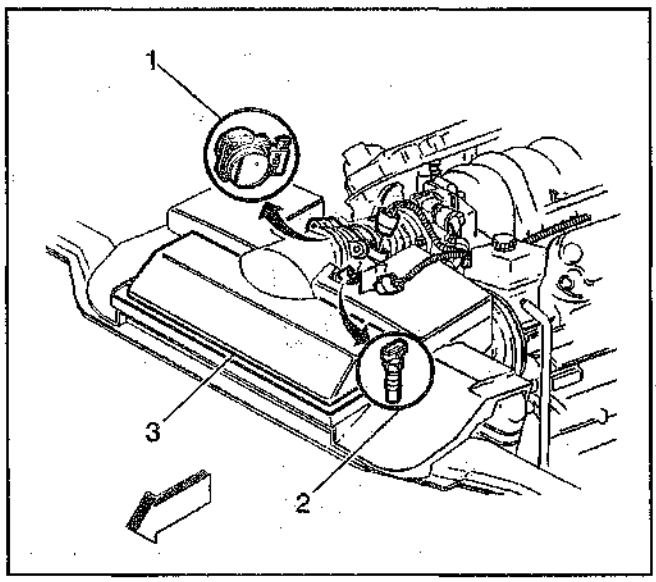


216230

IAT Sensor Replacement

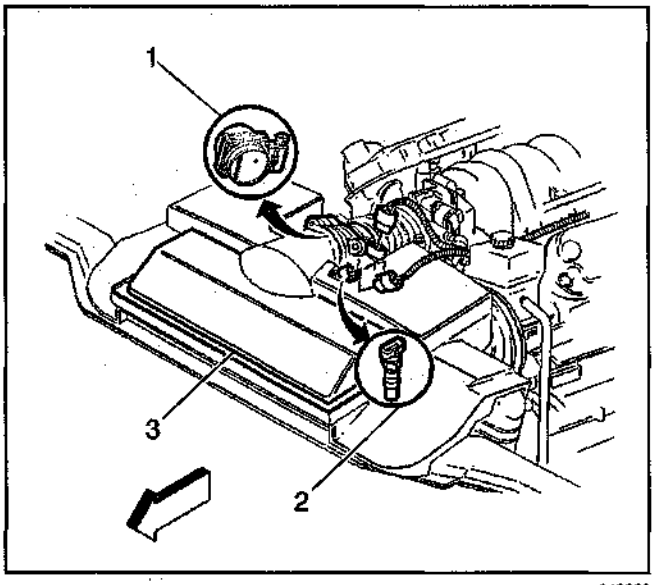
Removal Procedure

1. Disconnect the IAT sensor (2) electrical connector.
2. Carefully back out the IAT sensor (2) from the intake air duct.



242662

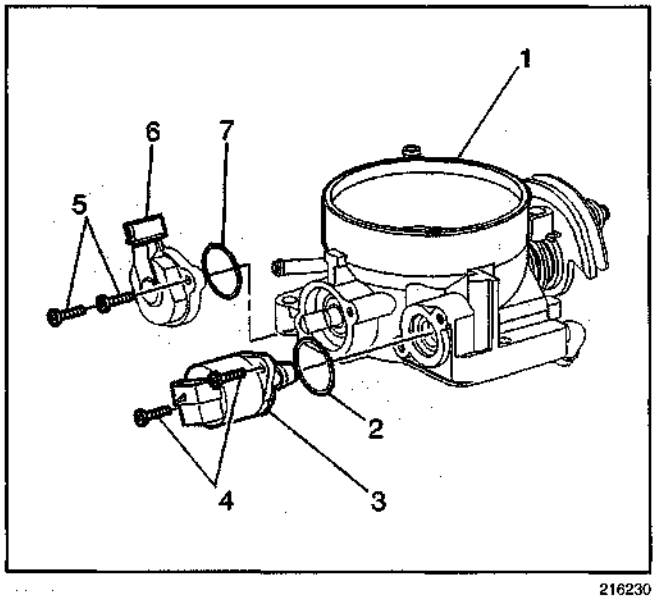
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242662

Installation Procedure

1. Install the IAT sensor (2) into the intake air duct.
2. Connect the IAT sensor (2) electrical connector.



216230

IAC Valve Replacement

Removal Procedure

1. Disconnect the IAC valve electrical connector.
2. Remove the IAC valve attaching screws (4).
3. Remove the IAC valve (3).
4. Remove the IAC valve O-ring seal (2).

Notice:

- Do Not push or pull on the IAC valve pintle on IAC valves that have been in service. The force required to move the pintle may damage the threads on the worm drive.
- Do Not soak the IAC valve in any liquid cleaner or solvent, as damage may result.

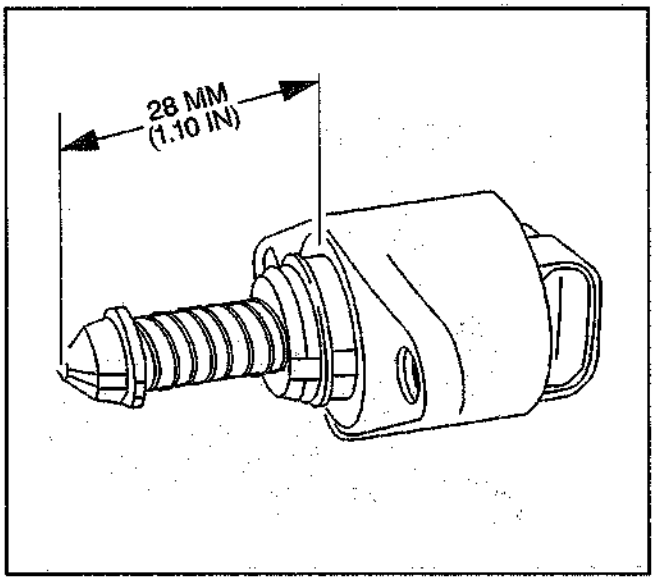
5. Clean the IAC valve O-ring sealing surface, the pintle valve seat, and the air passage.
   - Clean the IAC valve using GM cleaner 1052626 or GM X–66A. Use a shop towel or parts brush to remove heavy deposits.
   - If the air passage has heavy deposits, remove the throttle body for complete cleaning.
   - Shiny spots on the pintle or seat are normal, and do not indicate misalignment or a bent pintle shaft.
6. Inspect the IAC valve O-ring for cuts, cracks, or distortion. Replace the O-ring if it is damaged.

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Installation Procedure

Important: If installing a new IAC valve, be sure to replace it with an identical part. The pintle shape of the IAC valve and the diameter of the IAC valve are designed for the specific application.

1. Measure the distance between the tip of the IAC valve pintle and the mounting surface. If the distance is more than 28 mm, use finger pressure to slowly retract the pintle. The force required to retract the pintle of a new valve will not cause damage to the valve.



17065

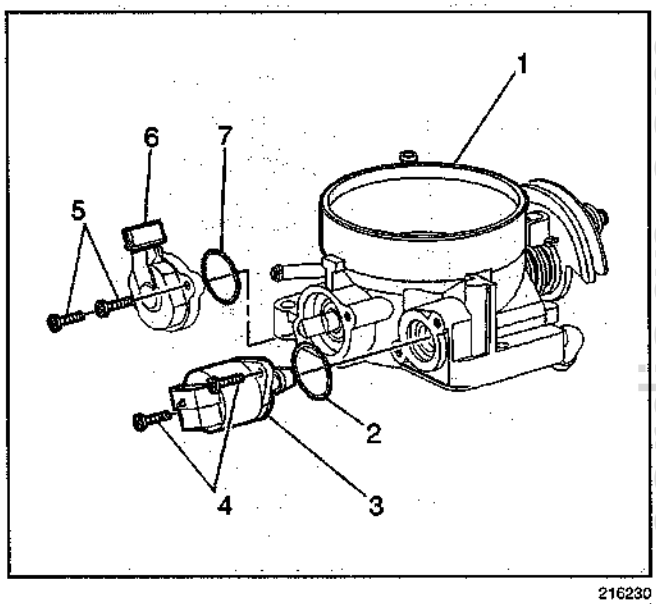
2. Lubricate the IAC valve O-ring (2) with clean engine oil.
3. Install the IAC valve O-ring (2) on the IAC valve (3).
4. Install the IAC valve (3).
5. Apply Loctite 262 to the IAC valve attaching screw threads if necessary.

Notice: Refer to the *Fastener Notice* in Cautions and Notices.

6. Install the IAC valve attaching screws (4).

   Tighten

   Tighten the IAC valve attaching screws to 3 N·m (27 lb in).
7. Connect the IAC valve electrical connector.
8. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure.*

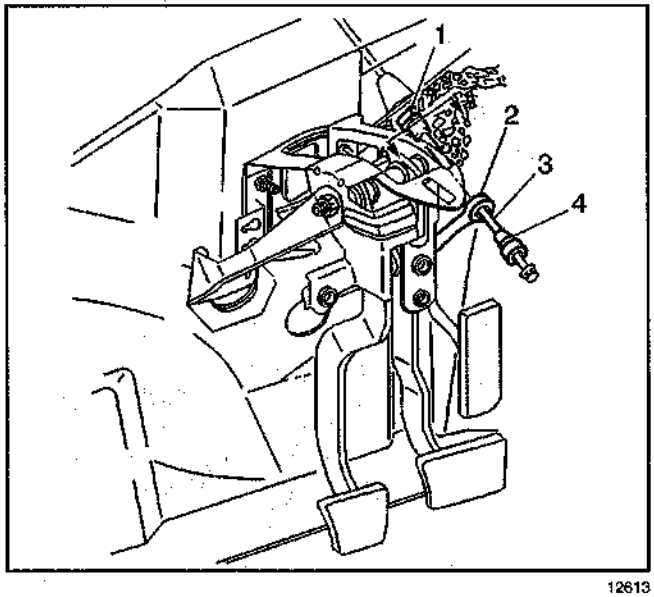


216230

Accelerator Controls Cable Replacement

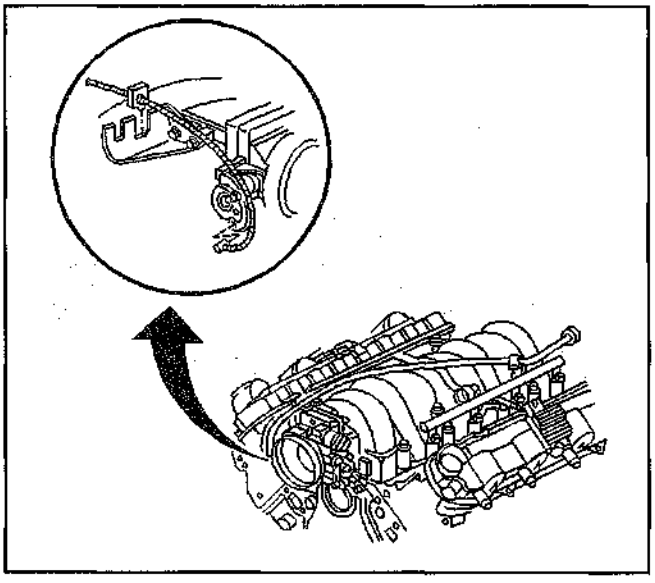
Removal Procedure

1. Remove the left instrument panel insulator. Refer to *Closeout/Insulator Panel Replacement - Left* in Instrument Panel, Gauges and Console.
2. Disconnect the accelerator cable (3) from the accelerator pedal lever (2).
3. Squeeze the accelerator cable cover tangs (1) and push the cable through the dash panel.
4. Disconnect the accelerator cable from the intake manifold bracket.



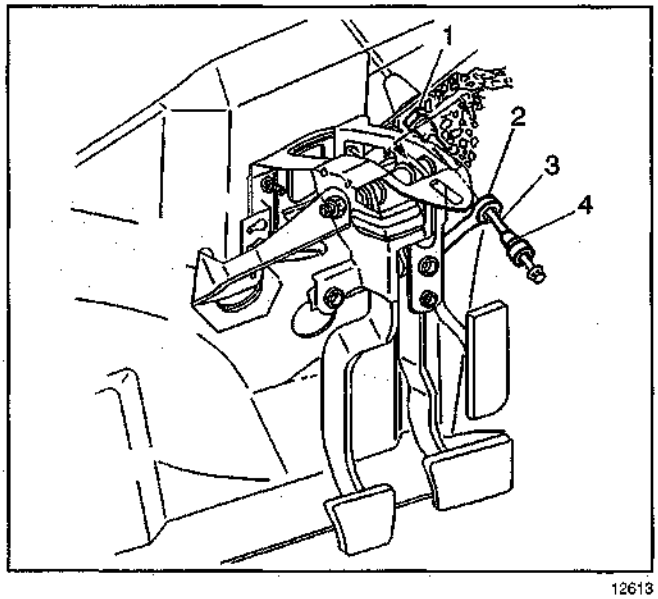
12613

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173436

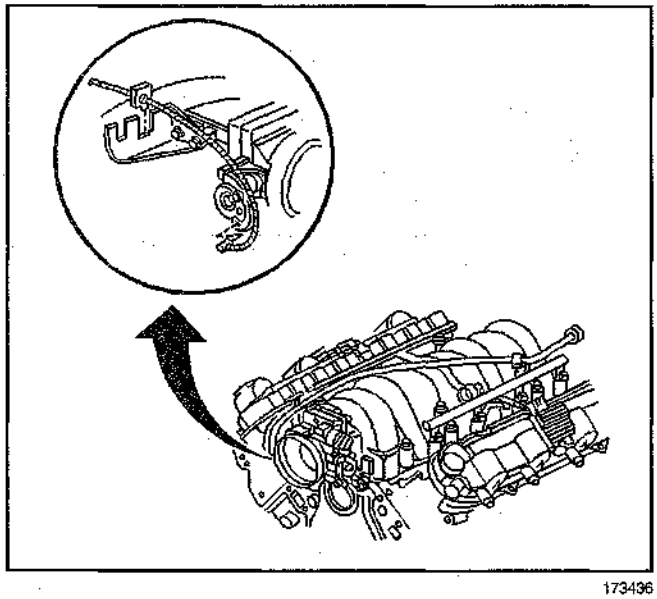
5. Remove the accelerator cable from the slot in the accelerator cable bracket.
6. Disconnect the accelerator cable from the throttle body lever.
7. Remove the accelerator cable.



12613

Installation Procedure

1. Install the accelerator cable (3) through the dash panel. Snap the retainer (1) through the dash panel.
2. Install the accelerator cable (3) through the slot in the accelerator pedal lever (2). Seat the retainer (4) in the accelerator pedal lever (2).



173436

3. Connect the accelerator cable to the throttle body lever.
4. Slide the accelerator cable into the slot on the accelerator cable bracket. Snap the locking tab into position.
5. Connect the accelerator cable to the intake manifold bracket.
6. Check for complete throttle opening and closing positions by operating the accelerator pedal. Also check for poor carpet fit under the accelerator pedal. The throttle should operate freely without bind between full closed throttle and wide open throttle.
7. Install the left instrument panel insulator. Refer to *Closeout/Insulator Panel Replacement - Left* in Instrument Panel, Gauges and Console.

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Accelerator Controls Pedal Replacement

Removal Procedure

1. Remove the left instrument panel insulator. Refer to *Closeout/Insulator Panel Replacement - Left* in Instrument Panel, Gauges and Console.
2. Disconnect the accelerator cable from the accelerator pedal lever.
3. Remove the retainer clip from the accelerator pedal pivot pin.
4. Remove the accelerator pedal from the accelerator pedal lever.

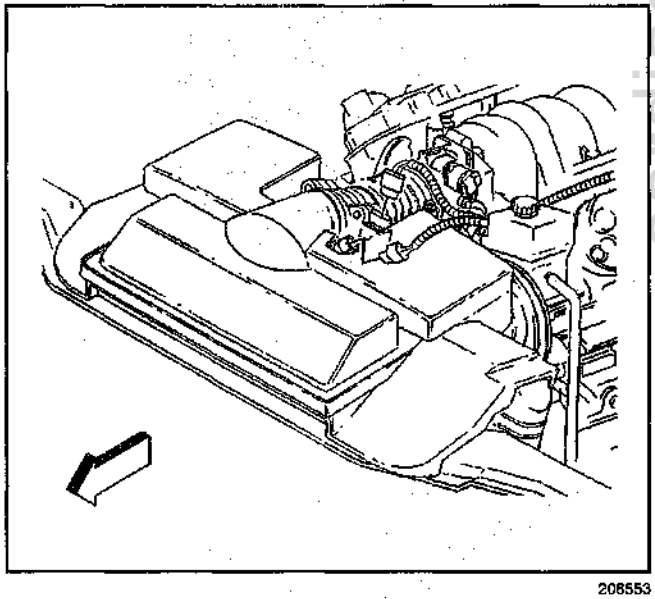
Installation Procedure

1. Install the accelerator pedal to the accelerator pedal lever.
2. Install the retainer clip to the accelerator pedal pivot pin.
3. Connect the accelerator cable to the accelerator pedal lever.
4. Check for complete throttle opening and closing positions by operating the accelerator pedal. Also check for poor carpet fit under the accelerator pedal. The throttle should operate freely without bind between full closed throttle and wide open throttle.
5. Install the left instrument panel insulator. Refer to *Closeout/Insulator Panel Replacement - Left* in Instrument Panel, Gauges and Console.

Throttle Body Assembly Replacement

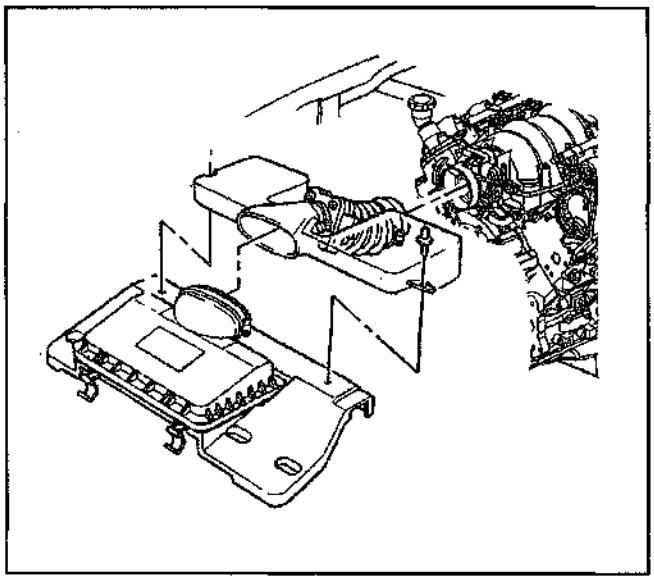
Removal Procedure

1. Partially drain the cooling system in order to remove the hoses at the throttle body. Refer to *Draining and Filling Cooling System (5.7 L)* in Engine Cooling.
2. Disconnect the IAT sensor and the MAF sensor electrical connectors.



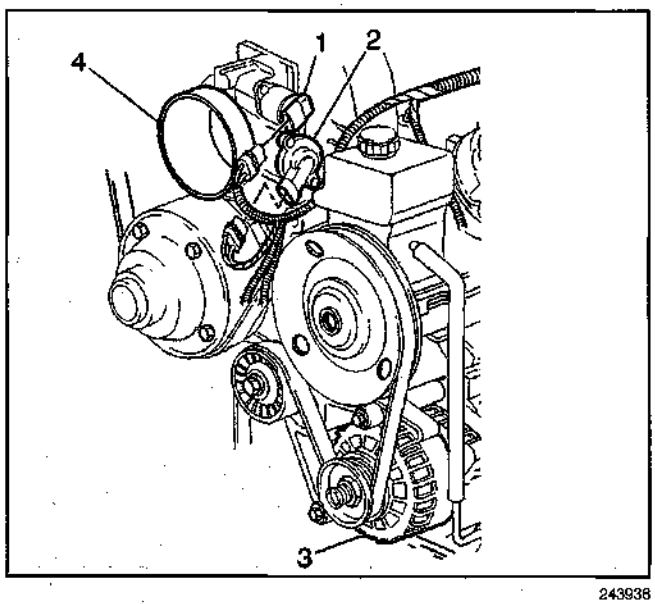
208553

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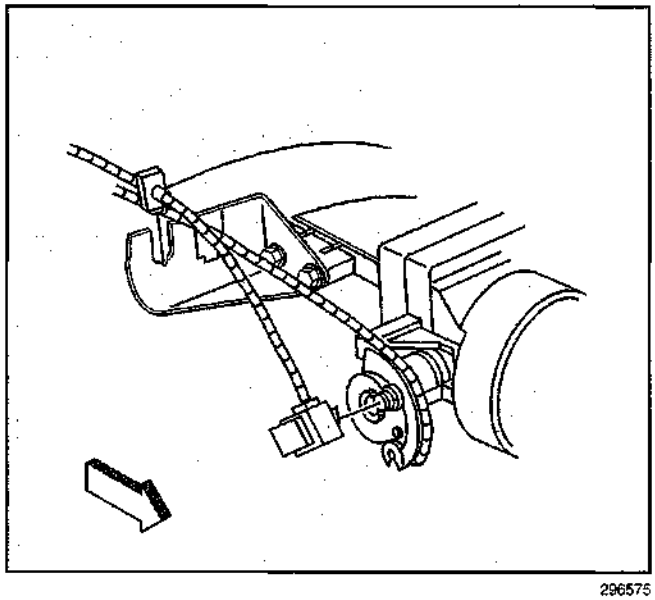
208569

3. Remove the air intake duct.



243938

4. Disconnect the TP sensor (2) and IAC valve (1) electrical connectors.
5. Disconnect the crankcase ventilation hose from the throttle body.

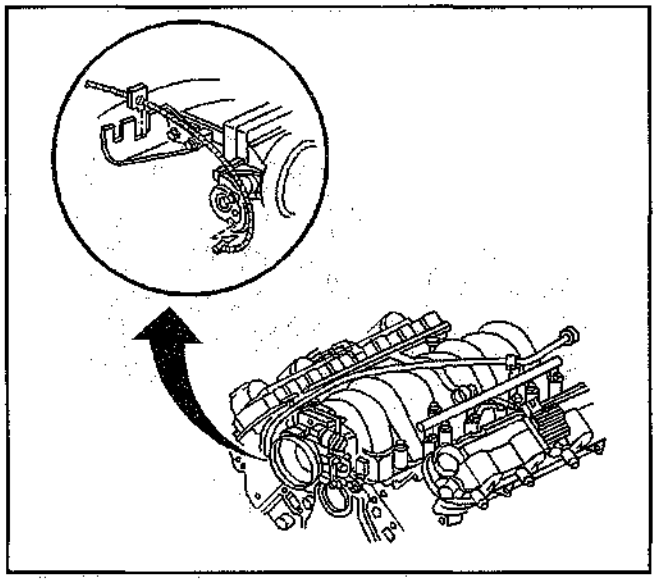


296575

6. Disconnect the cruise control cable at the throttle body lever.

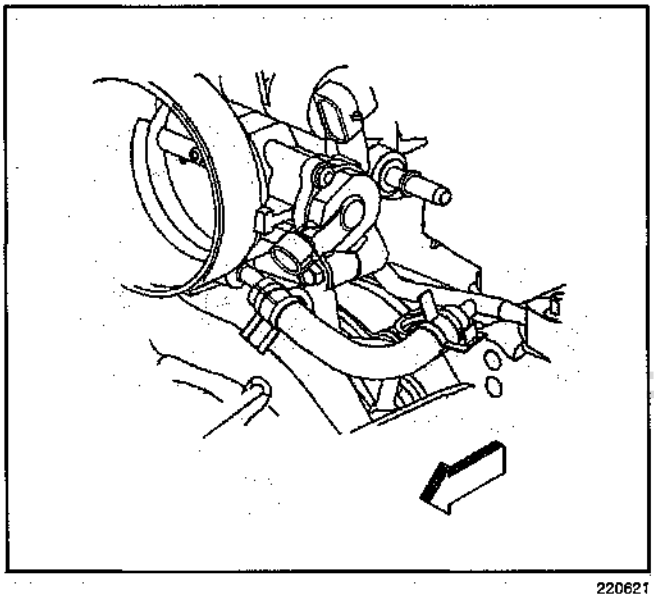
cardiagn.com

7. Disconnect the accelerator control cable at the throttle body lever.



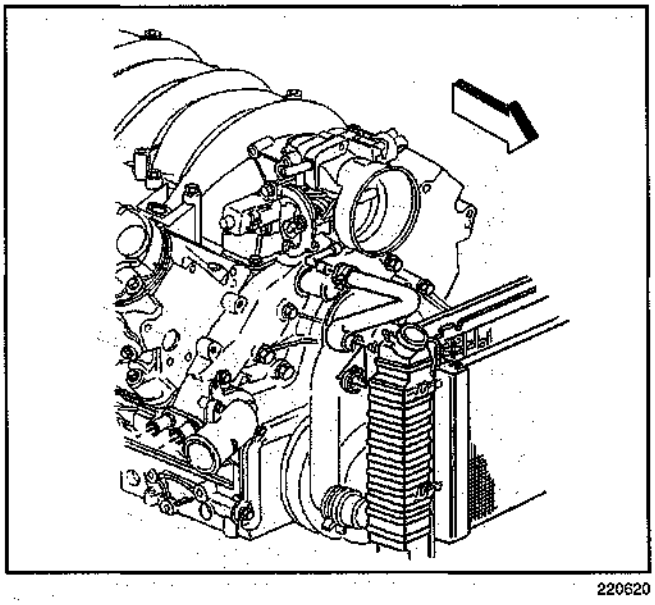
173436

8. Disconnect the coolant hose from the vapor vent pipe.



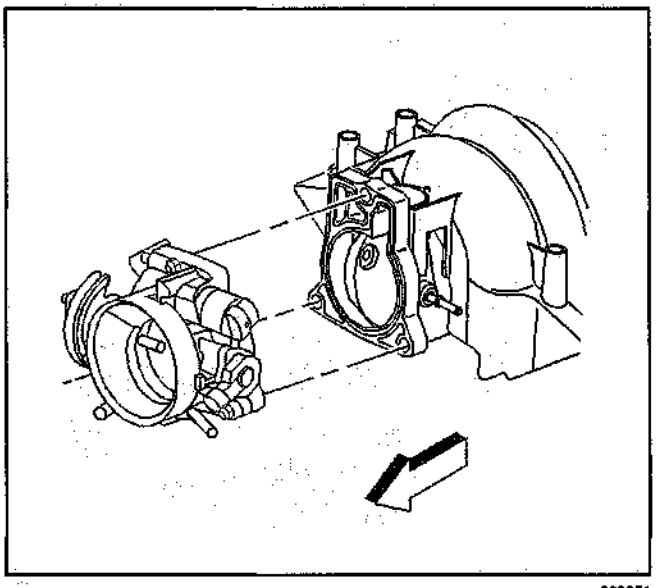
220621

9. Disconnect the coolant hose from the radiator.



220620

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222051

10. Remove the throttle body attaching bolts.
11. Remove the trottle body and the gasket. Discard the gasket.

Notice: In order to prevent damage to the sealing surfaces, carefully use sharp tools in cleaning the old gasket from the aluminum surfaces.

Important:

- Do Not soak the throttle body in cold immersion type cleaner. The throttle valve has a factory applied sealing compound (DAG material is applied to the outside edge of the valve and the throttle bore) to prevent air bypass at closed throttle. Strong solvents or brushing will remove the material. To clean the throttle body following disassembly, use a spray type cleaner such as GM X-66A or GM 1052626. Use a shop towel to remove heavy deposits.
- The TP sensor and the IAC valve are electrical components and should NOT come in contact with solvent or cleaner, as damage may result.

12. Clean the gasket sealing surfaces.

Installation Procedure

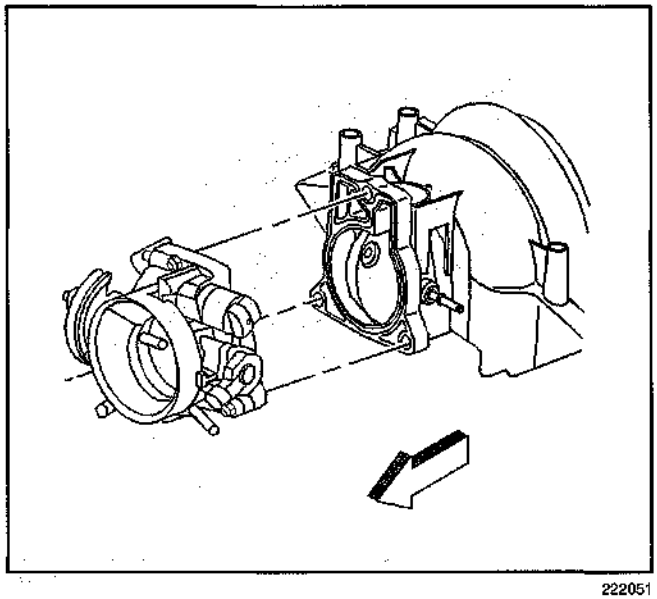
1. Install the throttle body with a new gasket.

Notice: Refer to the *Fastener Notice* in Cautions and Notices.

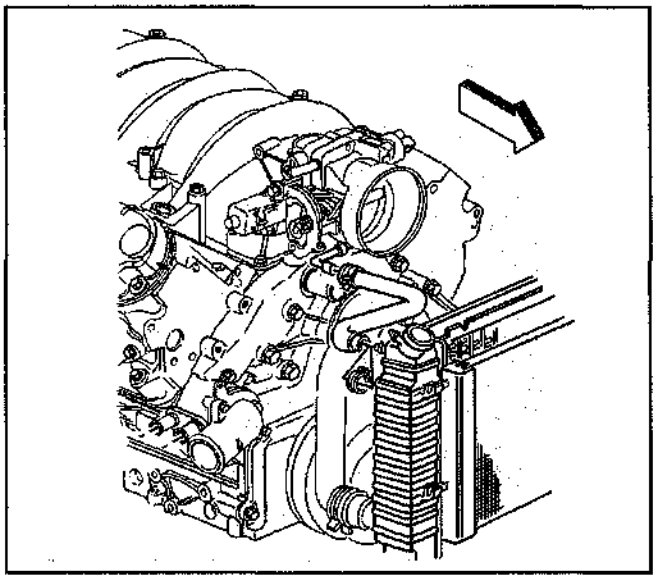
2. Install the throttle body attaching bolts.

   Tighten

   Tighten the throttle body attaching bolts to 12 N·m (106 lb in).



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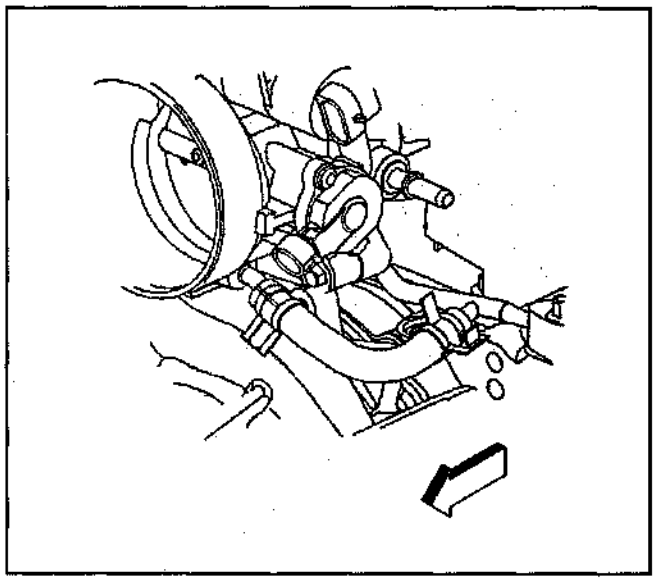


220620

3. Connect the coolant hose to the radiator.

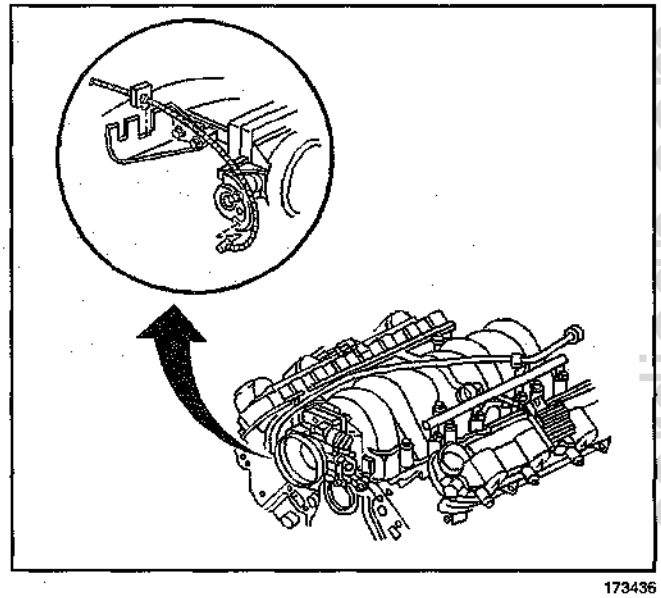
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4. Connect the coolant hose to the vapor vent pipe.



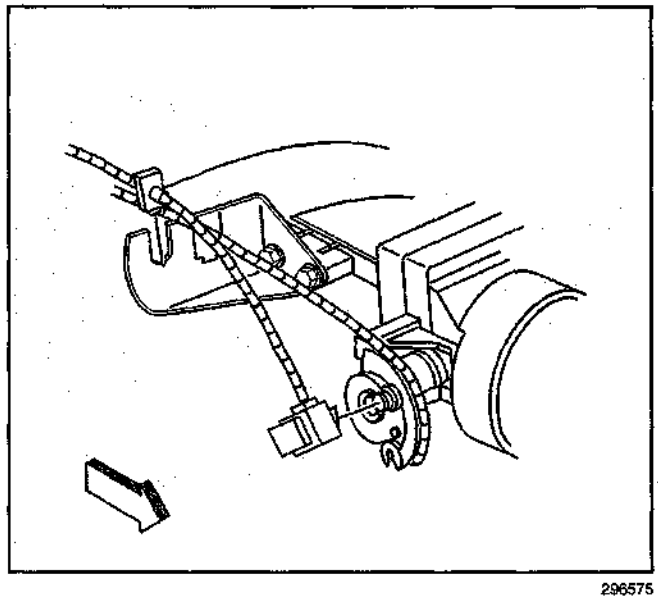
220621

5. Connect the accelerator control cable to the throttle body lever.



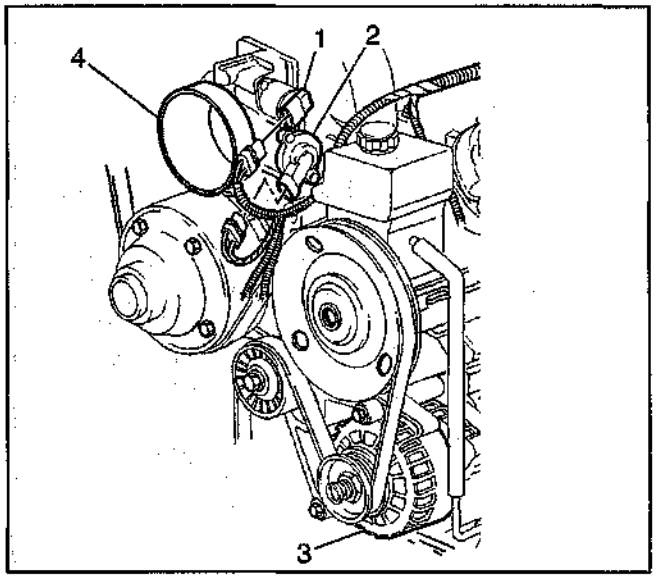
173436

6. Connect the cruise control cable to the throttle body lever.



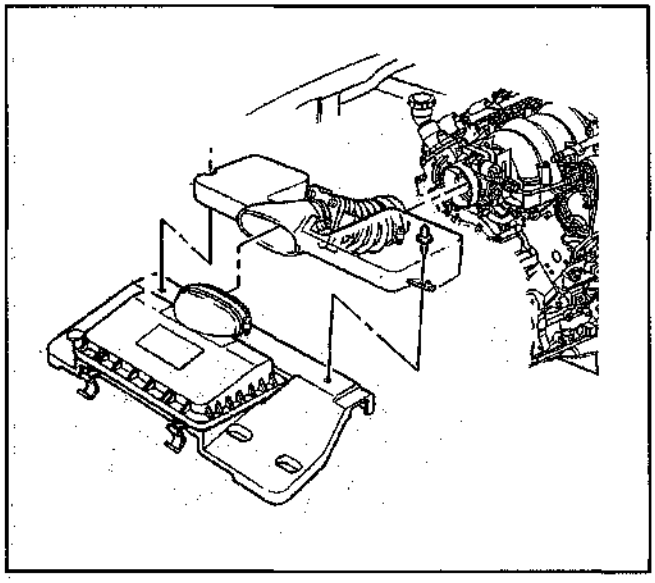
296575

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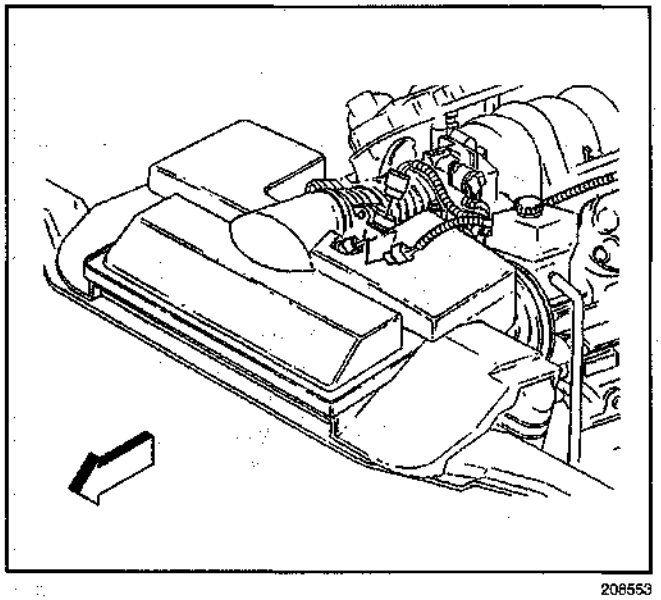


243938

7. Connect the crankcase ventilation hose to the throttle body.
8. Connect the TP sensor (2) and the IAC valve (1) electrical connectors.


208569

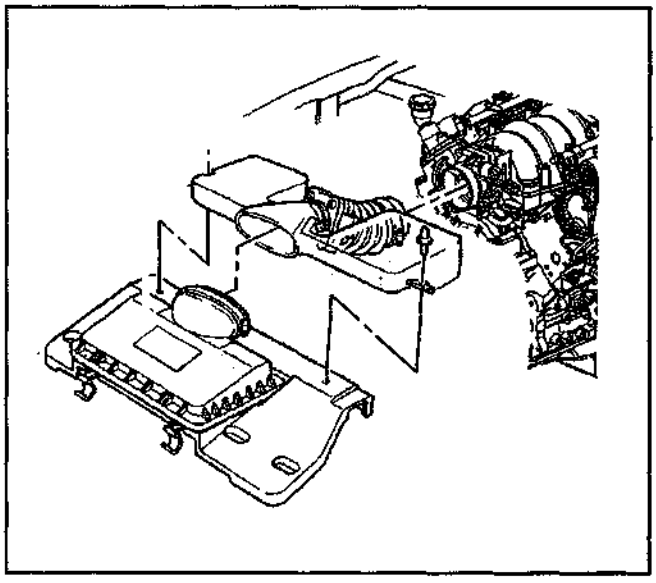
9. Install the air intake duct.


208553

10. Connect the IAT sensor and the MAF sensor electrical connectors.
11. Refill the cooling system. Refer to *Draining and Filling Cooling System (5.7 L)* in Engine Cooling.
12. With the engine OFF, check to see that the accelerator pedal is free. Depress the accelerator pedal to the floor and release.
13. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.

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Throttle Body Cleaning Procedure


208589

Important: Over extended time and mileage, deposits may accumulate on the back of the throttle valve plate. The source of the deposit is EGR gas. Typically these deposits pose no problem. Occasionally the deposit may accumulate to a point where perceived pedal effort is effected. This procedure should not be performed on vehicles with low mileage, under 80,450 kilometers (50,000 miles).

1. Remove the air intake duct.

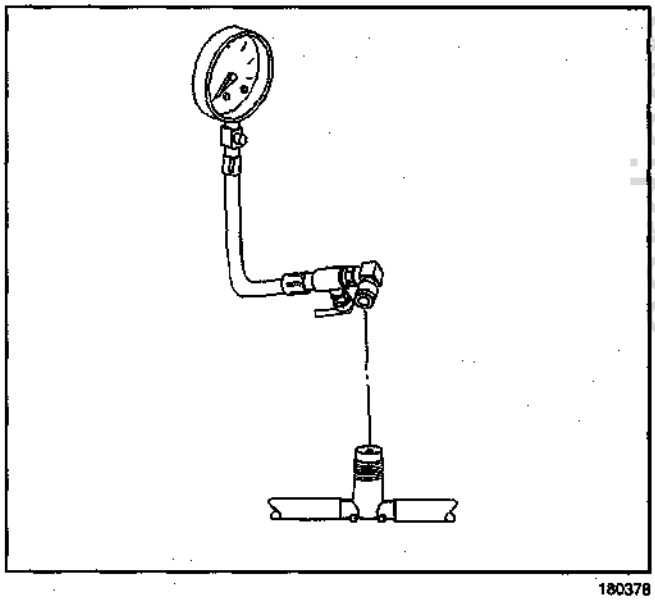
Notice: Do not insert any tools into the throttle body bore in order to avoid damage to the throttle valve plate.

2. Inspect the throttle body bore and the throttle valve plate for deposits. It is necessary to open the throttle valve to inspect all surfaces.

Notice: Do not use any solvent that contains Methyl Ethyl Ketone (MEK). This solvent may damage fuel system components.

3. Clean the throttle body bore and the throttle valve plate using a clean shop towel with GM Top Engine Cleaner, P/N 1052626 or AC-Delco Carburetor Tune-Up Conditioner, P/N X66–P, or equivalent product.
4. Install the air intake duct.

Fuel Pressure Relief Procedure


180378

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.

Tools Required

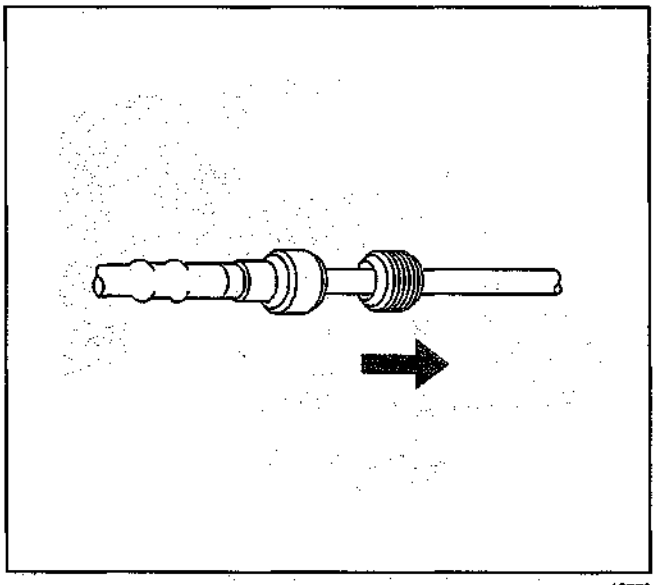
J 34730-1A Fuel Pressure Gauge

1. Turn the ignition OFF.

Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

2. Disconnect the negative battery cable in order to avoid possible fuel discharge if an accidental attempt is made to start the engine.
3. Loosen the fuel filler cap in order to relieve the fuel tank vapor pressure.
4. Connect the *J 34730-1A* fuel pressure gauge to the fuel pressure valve. Wrap a shop towel around the fitting while connecting the gauge in order to avoid spillage.
5. Install the bleed hose of the gauge into an approved container.
6. Open the valve on the gauge to bleed the system pressure. The fuel connections are now safe for servicing.
7. Drain any fuel remaining in the gauge into an approved container.

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12773

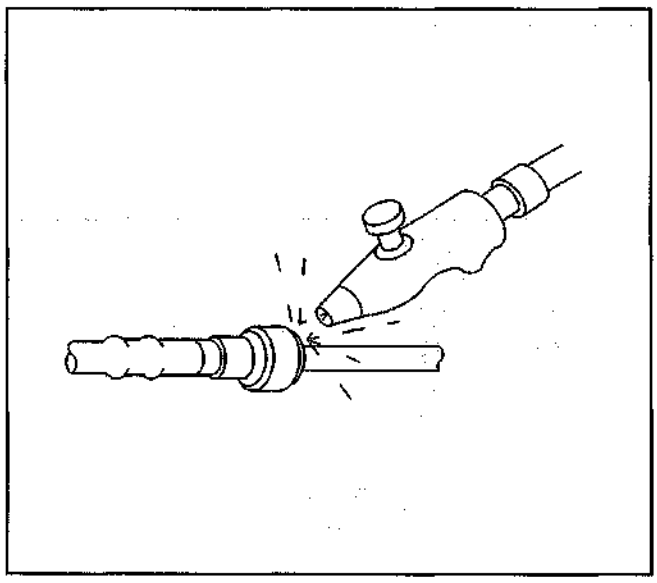
Quick Connect Fitting(s) Service (Metal Collar)

Removal Procedure

Tools Required

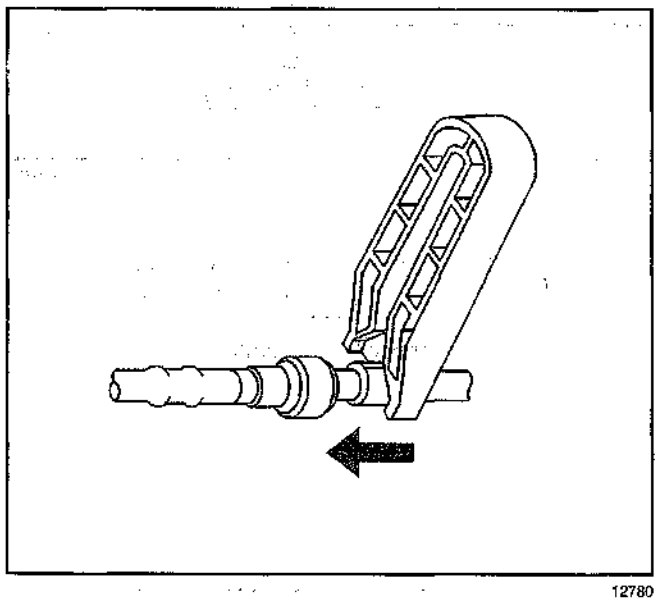
- *J 34730-1A* Fuel Pressure Gauge
- *J 37088-A* Tool Set, Fuel Line Quick-Connect Separator

1. Relieve the fuel system pressure before servicing any fuel system connection. Refer to the *Fuel Pressure Relief Procedure.*
2. Slide the dust cover from the quick-connect fitting.


12776

Caution: Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.

3. Blow dirt out of the fitting using compressed air.


12780

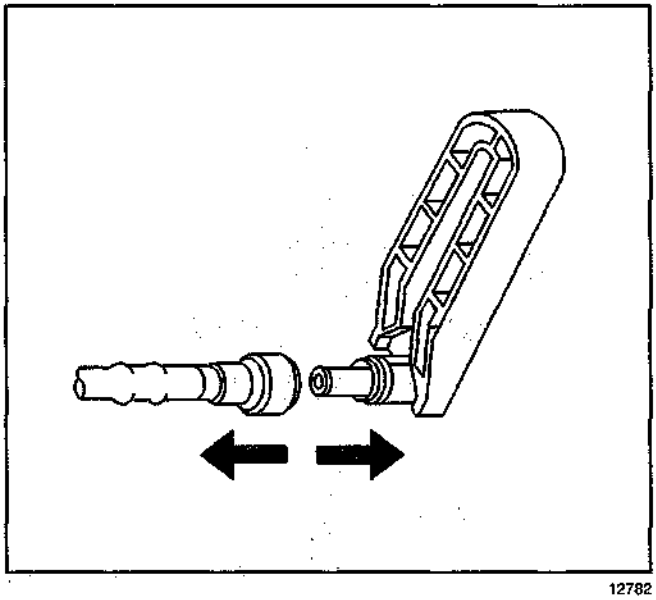
4. Choose the correct tool from *J 37088-A* Tool Set for the size of the fitting. Insert the tool into the female connector, then push inward to release the locking tabs.

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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.


12782

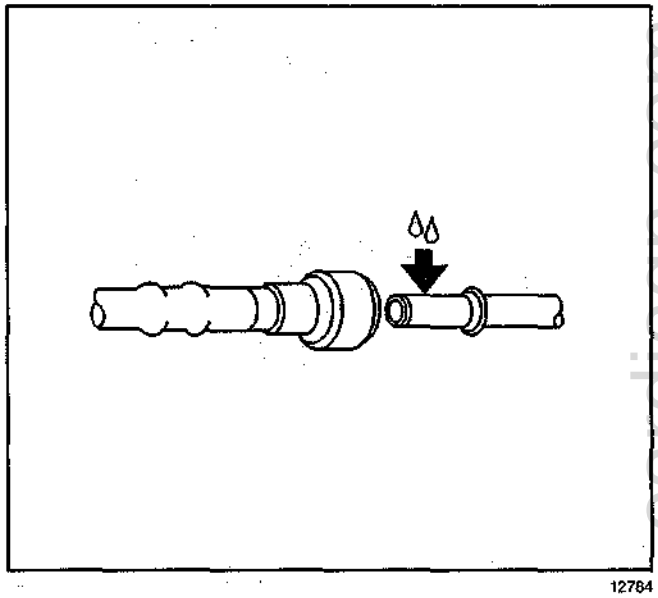
Installation Procedure

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.

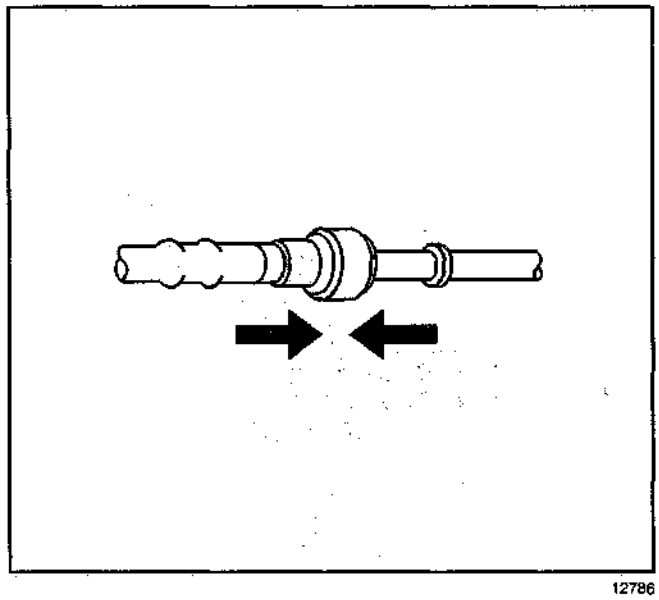
This will ensure proper reconnection and prevent a possible fuel leak.

During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.

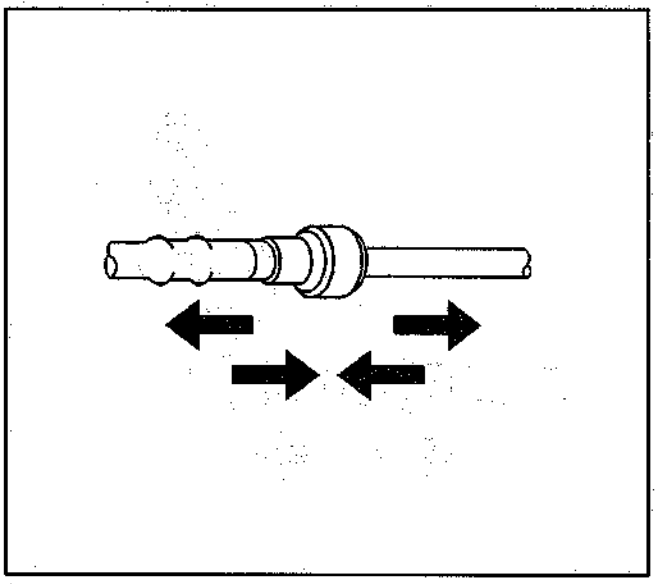
1. Apply a few drops of clean engine oil to the male pipe end.


12784

2. Push both sides of the fitting together to cause the retaining tabs to snap into place.

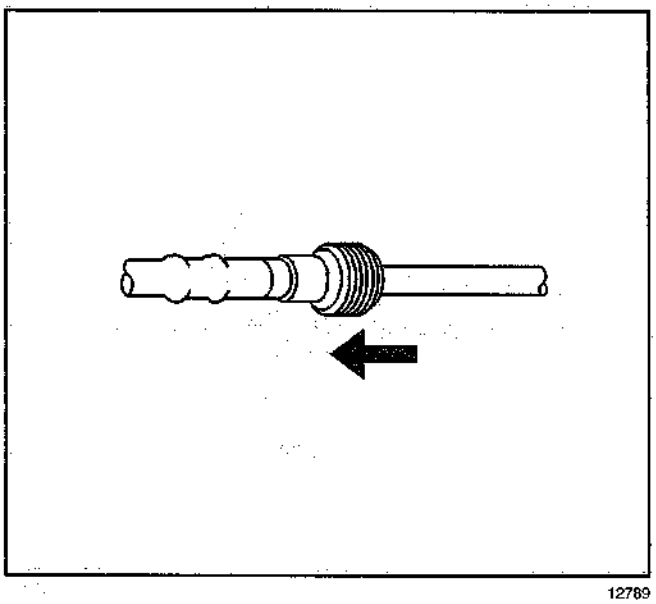

12786

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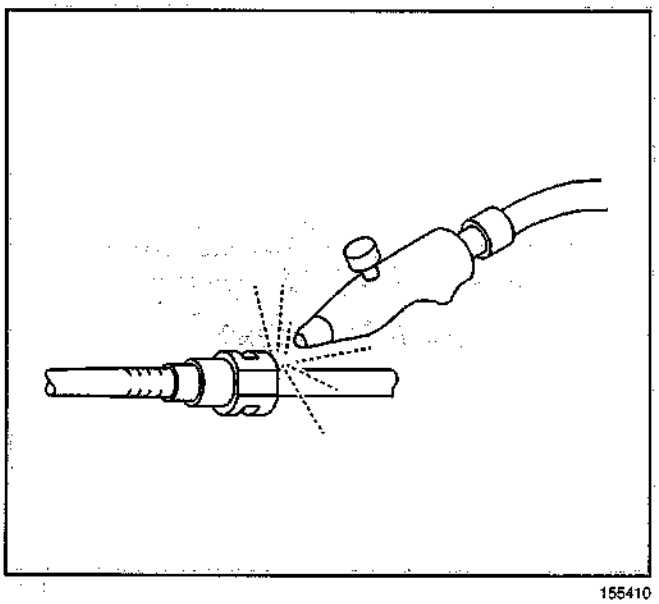
12787

3. Once installed, pull on both sides of the fitting to make sure the connection is secure.



12789

4. Reposition the dust cover over the quick-connect fitting.



155410

Quick Connect Fitting(s) Service (Plastic Collar)

Removal Procedure

Tools Required

J 34730-1A Fuel Pressure Gauge

1. Relieve the fuel system pressure before servicing any fuel system connection. Refer to the *Fuel Pressure Relief Procedure*.

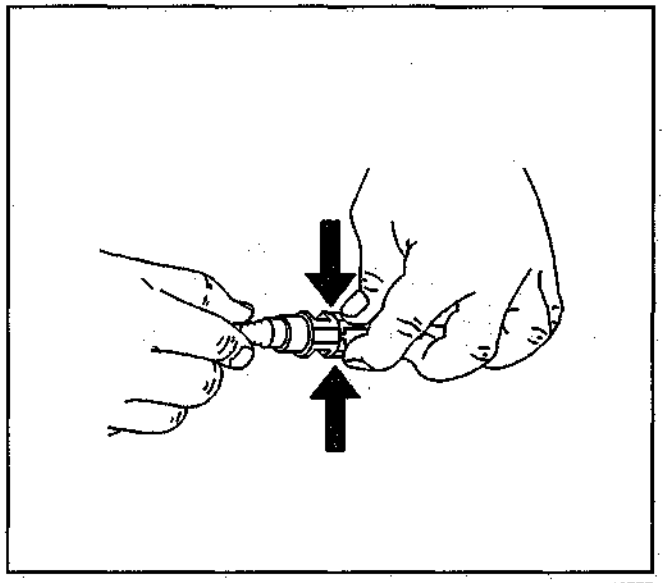
Caution: Wear safety glasses when using compressed air in order to prevent eye injury.

2. Using compressed air, blow any dirt out of the quick-connect fitting.

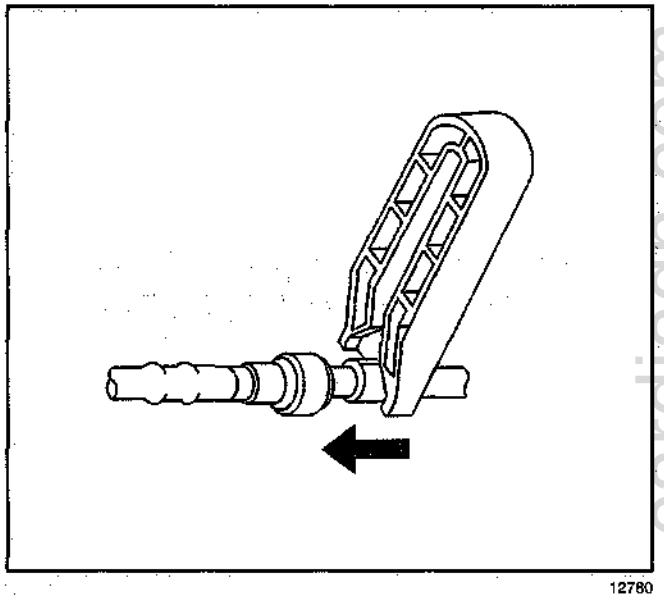
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Important: Plastic quick connect fittings can be released either by squeezing the plastic retainer release tabs (step 3) or by using the appropriate *J 37088-A* Fuel Line Quick-Connect Separator Tool (step 4).

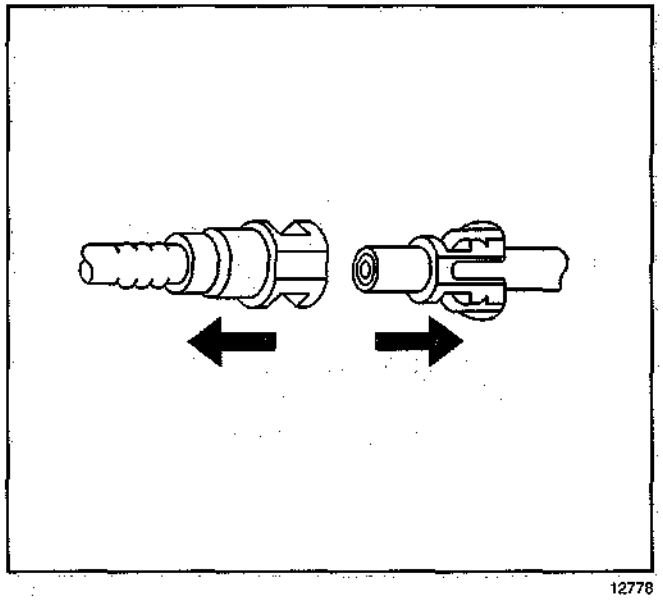
3. Squeeze the plastic retainer release tabs.


12777

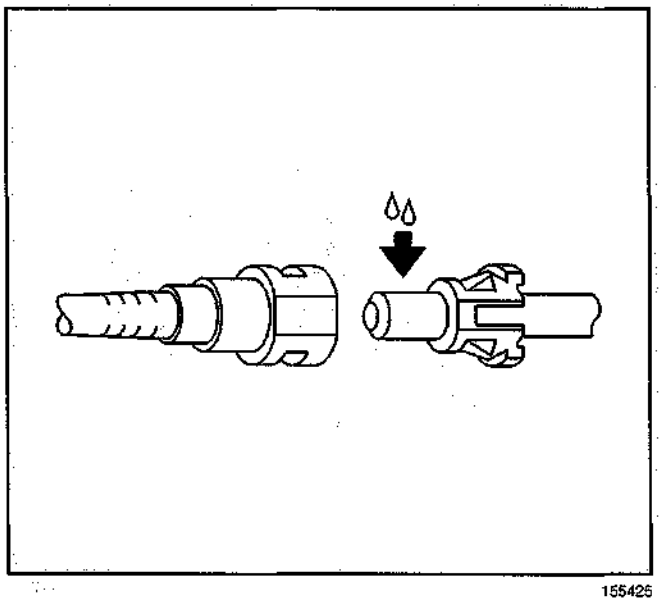
4. Choose the correct tool from *J 37088-A* Tool Set for the size of the fitting. Insert the tool into the female connector, then push inward to release the locking tabs. The plastic retainer will remain on the female connector.


12780

5. Pull the connection apart.


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155425

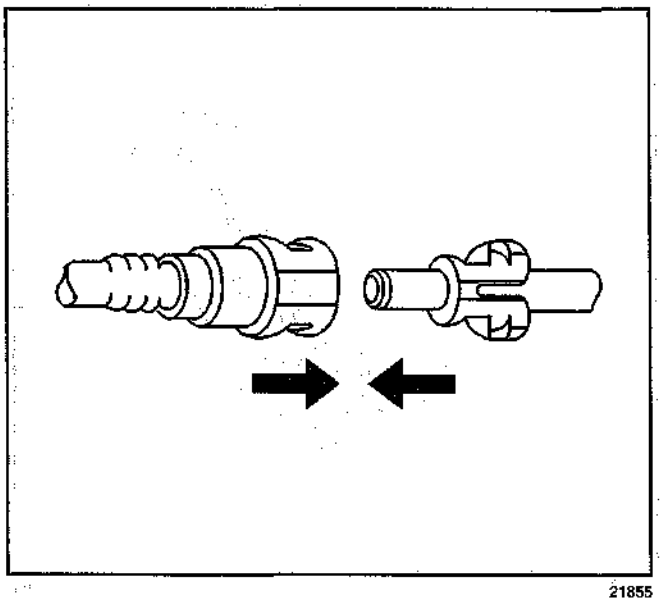
Installation Procedure

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.

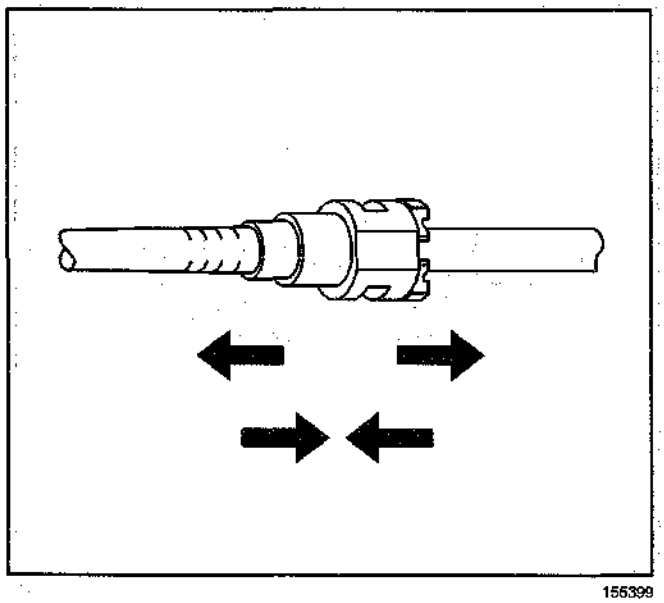
This will ensure proper reconnection and prevent a possible fuel leak.

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 fuel pipe end.


21855

2. Push both sides of the quick-connect fitting together in order to cause the retaining tabs/fingers to snap into place.


155399

3. Once installed, pull on both sides of the quick-connect fitting in order to make sure the connection is secure.

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In-Line Fuel Filter Replacement

Removal Procedure

Important:

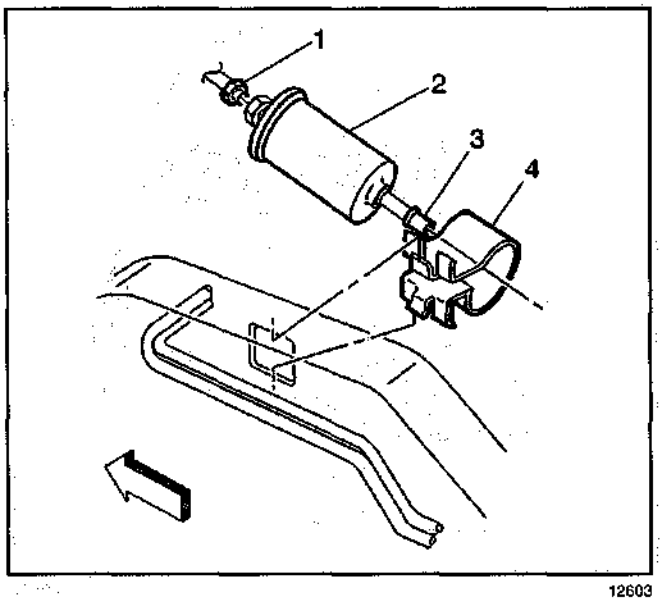
- There is no service interval for fuel filter replacement. Only replace a restricted fuel filter.
- Inspect the fuel tank internally and clean the fuel tank if you find a restricted fuel filter.

Tools Required

J 34730-1A Fuel Pressure Gauge

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. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
4. 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.
5. Disconnect the quick-connect fitting at the fuel filter inlet (3). Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
6. Disconnect the threaded fitting (1) from the fuel filter outlet.
7. Cap the fuel pipes in order to prevent possible fuel system contamination.
8. Slide the fuel filter (2) from the bracket (4).
9. Remove the fuel pipe O-ring.



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Installation Procedure

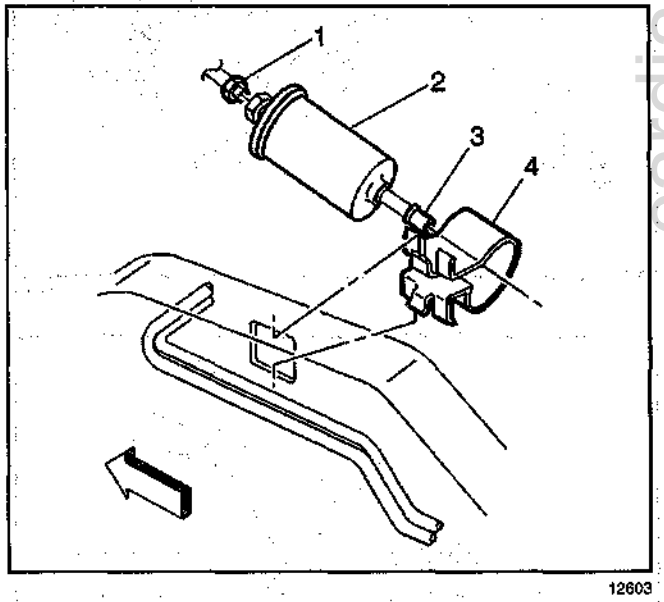
1. Slide the fuel filter (2) into the bracket (4).
2. Remove the caps from the fuel pipes.
3. Lubricate the new fuel pipe O-ring with clean engine oil.
4. Install the fuel pipe O-ring.

Notice: Refer to the *Fastener Notice* in Cautions and Notices.

5. Connect the threaded fitting (1) to the fuel filter outlet.

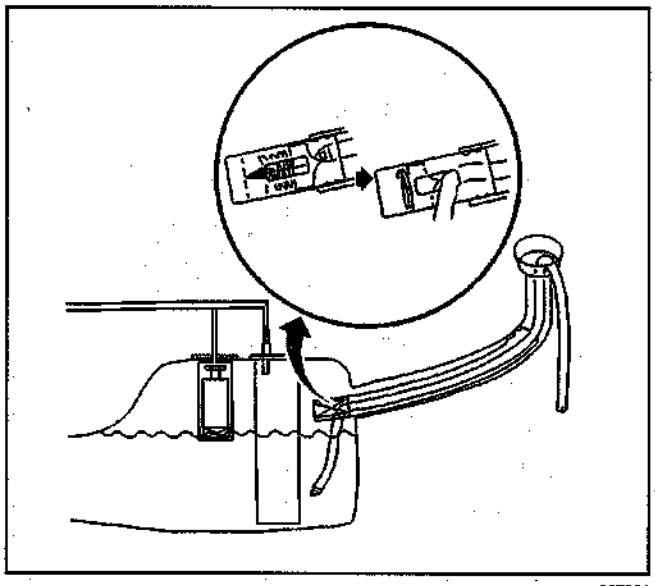
   Tighten

   Tighten the fuel filter fitting to 30 N·m (22 lb ft).
6. Connect the quick-connect fitting to the fuel filter inlet (3). Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
7. Lower the vehicle.
8. Tighten the fuel filler cap.
9. Connect the negative battery cable.
10. Inspect for leaks.
    - 10.1. Turn the ignition switch ON for 2 seconds.
    - 10.2. Turn the ignition switch OFF for 10 seconds.
    - 10.3. Turn the ignition switch ON.
    - 10.4. Check for fuel leaks.
11. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.



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Fuel Tank Draining Procedure

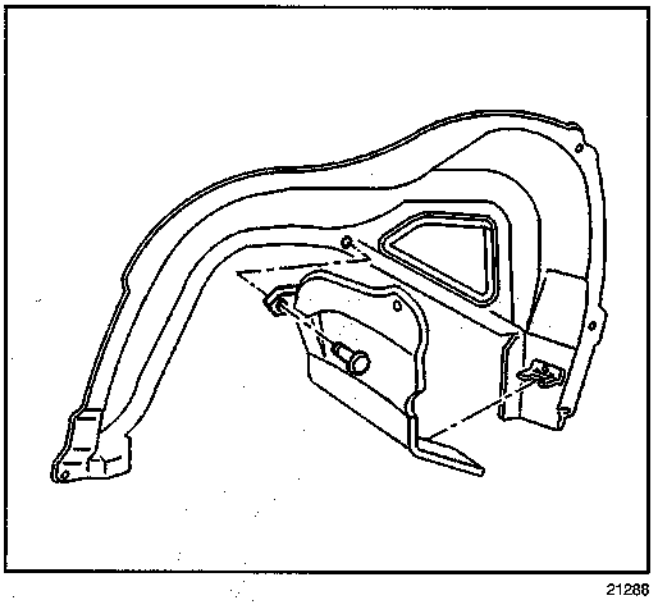
Tools Reqired

- *J 42960-1* Fuel Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

Caution: Never drain or store fuel in an open container. Always use an approved fuel storage container in order to reduce the chance of fire or explosion.

Notice: Do not run the fuel pump unless the fuel pump is submerged in fuel in order to prevent damage to the fuel pump.

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.


21288

Fuel Tank Replacement

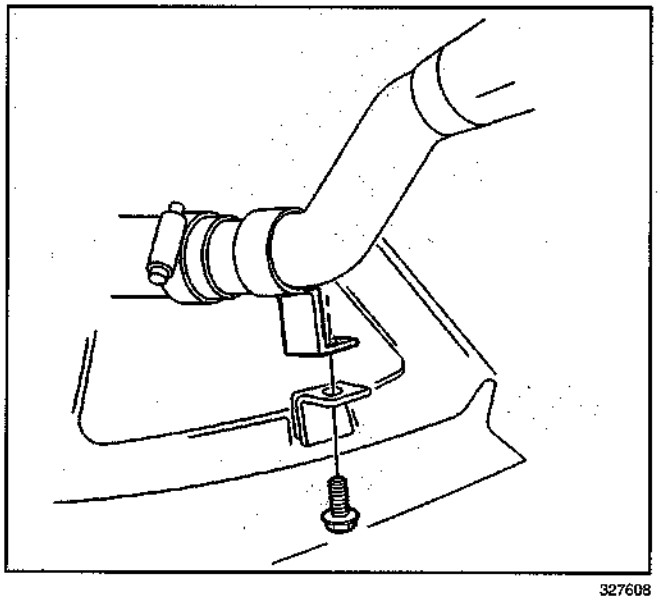
Removal Procedure

Tools Requlred

- *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.

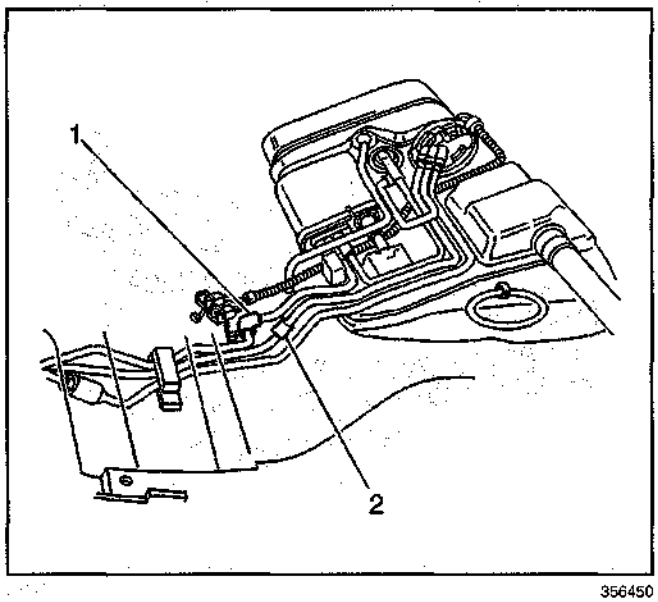
1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure*.
3. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure*.
4. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
5. Remove the fuel fill pipe shield.


327608

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.

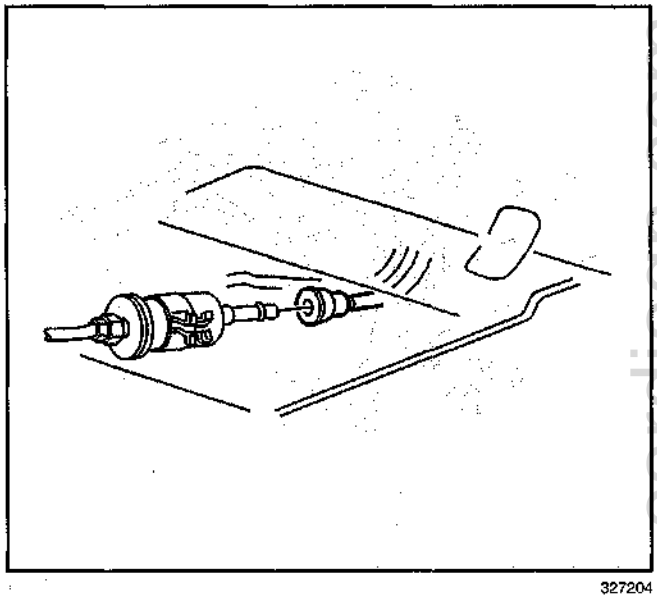
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9. Clean all fuel pipe connections and surrounding areas before disconnecting the fuel pipes in order to avoid possible contamination of the fuel system.
10. Disconnect the fuel return pipe (2) at the rear quick-connect fitting.
11. Disconnect the EVAP purge pipe (1) at the rear quick-connect fitting.

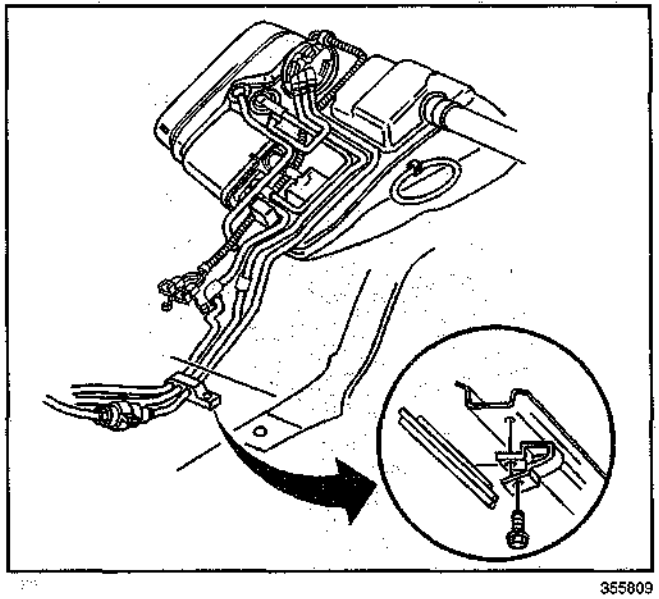


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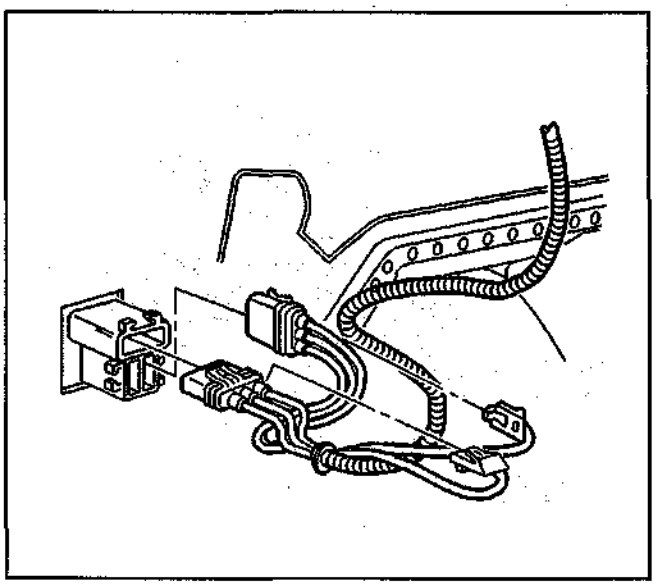
12. Disconnect the fuel feed pipe at the fuel filter inlet.
13. Cap the fuel pipes in order to prevent possible fuel system contamination.


327204

14. Remove the rear pipe clip.

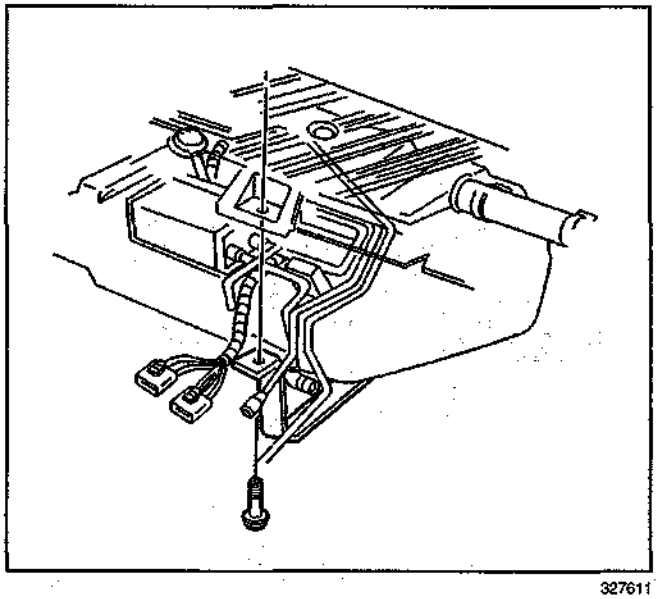

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15. Disconnect the fuel sender and the fuel pressure sensor electrical connectors at the pass through connector.

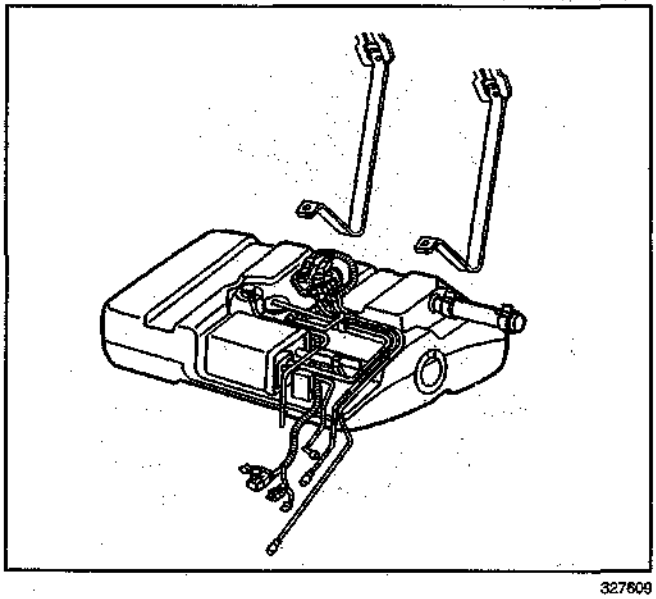


327611

16. With the aid of an assistant, support the fuel tank.

Notice: Do not bend the fuel tank straps. Bending the fuel tank straps may damage the straps.

17. Remove the fuel tank strap attaching bolts from the underbody brackets.
18. Lower the fuel tank straps.

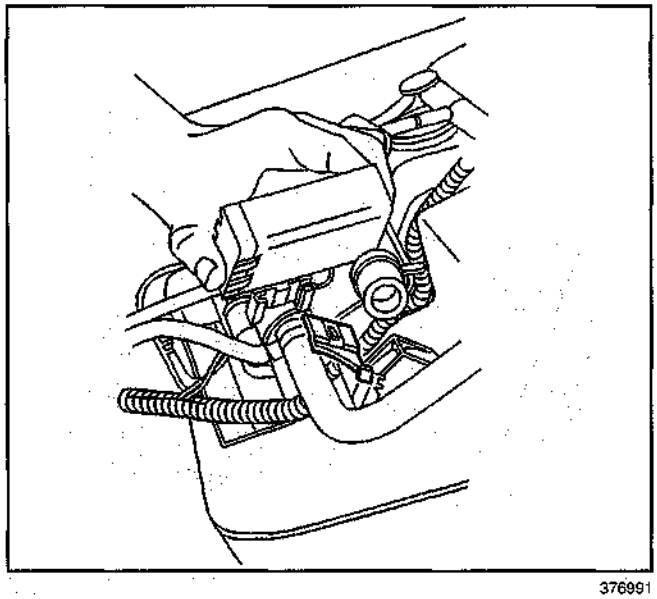


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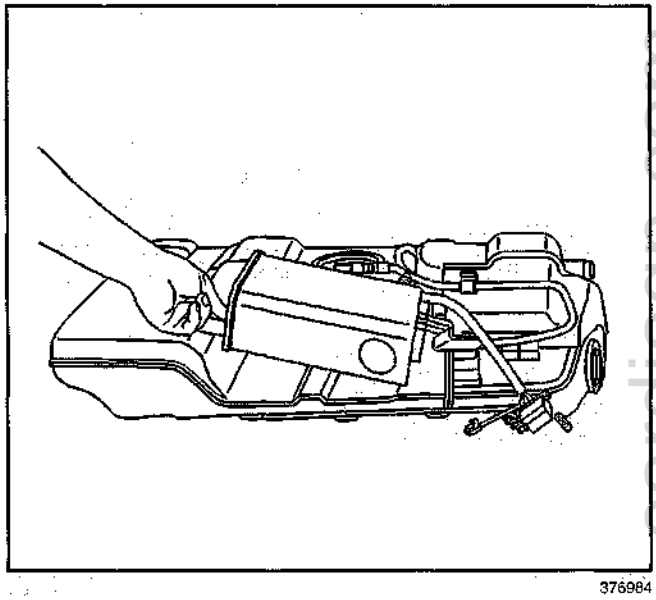
19. Remove the fuel tank.
20. Place the fuel tank in a suitable work area.

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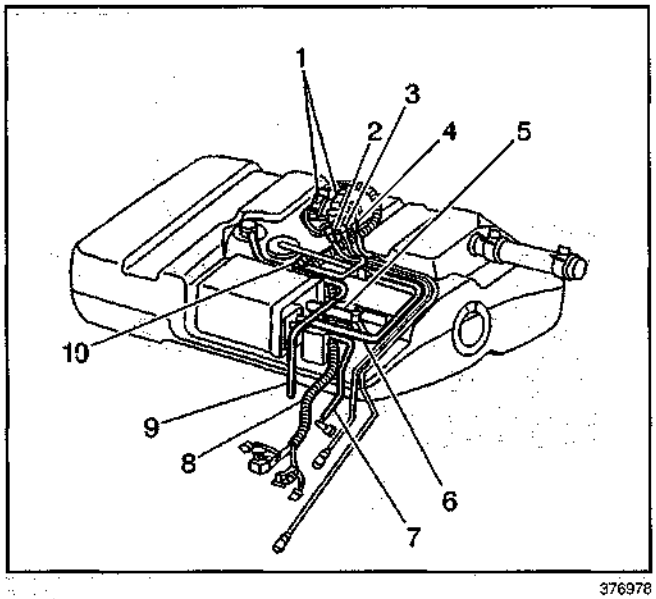
21. Disconnect the hose from the EVAP canister vent solenoid.
22. Remove the EVAP canister vent solenoid from the fuel tank bracket.


376991

23. Disconnect the fill limiter vent valve pipe from the EVAP canister.
24. Carefully bend the fuel tank bracket in order to remove the EVAP canister.

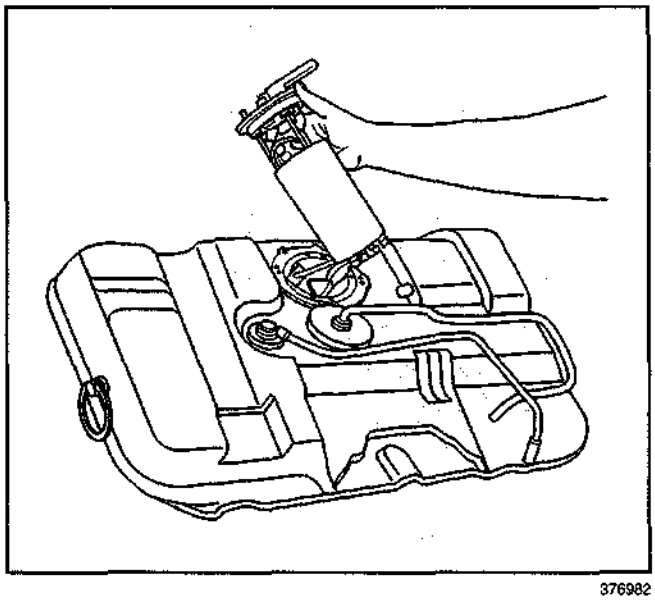

376984

25. Disconnect the fuel feed pipe (4), the fuel return pipe (2), and the EVAP pipe (3) from the fuel sender.
26. Disconnect the EVAP pipe from the fill limiter vent valve pipe (10).
27. Remove the fuel and EVAP pipes from the fuel tank.
28. Disconnect the fuel sender electrical connectors (1).
29. Remove the fuel sender electrical harness (8) from the fuel tank.

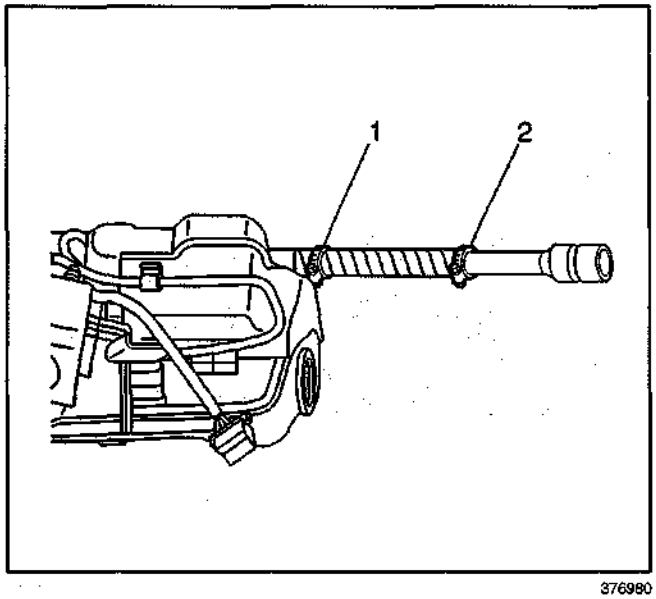


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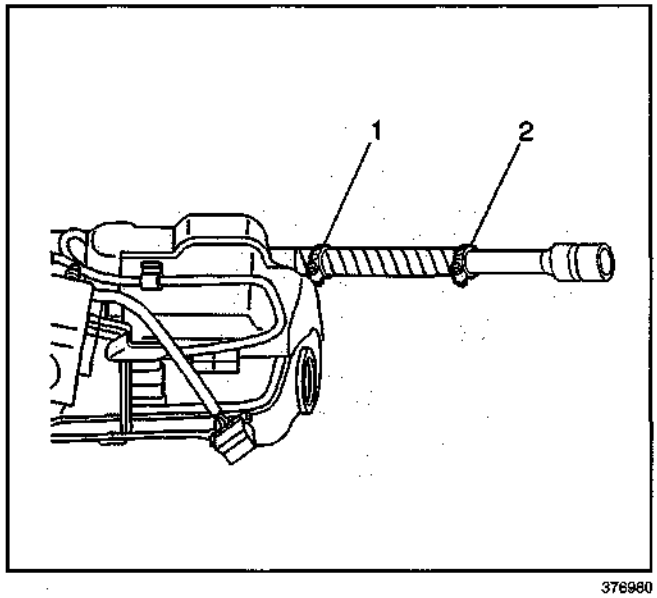

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30. Remove the fuel sender assembly from the fuel tank. Refer to *Fuel Sender Assembly Replacement*.



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31. Remove the fuel fill hose to fuel tank clamp (1).
32. Remove the fuel fill pipe and hose from the fuel tank.



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Installation Procedure

Notice: Refer to the *Fastener Notice* in Cautions and Notices.

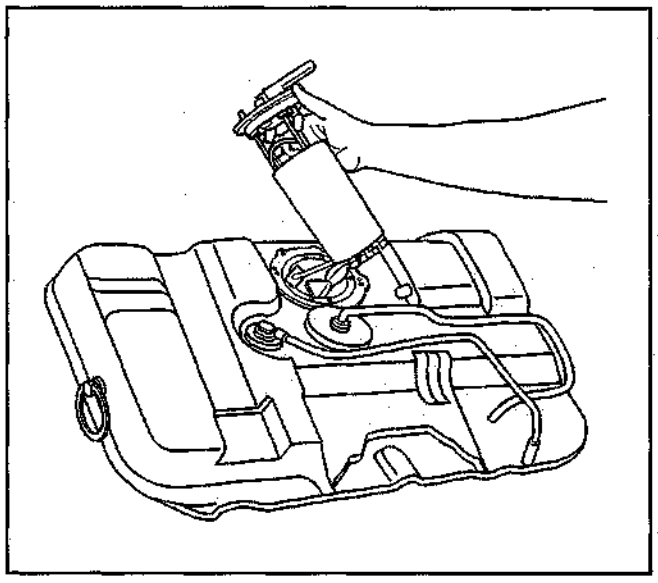
1. Install the fuel fill pipe and hose to the fuel tank.

   Tighten

   Tighten the fuel fill hose clamp (1) to 2.5 N·m (22 lb in).

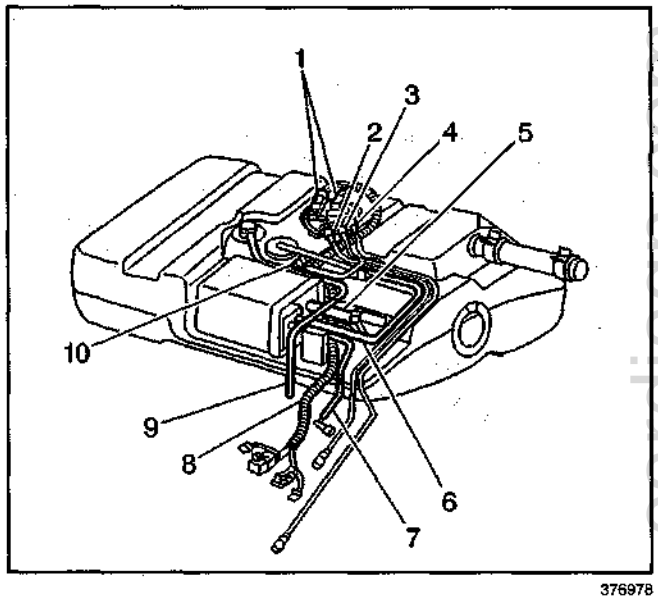
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2. Install the fuel sender assembly to the fuel tank. Refer to *Fuel Sender Assembly Replacement*.
3. Perform the fuel tank leak check. Refer to *Fuel Tank Leak Check*.



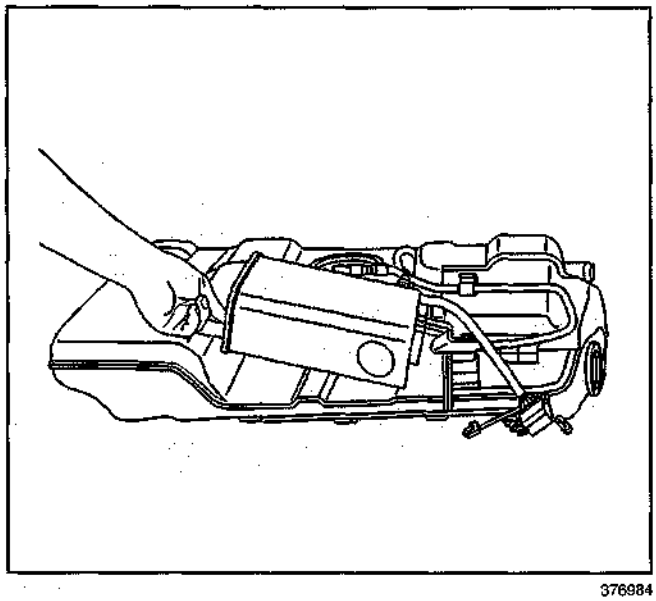
376982

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).



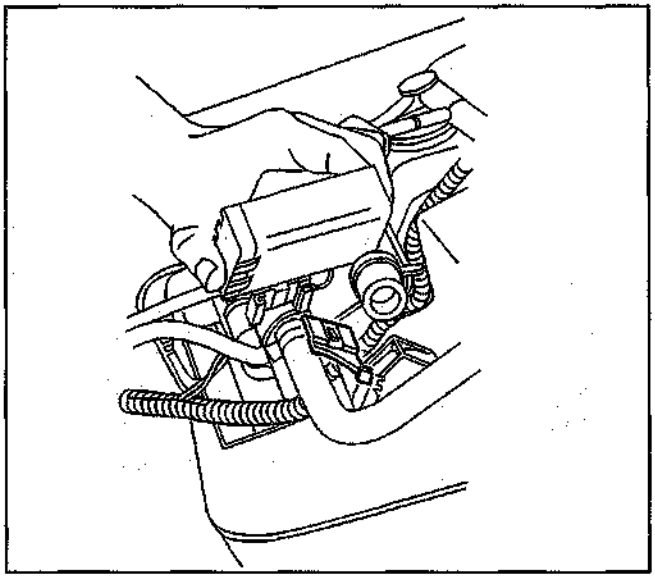
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9. Carefully bend the fuel tank bracket in order to install the EVAP canister.
10. Connect the fill limiter vent valve pipe to the EVAP canister.

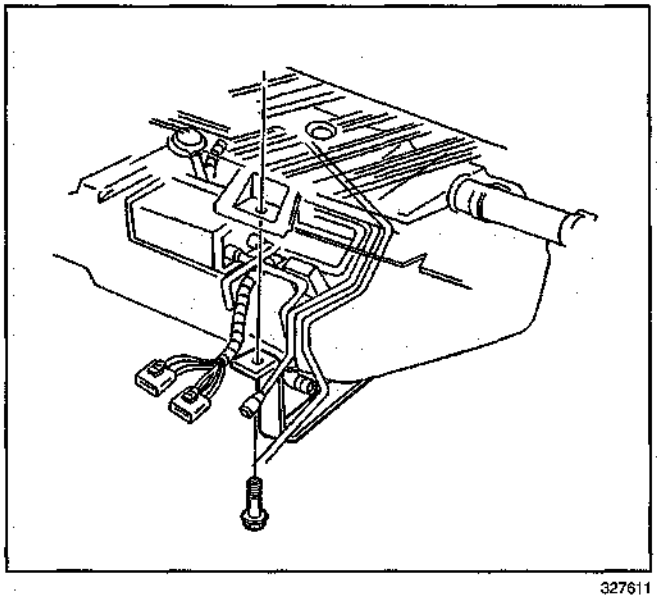


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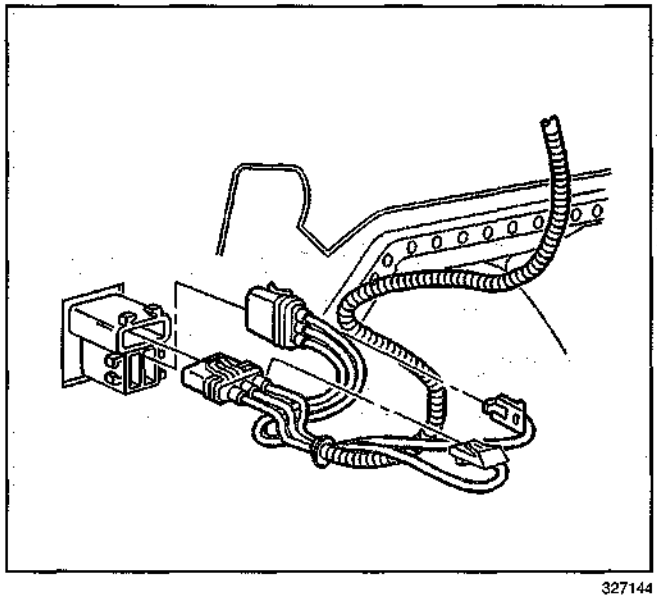
11. Install the EVAP canister vent solenoid to the fuel tank bracket.
12. Connect the hose to the EVAP canister vent solenoid.


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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

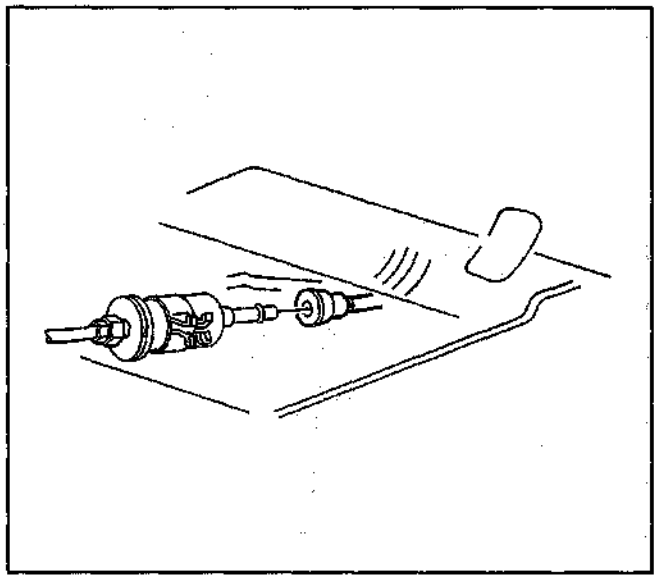
    Tighten the fuel tank strap attaching bolts to 33 N·m (24 lb ft).


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16. Connect the fuel sender and the fuel pressure sensor electrical connectors at the pass through connector.

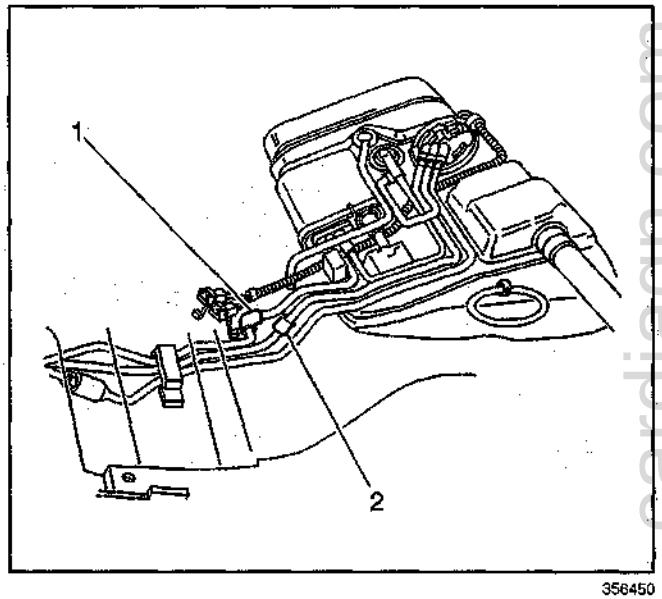
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17. Remove the caps from the fuel pipes.
18. Connect the fuel feed pipe at the fuel filter inlet.



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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.

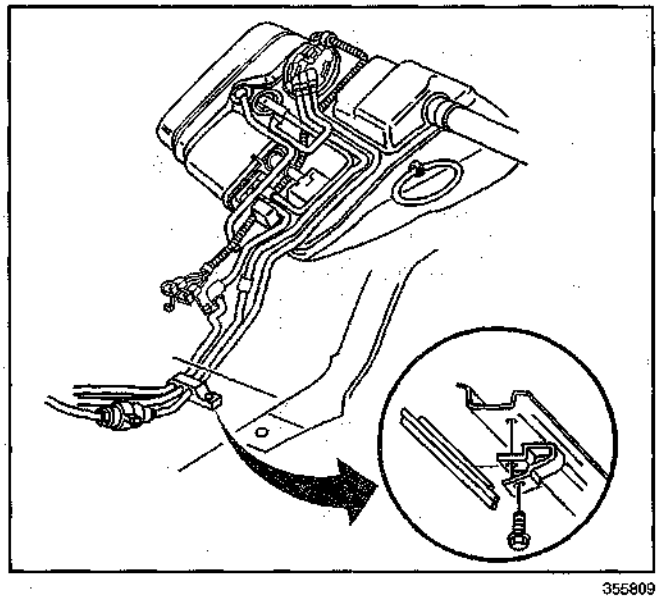


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21. Install the fuel and EVAP pipes into the pipe clip.
22. Align the fuel and EVAP pipes into a flat position.
23. Install the pipe clip bolt.

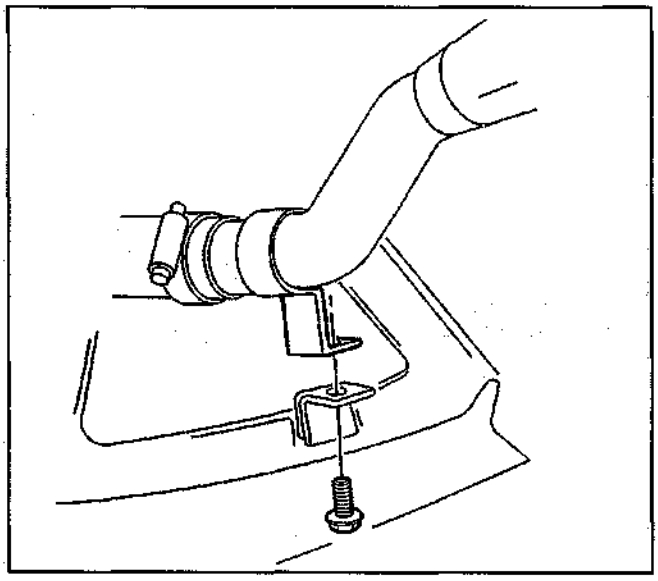
Tighten

Tighten the pipe clip bolt to 5.5 N·m (49 lb in).

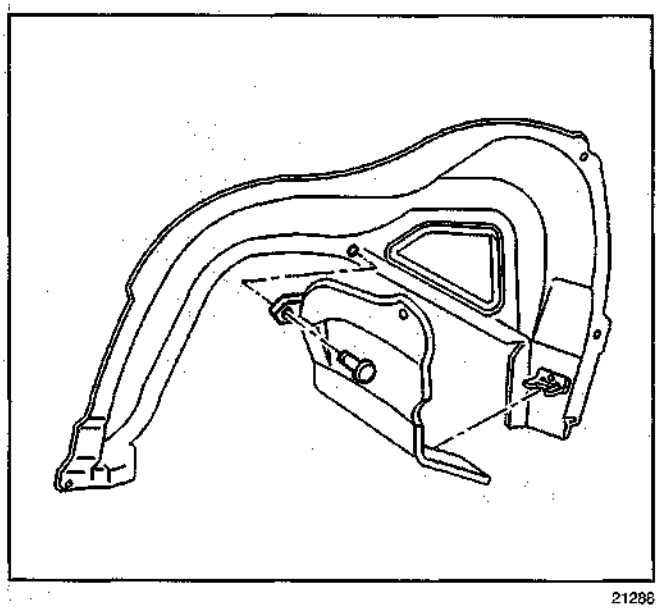


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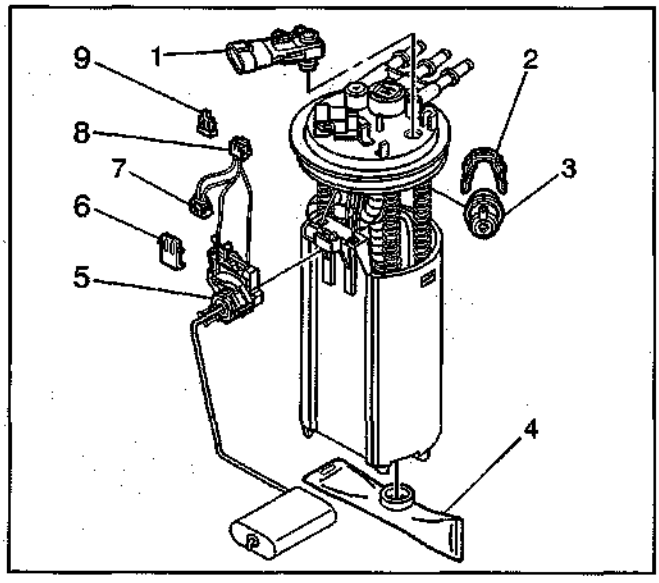
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24. Install the fuel tank fill pipe support bracket bolt.
    Tighten
    Tighten the fuel tank fill pipe support bracket bolt to 10 N·m (89 lb in).
25. Install the exhaust system heat shields and attaching screws. Refer to *Exhaust Pipe and Muffler 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 the ignition switch ON for 2 seconds.
    32.2. Turn the ignition switch OFF for 10 seconds.
    32.3. Turn the ignition switch ON.
    32.4. Check for fuel leaks.
33. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure.*



370970

Fuel Tank Pressure Sensor Replacement

Removal Procedure

Tools Required

- *J 34730-1A* Fuel Pressure Gauge
- *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.

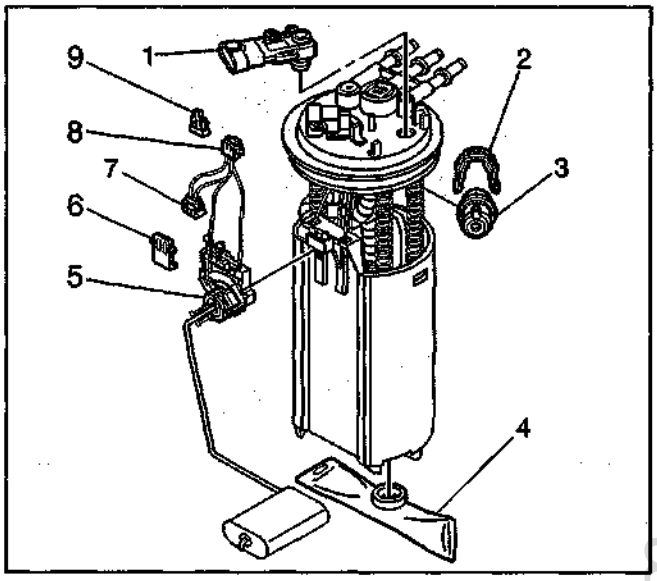
1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure.*
3. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure.*
4. Remove the fuel tank. Refer to *Fuel Tank Replacement.*

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5. Disconnect the fuel pressure sensor electrical connector.
6. Remove the fuel pressure sensor (1).

Installation Procedure

1. Install the fuel pressure sensor (1).
2. Connect the fuel pressure sensor electrical connector.
3. Install the fuel tank. Refer to *Fuel Tank Replacement.*
4. Refill the fuel tank.
5. Install the fuel filler cap.
6. Connect the negative battery cable.
7. Inspect for leaks.
   7.1. Turn the ignition switch ON for 2 seconds.
   7.2. Turn the ignition switch OFF for 10 seconds.
   7.3. Turn the ignition switch ON.
   7.4. Check for fuel leaks.
8. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure.*



370970

Fuel Level Sensor Replacement

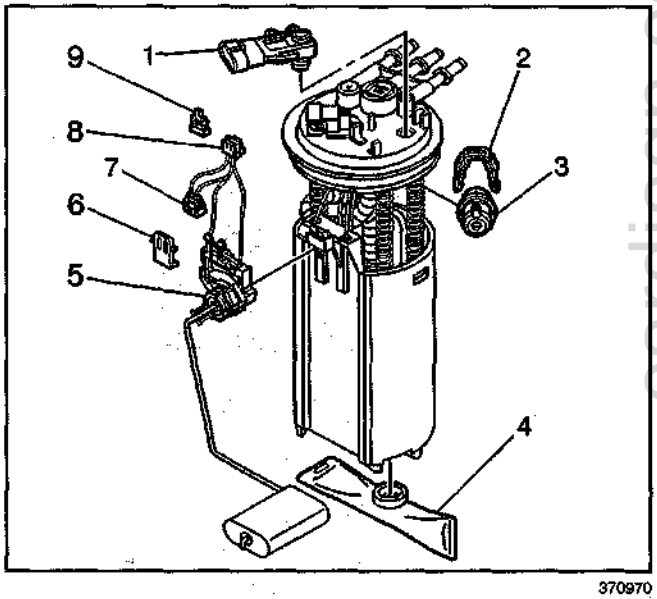
Removal Procedure

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

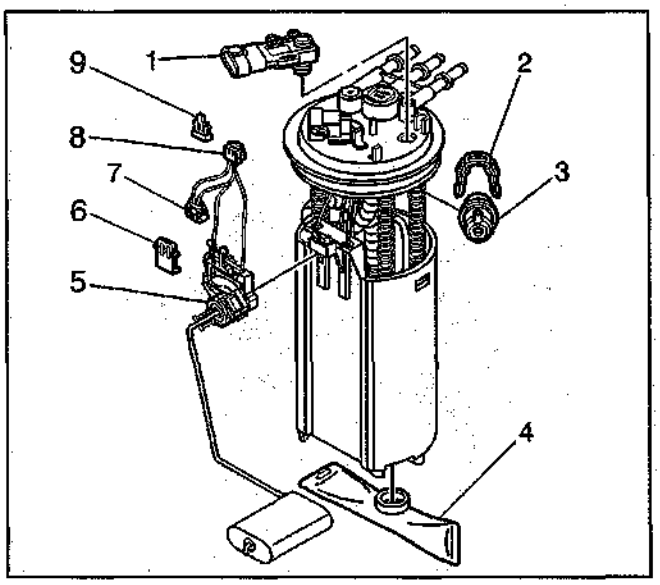
Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

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. Remove the fuel tank. Refer to *Fuel Tank Replacement.*
5. Remove the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement.*
6. Disconnect the fuel pump electrical connector (7).
7. Remove the fuel level sensor electrical connector retaining clip (9).
8. Disconnect the fuel level sensor electrical connector (8) from under the fuel sender cover.
9. Remove the fuel level sensor retaining clip (6).
10. Squeeze the locking tangs and remove the fuel level sensor (5).



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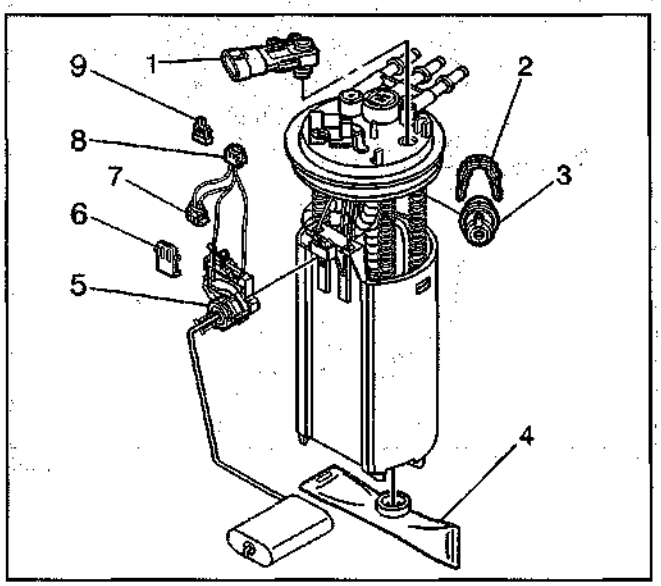
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Installation Procedure

1. Install the fuel level sensor (5).
2. Install the fuel level sensor retaining clip (6).
3. Connect the fuel level sensor electrical connector (8).
4. Connect the fuel level sensor electrical connector retaining clip (9).
5. Connect the fuel pump electrical connector (7).
6. Install the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*.
7. Perform the fuel tank leak check. Refer to *Fuel Tank Leak Check*.
8. Install the fuel tank. Refer to *Fuel Tank Replacement*.
9. Refill the fuel tank.
10. Install the fuel filler cap.
11. Connect the negative battery cable.
12. Inspect for leaks.
    - 12.1. Turn the ignition switch ON for 2 seconds.
    - 12.2. Turn the ignition switch OFF for 10 seconds.
    - 12.3. Turn the ignition switch ON.
    - 12.4. Check for fuel leaks.
13. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure*.



370970

Fuel Strainer 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

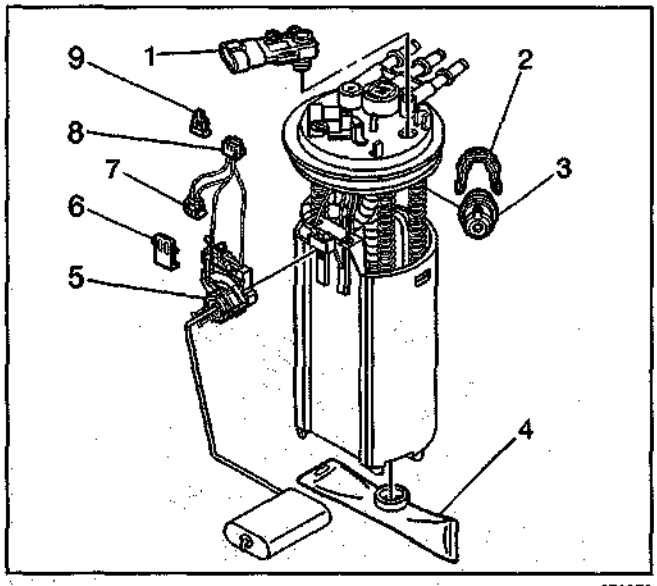
Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

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. Remove the fuel tank. Refer to *Fuel Tank Replacement*.
5. Remove the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*.
6. Note the position of the fuel strainer (4) on the fuel pump.
7. Support the fuel sender assembly with one hand and grasp the strainer (4) with the other hand.
8. Pull the strainer off the pump. Discard the strainer after inspection.
9. Inspect the strainer. Replace a contaminated strainer and clean the fuel tank.

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Installation Procedure

1. 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.
2. Install the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement.*
3. Perform the fuel tank leak check. Refer to *Fuel Tank Leak Check.*
4. Install the fuel tank. Refer to *Fuel Tank Replacement.*
5. Refill the fuel tank.
6. Install the fuel filler cap.
7. Connect the negative battery cable.
8. Inspect for leaks.
   - 8.1. Turn the ignition switch ON for 2 seconds.
   - 8.2. Turn the ignition switch OFF for 10 seconds.
   - 8.3. Turn the ignition switch ON.
   - 8.4. Check for fuel leaks.
9. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure.*



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Fuel Tank Pump Module Replacement

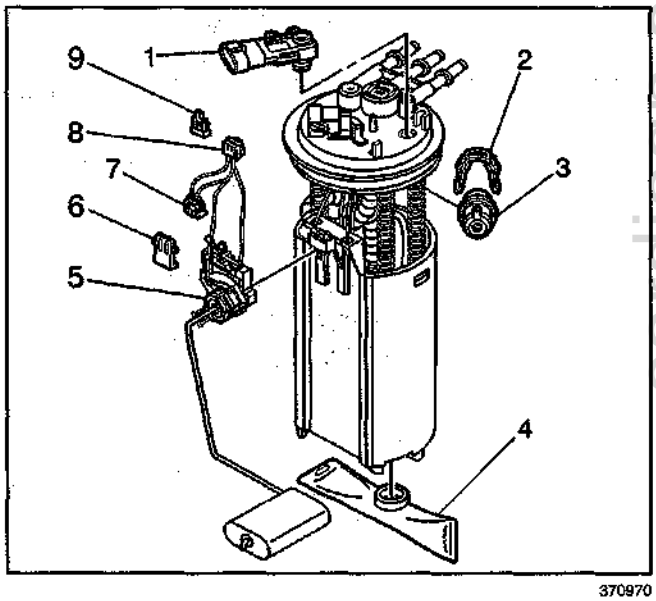
Removal Procedure

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

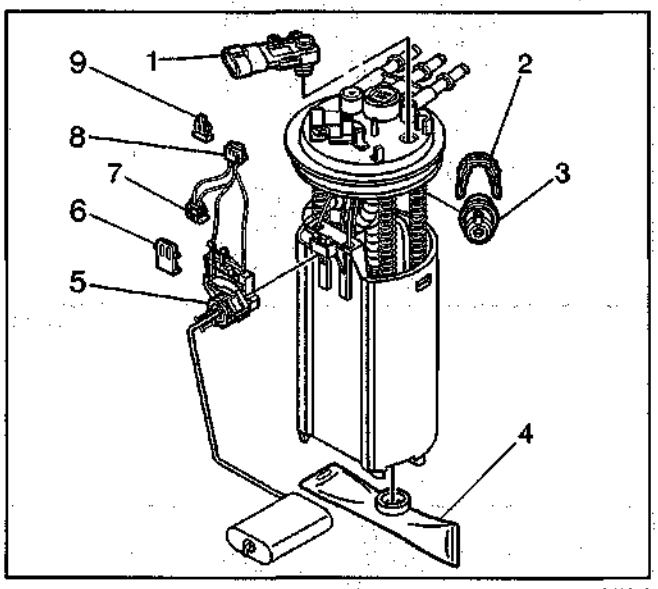
Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

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. Remove the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement.*
6. Note the position of the fuel strainer (4) on the fuel pump.
7. Support the fuel sender assembly with one hand and grasp the strainer (4) with the other hand.
8. Pull the strainer off the pump. Discard the strainer after inspection.
9. Inspect the strainer. Replace a contaminated strainer and clean the fuel tank.
10. Remove the fuel pressure regulator retaining clip (2).
11. Remove the fuel pressure regulator (3) from the housing on the fuel return pipe.
12. Disconnect the fuel pump electrical connector (7).



370970

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370970

13. Remove the fuel level sensor electrical connector retaining clip (9).
14. Disconnect the fuel level sensor electrical connector (8) from under the fuel sender cover.
15. Remove the fuel level sensor retaining clip (6).
16. Squeeze the locking tangs and remove the fuel level sensor (5).
17. Remove the fuel pressure sensor (1).

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).
7. If needed, clean the fuel pressure regulator filter screen with gasoline.
8. Lubricate the fuel pressure regulator large and small O-rings with clean engine oil.
9. Install the fuel pressure regulator (3) into the housing on the fuel return pipe.
10. Install the fuel pressure regulator retaining clip (2).

Important: Always install a new fuel strainer when replacing the fuel tank fuel pump module.

11. 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.
12. Install the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*.
13. Perform the fuel tank leak check. Refer to *Fuel Tank Leak Check*.
14. Install the fuel tank. Refer to *Fuel Tank Replacement*.
15. Refill the fuel tank.
16. Install the fuel filler cap.
17. Connect the negative battery cable.
18. Inspect for leaks.
    - 18.1. Turn the ignition switch ON for 2 seconds.
    - 18.2. Turn the ignition switch OFF for 10 seconds.
    - 18.3. Turn the ignition switch ON.
    - 18.4. Check for fuel leaks.
19. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure*.

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Fuel Sender Assembly Replacement

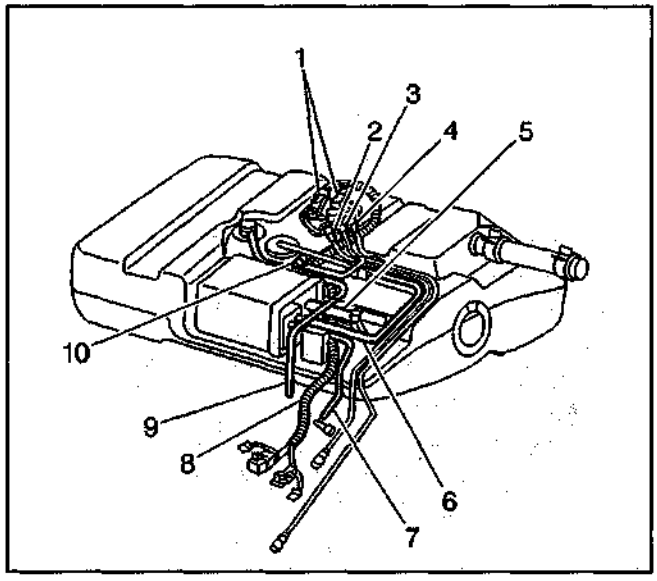
Removal Procedure

Tools Required

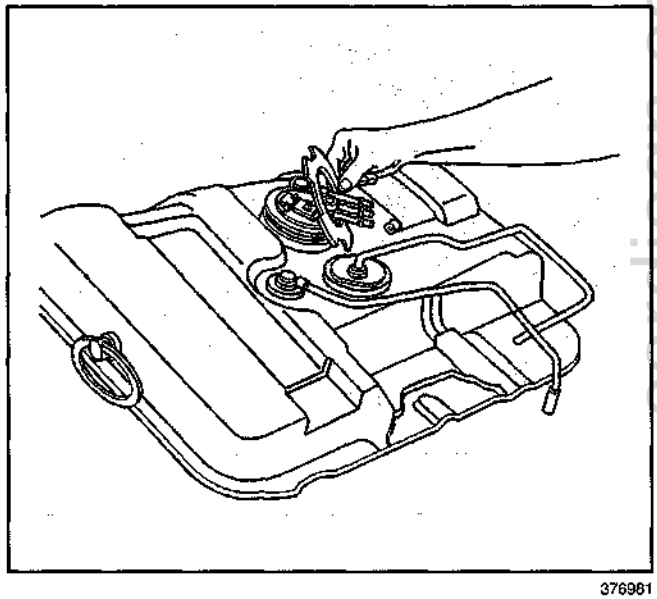
- *J 34730-1A* Fuel Pressure Gauge
- *J 39765* Fuel Sender Lock Nut Wrench
- *J 42960-1* Fuel Tank Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

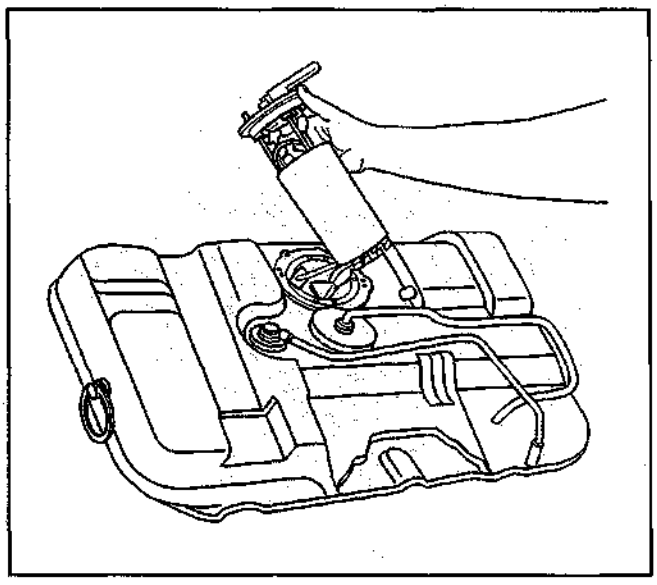
1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure*.
3. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure*.
4. Remove the fuel tank. Refer to *Fuel Tank Replacement*.
5. Disconnect the fuel feed pipe (4), the fuel return pipe (2), and the EVAP pipe (3) from the fuel sender.
6. Disconnect the fuel sender electrical connectors (1) from the fuel sender.
7. Remove the fuel sender assembly retaining ring using the *J 39765* Fuel Sender Lock Nut Wrench.



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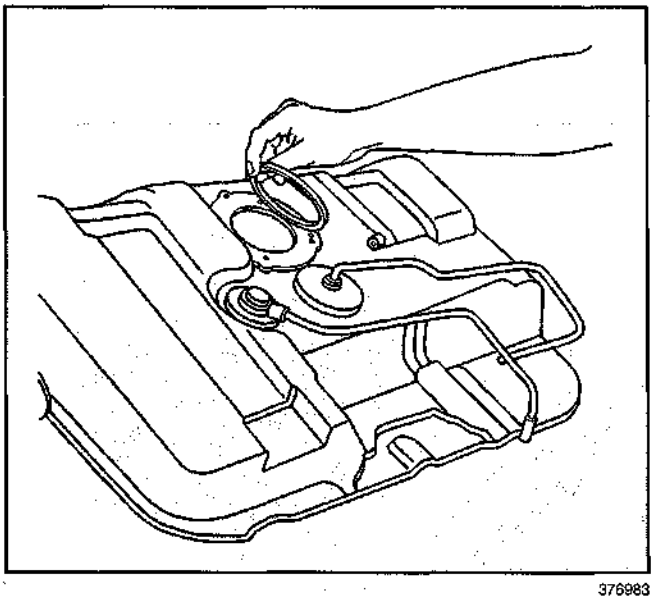
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376982

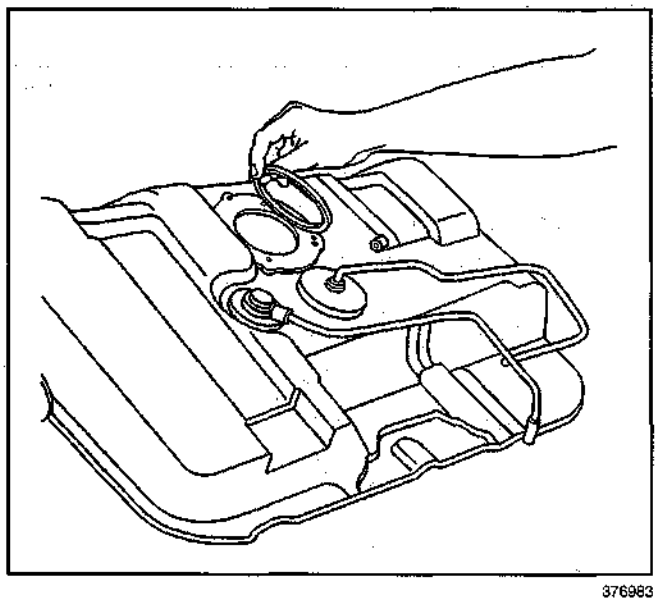
Notice: Do Not handle the fuel sender assembly by the fuel pipes. The amount of leverage generated by handling the fuel pipes could damage the joints.

8. Remove the fuel sender assembly.

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.


376983

9. Remove the fuel sender seal.
10. Discard the fuel sender seal.
11. Clean the seal sealing surfaces.


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Installation 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.

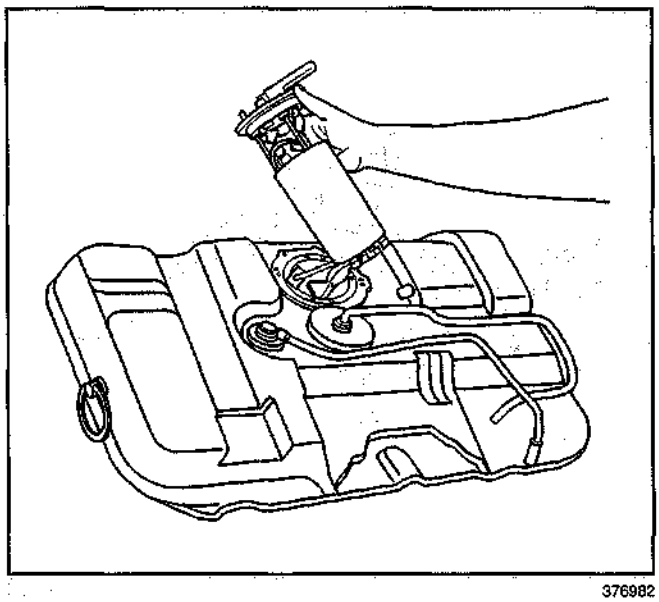
Notice: With extreme care align the fuel sender seal in the fuel tank groove. Properly align the tab on the fuel sender in the notch on the fuel tank. Misalignment of the fuel sender seal or the fuel sender could damage the fuel tank sender tabs. Replace the fuel tank if the fuel tank fuel sender tabs are damaged.

1. Install the new fuel sender seal on the fuel tank.

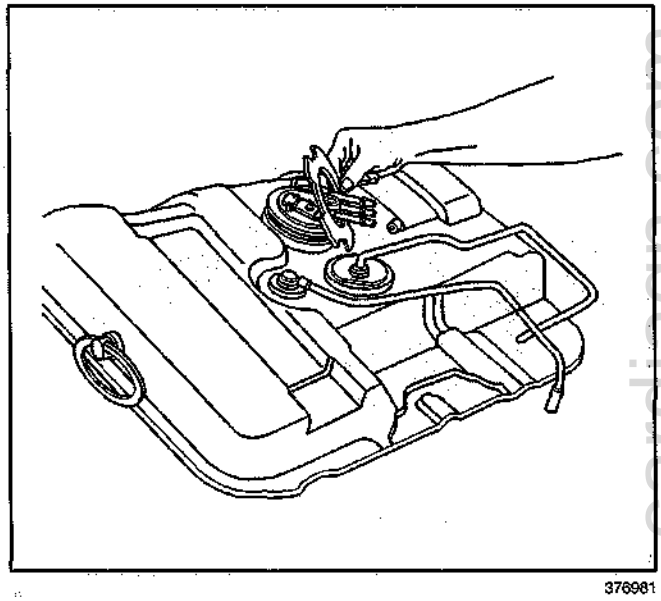
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Important: The fuel pump strainer must be in a horizontal position when the fuel sender is installed in the tank. When installing the fuel sender assembly, assure that the fuel pump strainer does not block full travel of the float arm.

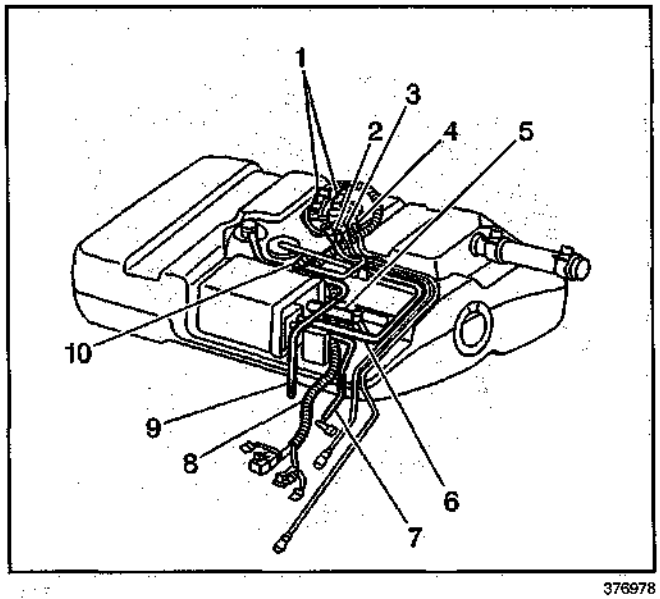
2. Install the fuel sender assembly into the fuel tank.


376982

3. Install the fuel sender assembly retaining ring using the *J 39765* Fuel Sender Lock Nut Wrench.
4. Perform the fuel tank leak check. Refer to *Fuel Tank Leak Check*.

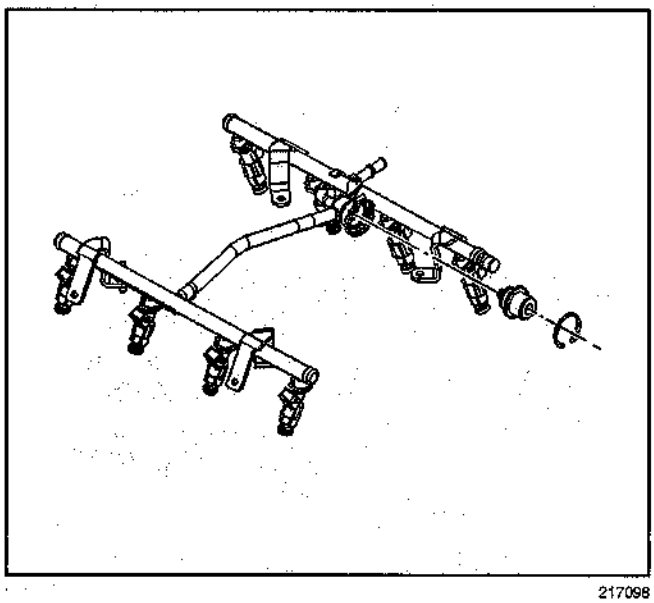

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5. Connect the fuel sender electrical connectors (1) to the fuel sender.
6. Connect the fuel feed pipe (4), the fuel return pipe (2), and the EVAP pipe (3) to the fuel sender.
7. Install the fuel tank. Refer to *Fuel Tank Replacement*.
8. Refill the fuel tank.
9. Install the fuel filler cap.
10. Connect the negative battery cable.
11. Inspect for leaks.
    - 11.1. Turn the ignition switch ON for 2 seconds.
    - 11.2. Turn the ignition switch OFF for 10 seconds.
    - 11.3. Turn the ignition switch ON.
    - 11.4. Check for fuel leaks.
12. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure*.



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217098

Fuel Pulse Dampener Replacement

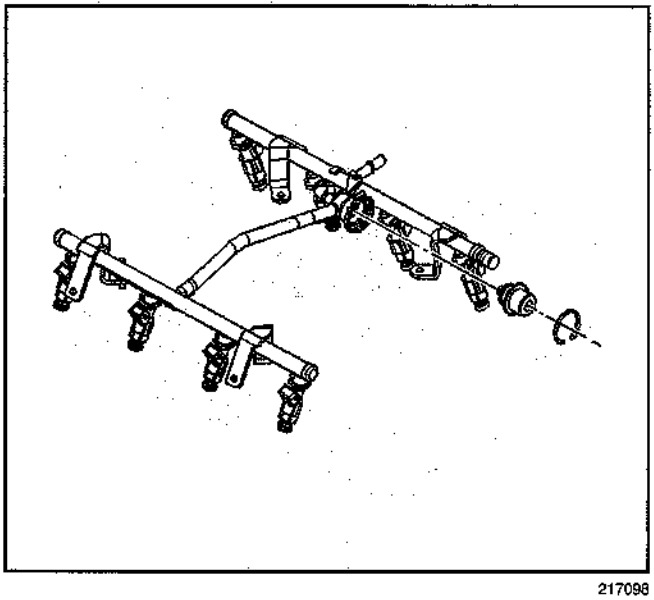
Removal Procedure

Tools Required

J 34730-1A Fuel Pressure Gauge

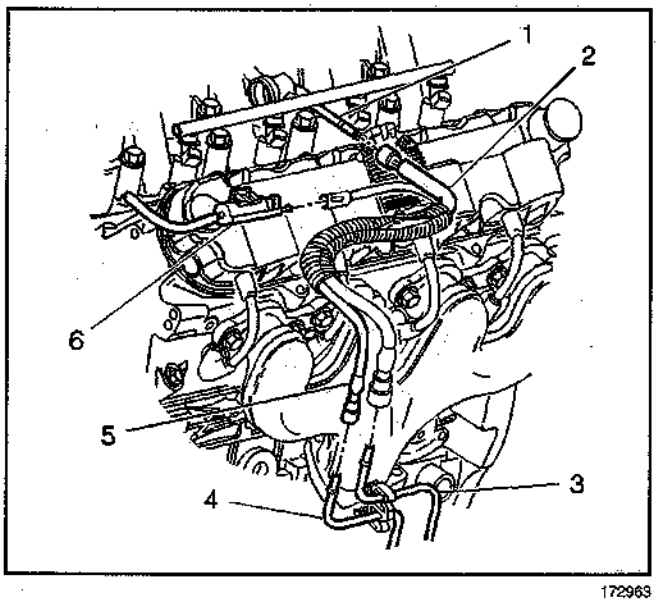
Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to *Fuel Pressure Relief Procedure*.
3. Clean any dirt from the fuel pulse dampener retaining ring.
4. Remove the fuel pulse dampener retaining ring.
5. Discard the fuel pulse dampener retaining ring.
6. Remove the fuel pulse dampener from the fuel rail.
7. Remove the fuel pulse dampener O-ring.
8. Discard the fuel pulse dampener O-ring.


217098

Installation Procedure

1. Install the new O-ring on the fuel pulse dampener.
2. Lubricate the fuel pulse dampener O-ring with clean engine oil.
3. Push the fuel pulse dampener into the fuel rail.
4. Install the new fuel pulse dampener retaining ring.
5. Tighten the fuel filler cap.
6. Connect the negative battery cable.
7. Inspect for leaks.
   - 7.1. Turn the ignition switch ON for 2 seconds.
   - 7.2. Turn the ignition switch OFF for 10 seconds.
   - 7.3. Turn the ignition switch ON.
   - 7.4. Check for fuel leaks.
8. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.



172963

Fuel Hose/Pipes Replacement (Chassis)

Removal Procedure

Tools Required

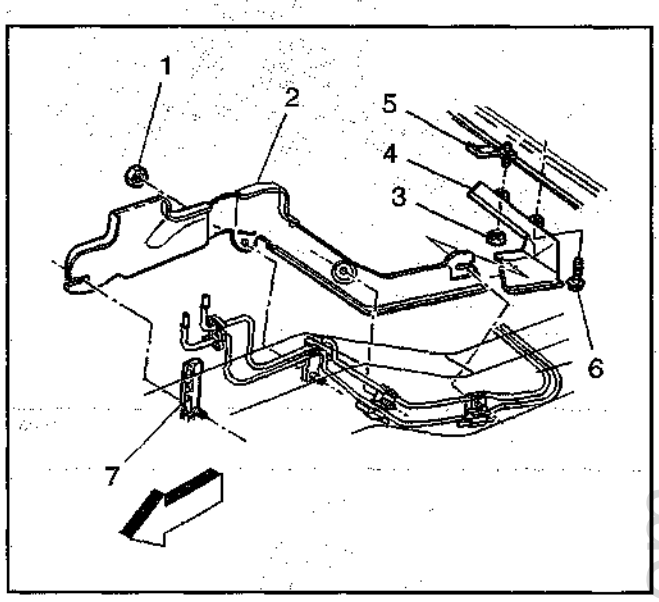
J 37088-A Tool Set, Fuel Line Quick-Connect Separator

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. Clean all the fuel pipe connections and the surrounding areas before disconnecting the pipes in order to avoid possible contamination of the fuel system.

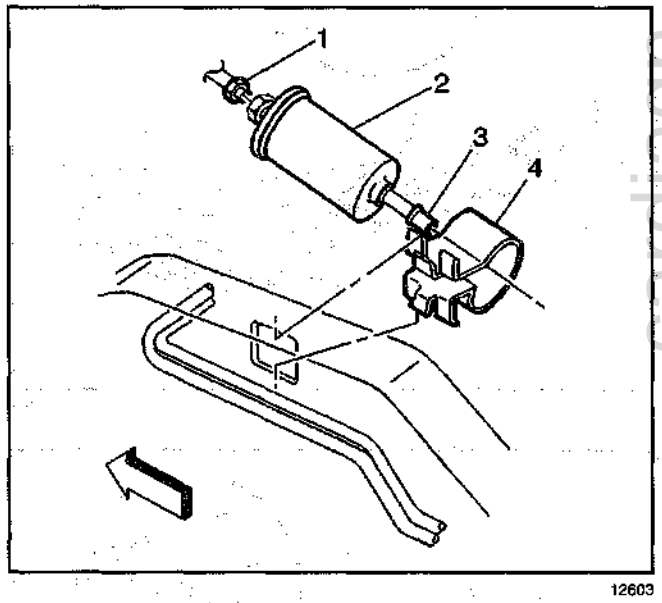
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5. Disconnect the engine compartment fuel feed pipe (2) from the chassis fuel feed pipe (3). Refer to *Quick Connect Fitting(s) Service (Metal Collar)*.
6. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
7. Remove the rear fuel pipe shield attaching nuts (3) and bolt (6).
8. Remove the rear fuel pipe shield (4).
9. Remove the front fuel pipe shield attaching nuts (1).
10. Remove the front fuel pipe shield (2).



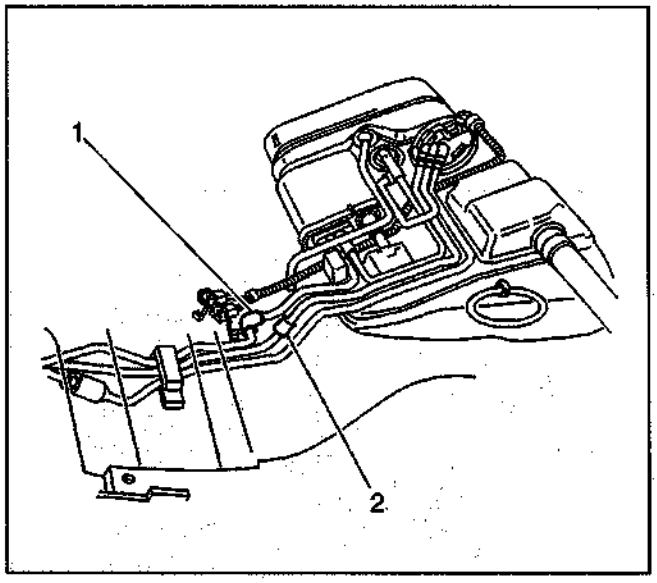
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11. Disconnect the fuel feed pipe (1) from the outlet side of the fuel filter (2). Discard the O-ring.



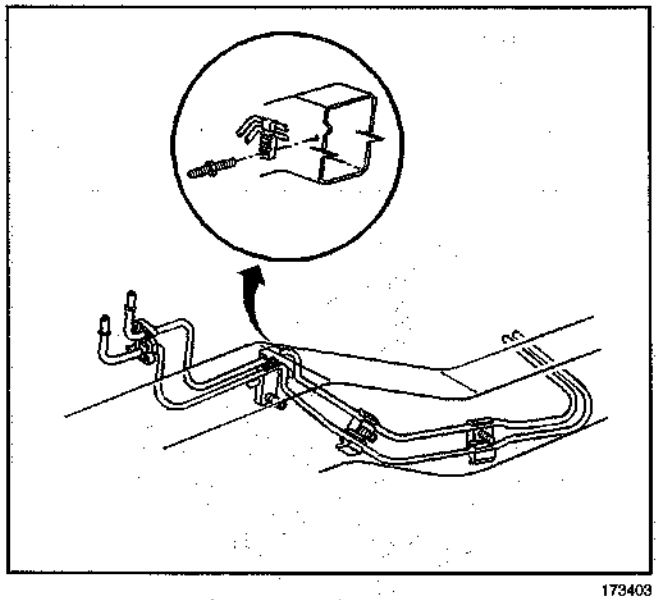
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12. Disconnect the fuel return pipe (2) at the rear quick connect fitting. Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
13. Remove the fuel pipe attaching hardware and the fuel pipes. Note the position of the fuel pipes for installation.


173403

Installation Procedure

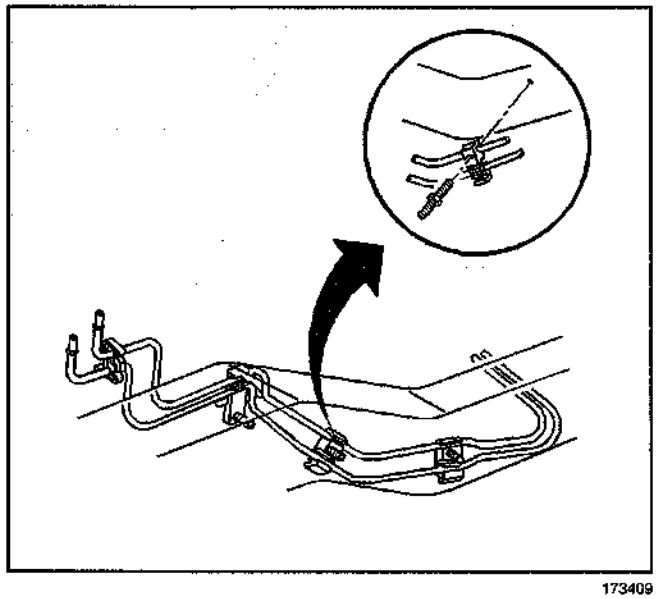
Important:

- When replacing the fuel 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 pipe 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.

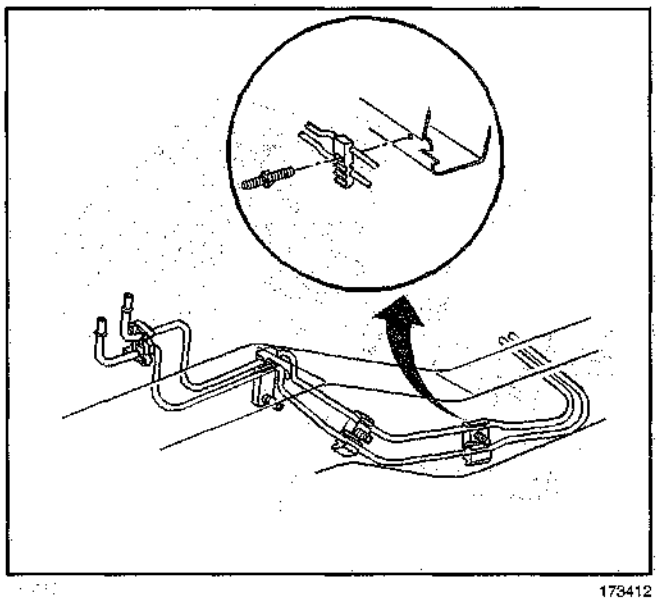

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4. Loosely install the number 3 position pipe clip stud.

   Tighten

   Tighten the 3 studs to 5 N·m (44 lb in).

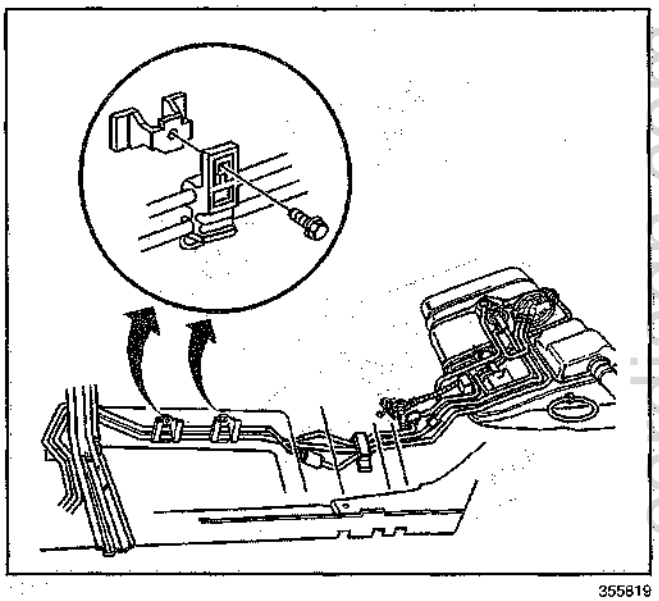


173412

5. Align the fuel pipe 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).

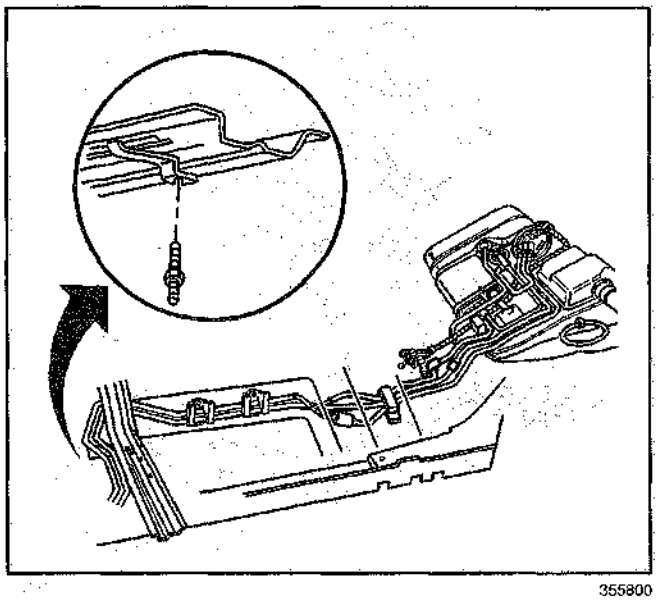


355819

7. Align the fuel pipe to the number 4 position clamp.
8. Install the pipe clamp stud.

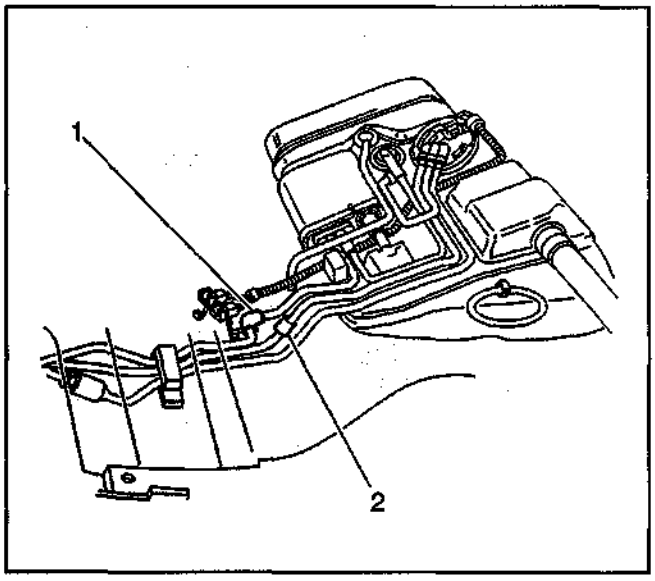
   Tighten

   Tighten the pipe clamp stud to 5 N·m (44 lb in).



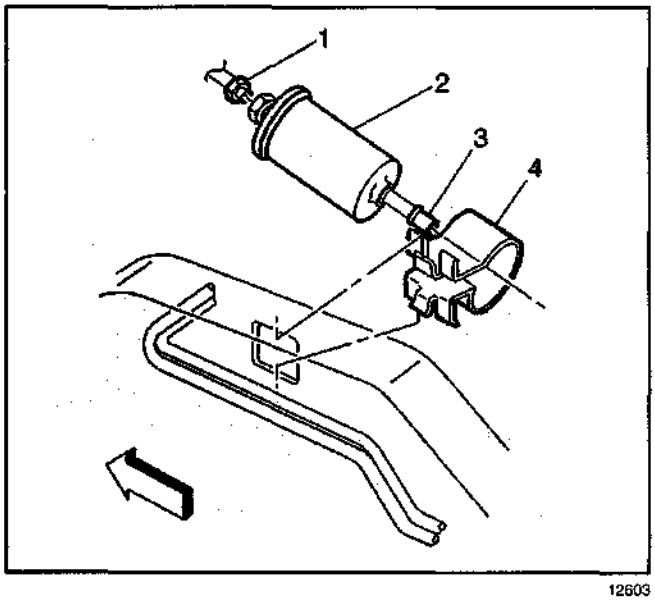
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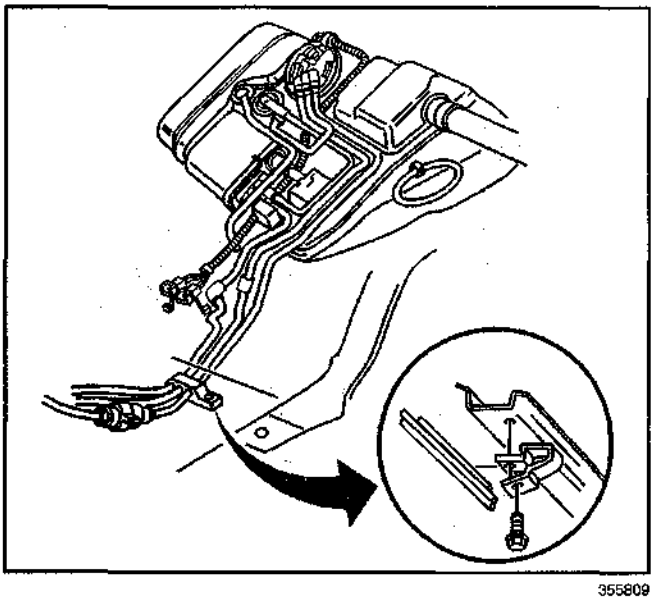
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9. Connect the fuel return pipe (2) at the rear quick connect fitting. Refer to *Quick Connect Fitting(s) Service (Plastic Collar).*



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10. 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).


355809

11. Install the fuel pipes into the rear pipe clip.
12. Align the fuel pipes in a flat position.
13. 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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14. Position the front fuel pipe shield (2) to the 3 fuel pipe clip studs and the brake pipe clip stud (7).
15. Install the pipe shield nuts (1).

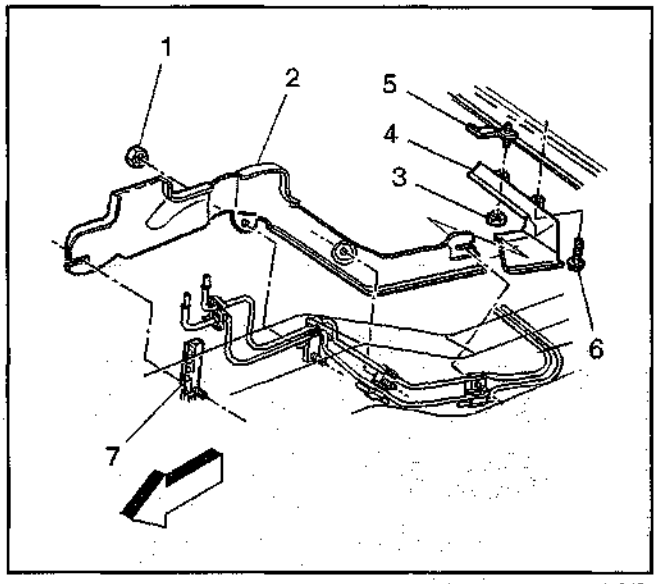
    Tighten

    Tighten the pipe shield nuts to 5 N·m (44 lb in).
16. Position the rear fuel pipe shield (4) to the fuel pipe stud and the fuel pipe clip stud (5).
17. Loosely install the pipe shield nuts (3).
18. Install the pipe shield bolt (6).

    Tighten

    18.1. Tighten the pipe shield bolt to 5 N·m (44 lb in).

    18.2. Tighten the pipe shield nuts to 5 N·m (44 lb in).
19. Lower the vehicle.



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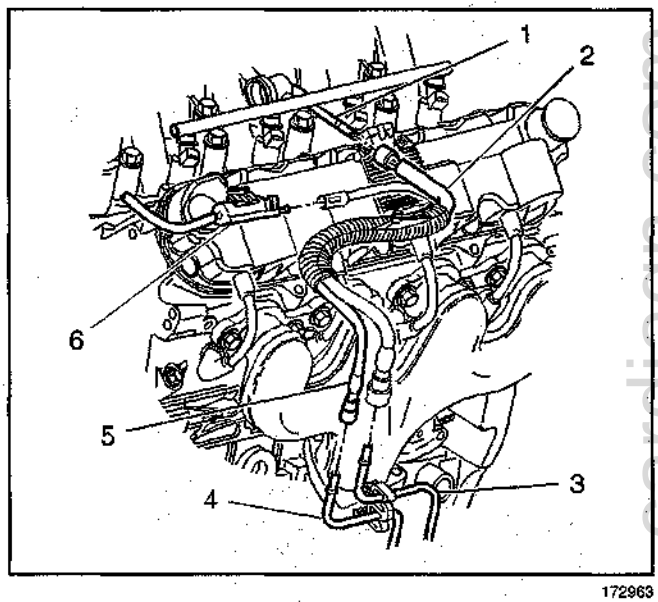
20. Connect the engine compartment fuel feed pipe (2) to the chassis fuel feed pipe (3). Refer to *Quick Connect Fitting(s) Service (Metal Collar).*
21. Refill the fuel tank.
22. Tighten the fuel filler cap.
23. Connect the negative battery cable.
24. Inspect for leaks.

    24.1. Turn the ignition switch ON for 2 seconds.

    24.2. Turn the ignition switch OFF for 10 seconds.

    24.3. Turn the ignition switch ON.

    24.4. Inspect for fuel leaks.
25. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure.*



172963

Fuel Hose/Pipes Replacement (Engine Compartment)

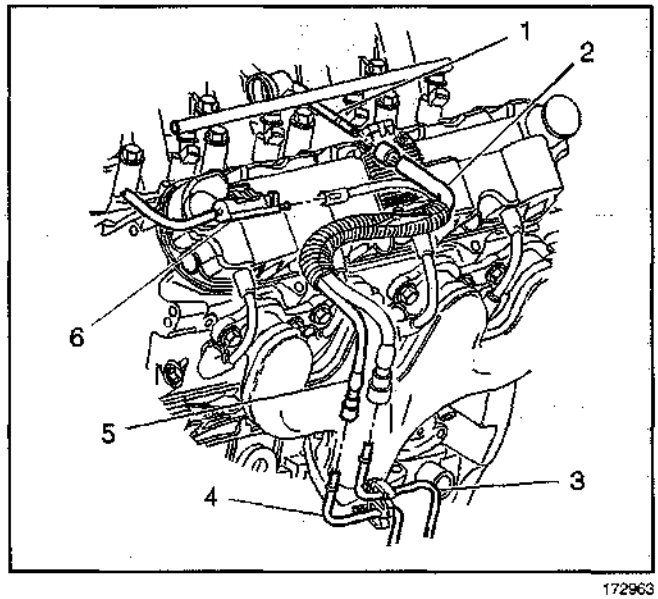
Removal Procedure

Tools Required

- *J 34730-1A* Fuel Pressure Gauge
- *J 37088-A* Tool Set, Fuel Line Quick-Connect Separator

Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

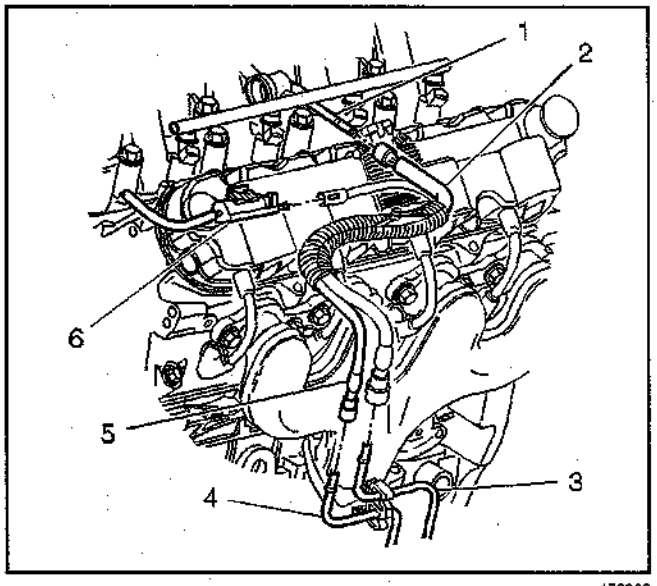
1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure.*
3. Clean all the engine compartment connecting fuel pipe connections and the surrounding areas before disconnecting in order to avoid possible contamination of the fuel system.



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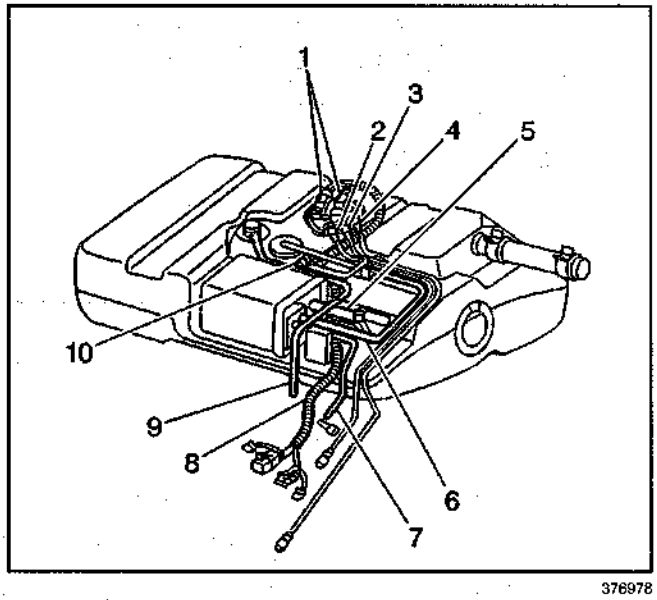
4. Disconnect the engine compartment fuel feed pipe (2) at the fuel rail (1). Refer to *Quick Connect Fitting(s) Service (Metal Collar).*
5. Disconnect the engine compartment fuel feed pipe (2) at the chassis fuel feed pipe (4). Refer to *Quick Connect Fitting(s) Service (Metal Collar).*
6. Cap the fuel pipes in order to prevent possible fuel system contamination.



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Installation Procedure

1. Remove the caps from the fuel pipes.
2. Connect the engine compartment fuel feed pipe (2) to the chassis fuel feed pipe (3). Refer to *Quick Connect Fitting(s) Service (Metal Collar).*
3. Connect the engine compartment fuel feed pipe (2) to the fuel rail (1). Refer to *Quick Connect Fitting(s) Service (Metal Collar).*
4. Tighten the fuel filler cap.
5. Connect the negative battery cable.
6. Inspect for leaks.
   6.1. Turn the ignition switch ON for 2 seconds.
   6.2. Turn the ignition switch OFF for 10 seconds.
   6.3. Turn the ignition switch ON.
   6.4. Inspect for fuel leaks.
7. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure.*



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Fuel Hose/Pipes Assembly Replacement (Rear)

Removal Procedure

Tools Required

- *J 34730-1A* Fuel Pressure Gauge
- *J 42960-1* Fuel Tank Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

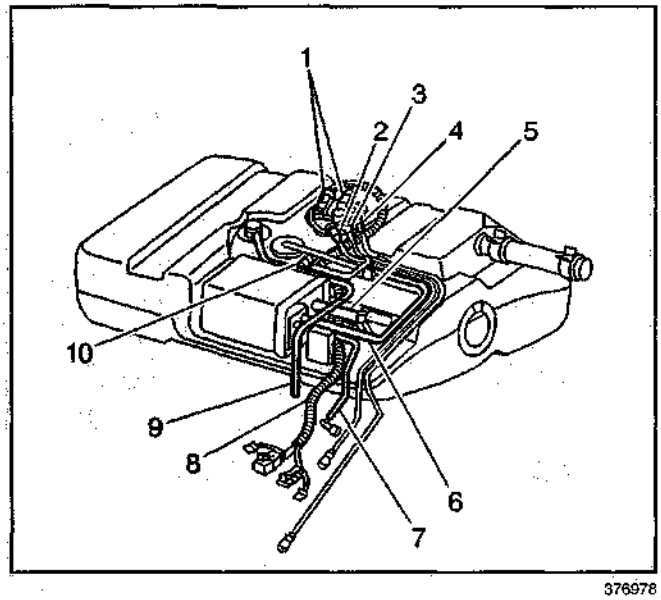
Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

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. Clean all the fuel pipe and hose connections and the surrounding areas before disconnecting in order to avoid possible contamination of the fuel system.
6. Remove the fuel tank. Refer to *Fuel Tank Replacement.*
7. Remove the fuel feed pipe (4) and the fuel return pipe (2) from the fuel sender pipes.
8. Remove the fuel feed and return pipes from the fuel tank.
9. Cap the fuel pipes in order to prevent possible fuel system contamination.

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Installation Procedure

1. Remove the caps from the fuel pipes.
2. Connect the fuel feed pipe (4) and the fuel return pipe (2) to the fuel sender pipes.
3. Install the fuel feed and return pipes into the fuel tank clips.
4. Install the fuel tank. Refer to *Fuel Tank Replacement*.
5. Lower the vehicle.
6. Refill the fuel tank.
7. Connect the negative battery cable.
8. Tighten the fuel filler cap.
9. Inspect for leaks.
   - 9.1. Turn the ignition switch ON for 2 seconds.
   - 9.2. Turn the ignition switch OFF for 10 seconds.
   - 9.3. Turn the ignition switch ON.
   - 9.4. Inspect for fuel leaks.
10. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure*.



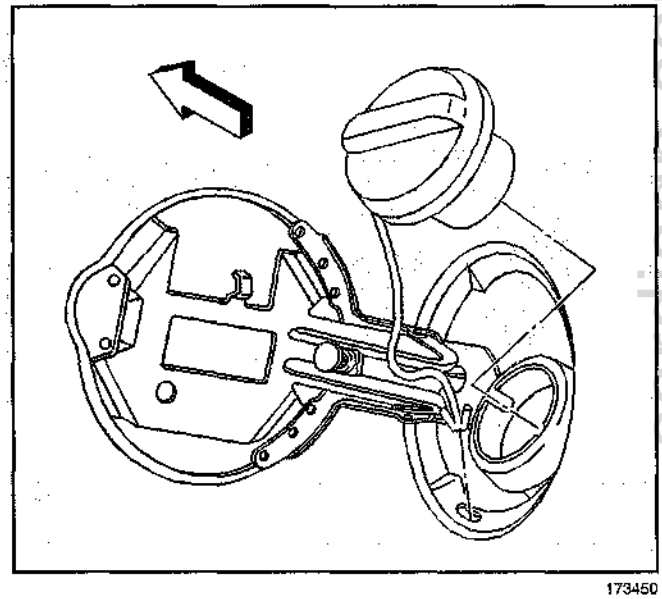
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Fuel Filler Hose Replacement

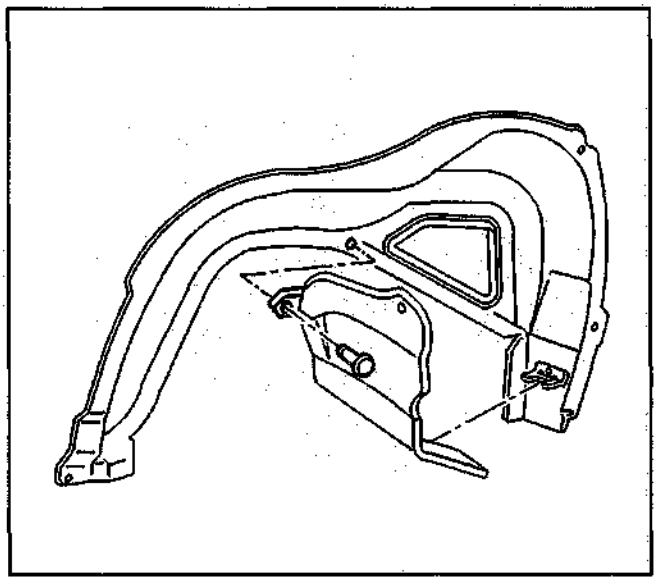
Removal Procedure

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. Clean all the fuel pipe and hose connections and the surrounding areas before disconnecting in order to avoid possible contamination of the fuel system.
4. Remove the fuel filler cap.

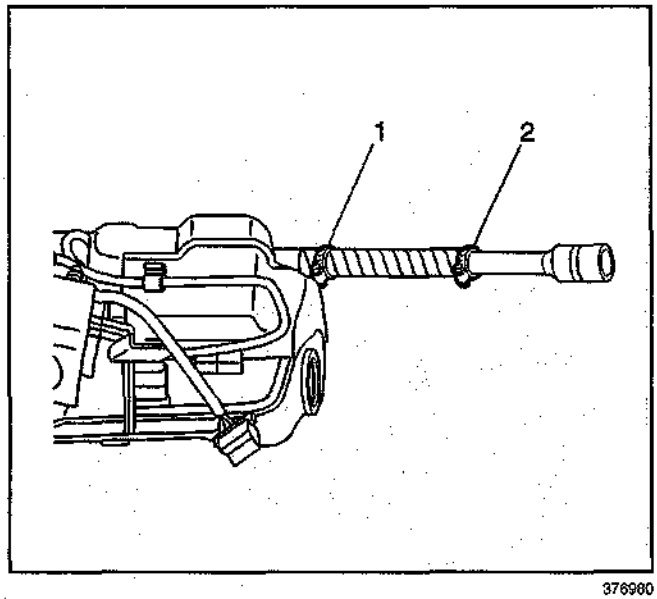

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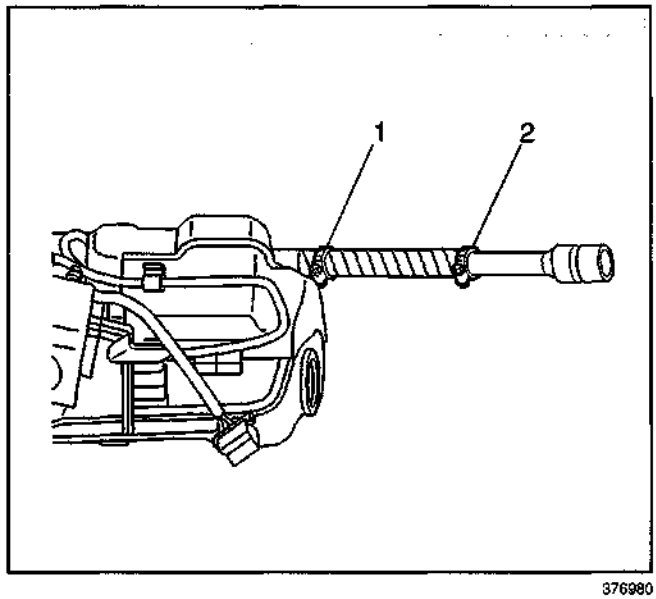
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5. Remove the fuel fill pipe shield.



376980

6. Remove the fuel fill hose clamps (1, 2).
7. Remove the fuel fill hose from the fuel tank and the fuel fill pipe.
8. Cap the fuel tank opening.



376980

Installation Procedure

1. Uncap the fuel tank opening.
2. Install the fuel fill hose to the fuel tank and the fuel fill pipe.

Notice: Refer to the *Fastener Notice* in Cautions and Notices.

3. Install the fuel fill hose clamps (1, 2).

   Tighten

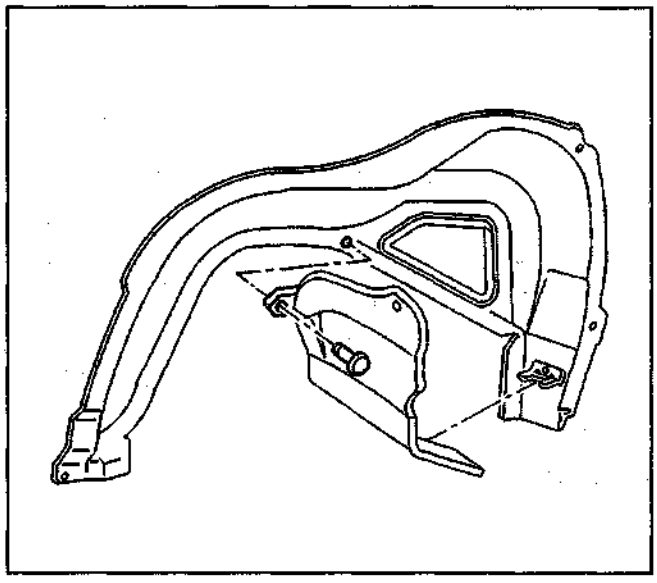
   Tighten the fuel fill hose clamps to 2.5 N·m (22 lb in).

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4. Install the fuel fill pipe shield.

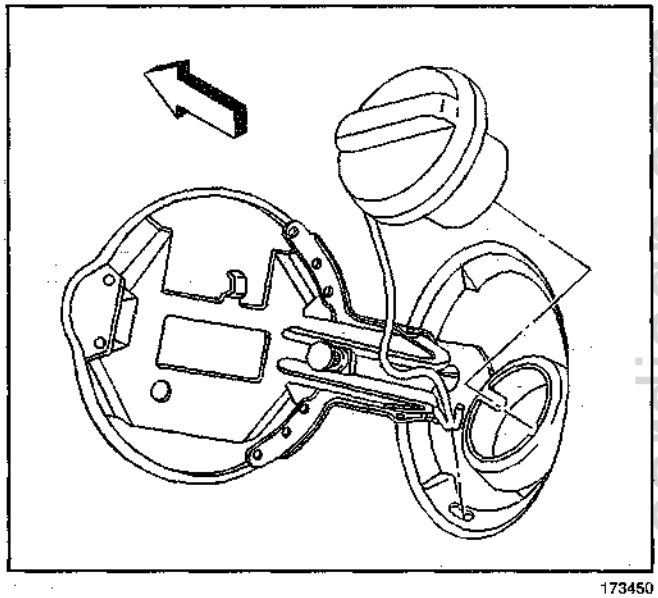
   Tighten

   Tighten the fuel fill pipe shield bolt to 2.5 N·m (22 lb in).



21288

5. Install the fuel filler cap.
6. Connect the negative battery cable.
7. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure.*



173450

Fuel System Cleaning

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

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.

Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

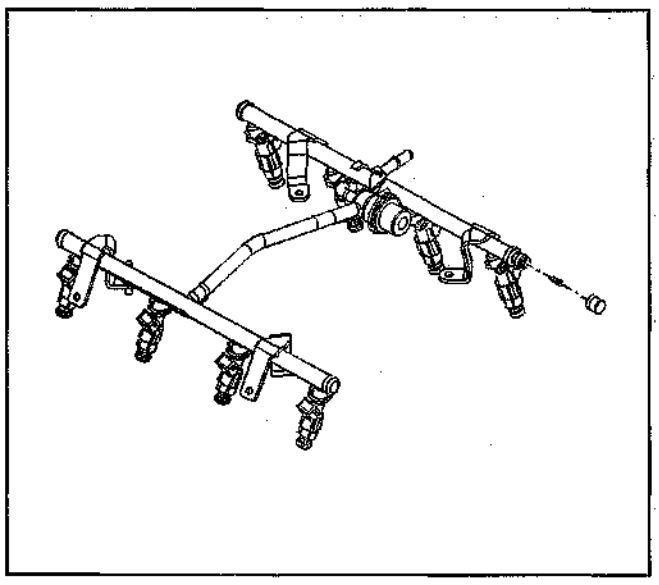
1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure.*

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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. Refer to *Fuel Sender Assembly Replacement*.
6. Inspect the fuel pump strainer. Replace a contaminated strainer and inspect the fuel pump.
7. 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.

8. Flush the fuel tank with hot water.
9. 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.
10. Install the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*.
11. Install the fuel tank. Refer to *Fuel Tank Replacement*.
12. Refill the fuel tank.
13. Install the fuel filler cap.
14. Connect the negative battery cable.
15. Inspect for leaks.
    - 15.1. Turn the ignition switch ON for 2 seconds.
    - 15.2. Turn the ignition switch OFF for 10 seconds.
    - 15.3. Turn the ignition switch ON.
    - 15.4. Check for fuel leaks.
16. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure*.



217118

Fuel Pressure Connection Valve Replacement

Removal Procedure

Tools Required

J 34730-1A Fuel Pressure Gauge

1. Clean the area around the fuel pressure connection with GM X-30A or equivalent.

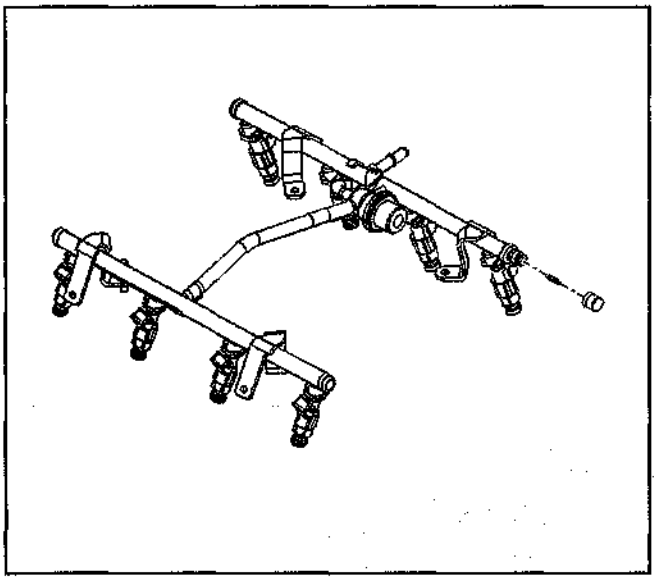
Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

2. Disconnect the negative battery cable.
3. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure*.
4. Remove the fuel pressure connection valve using a standard valve core removal and installation tool.

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Installation Procedure

1. Install the fuel pressure connection valve assembly using a standard valve core removal and installation tool.
2. Tighten the fuel filler cap.
3. Connect the negative battery cable.
4. Inspect for leaks.
   4.1. Turn the ignition switch ON for 2 seconds.
   4.2. Turn the ignition switch OFF for 10 seconds.
   4.3. Turn the ignition switch ON.
   4.4. Check for fuel leaks.
5. Install the fuel pressure connection valve cap.
6. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.



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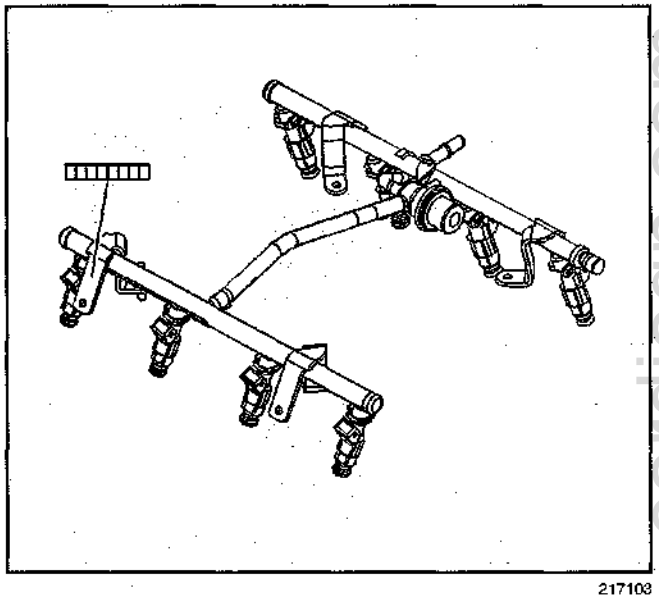
Fuel Rail Assembly Replacement

Removal Procedure

Tools Required

- *J 34730-1A* Fuel Pressure Gauge
- *J 37088-A* Tool Set, Fuel Line Quick-Connect Separator

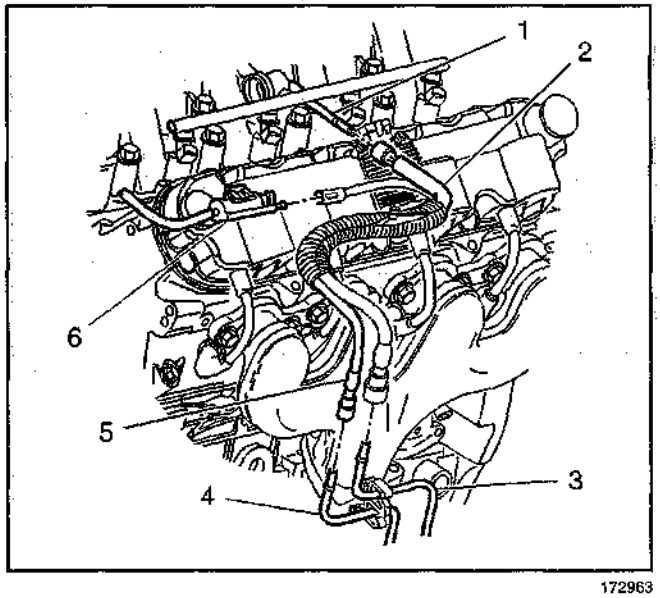
An eight digit identification number is stamped on the fuel rail assembly. Refer to this model identification number if servicing or part replacement is required.



217103

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. Before removal, clean the fuel rail assembly with a spray type engine cleaner, GM X-30A or equivalent, if necessary. Follow the package instructions. Do not soak fuel rails in liquid cleaning solvent.



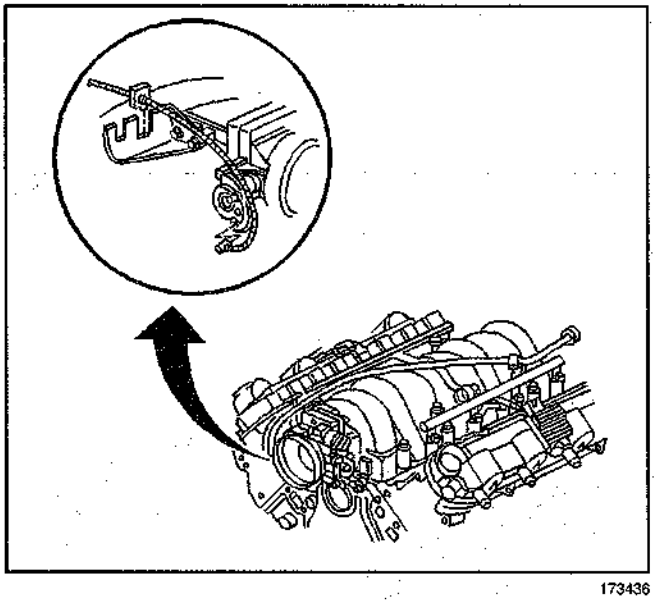
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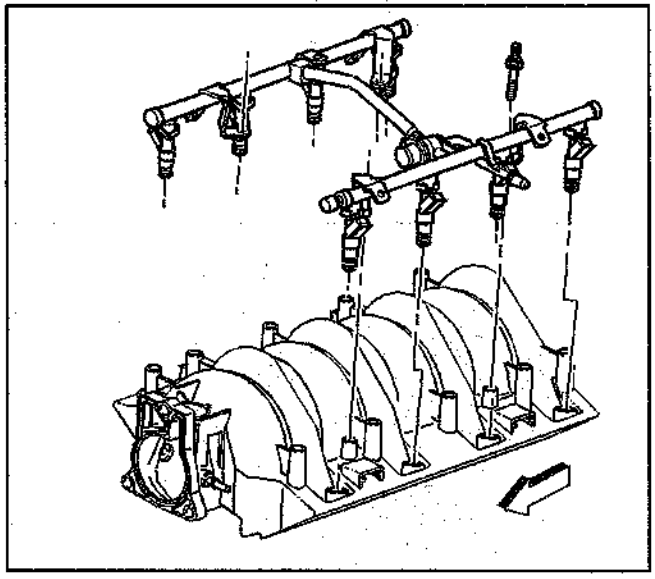
Notice:

- Remove the fuel rail assembly carefully in order to prevent damage to the injector electrical connector terminals and the injector spray tips. Support the fuel rail after the fuel rail is removed in order to avoid damaging the fuel rail components.
- Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering open pipes and passages.

4. Disconnect the fuel feed hose (2) from the fuel rail (1). Refer to *Quick Connect Fitting(s) Service (Metal Collar)*.
5. Disconnect the accelerator cable from the throttle body and the accelerator cable bracket (without traction control).
6. Move the accelerator cable aside.



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7. Disconnect the electrical connectors from the fuel injectors. Identify the connectors to their corresponding injectors to ensure correct sequential injector firing order after reassembly.
8. Disconnect the electrical harness from the fuel rail brackets.
9. Remove the fuel rail attaching bolts.
10. Remove the fuel rail assembly.
11. Remove the injector lower O-ring seal from the spray tip end of each injector.
12. Discard the O-ring seals.

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Installation Procedure

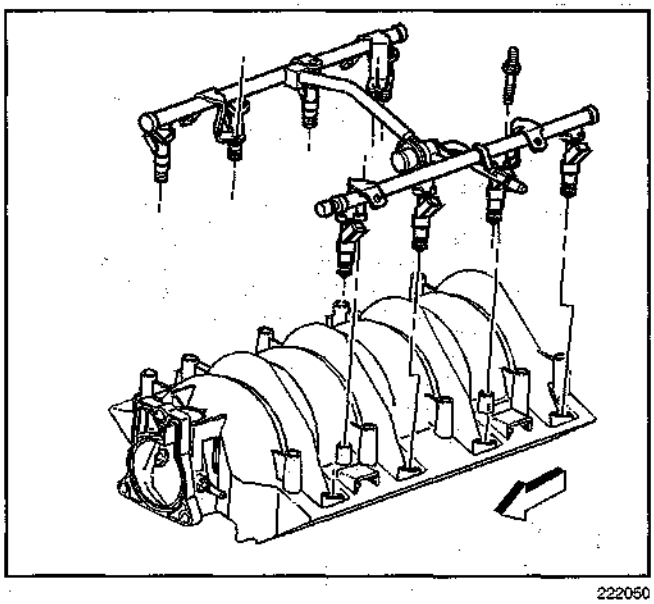
1. Lubricate the new lower injector O-ring seals with clean engine oil.
2. Install the new O-ring seals on the spray tip end of each injector.
3. Install the fuel rail assembly to the intake manifold.
4. Apply a 5 mm (0.020 in) band of GM P/N 12345382 threadlock or equivalent to the threads of the fuel rail bolts.

Notice: Refer to the *Fastener Notice* in Cautions and Notices.

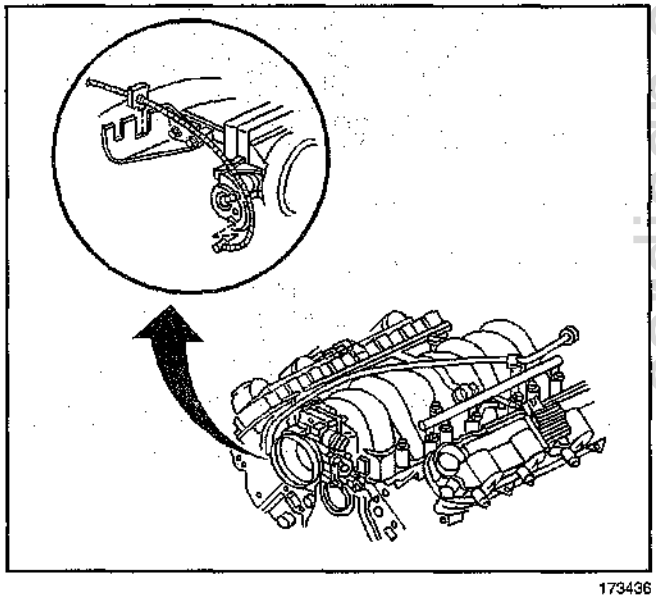
5. Install the fuel rail attaching bolts.

   Tighten

   Tighten the fuel rail attaching bolts to 10 N·m (89 lb in).
6. Connect the injector electrical connectors.
   - Install each connector on the proper injector in order to ensure correct sequential injector firing order.
   - Rotate the injectors as required in order to avoid stretching the wire harness.
7. Connect the electrical harness to the fuel rail brackets.
8. Connect the accelerator cable to the throttle body and the accelerator cable bracket (without traction control).

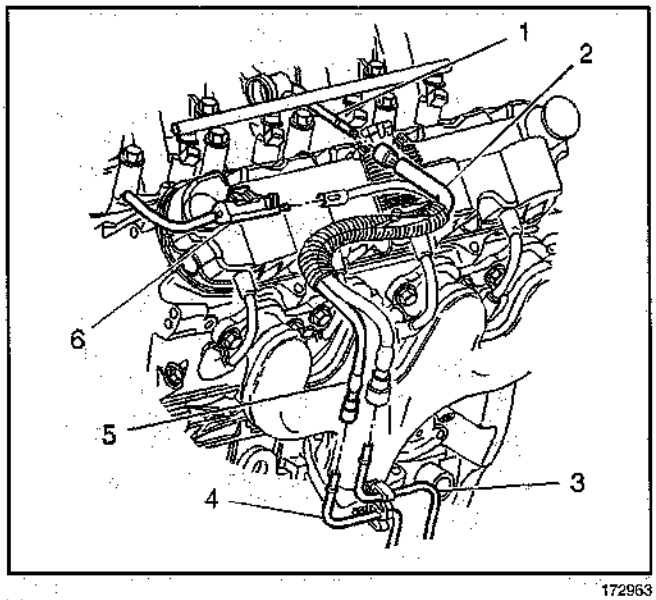


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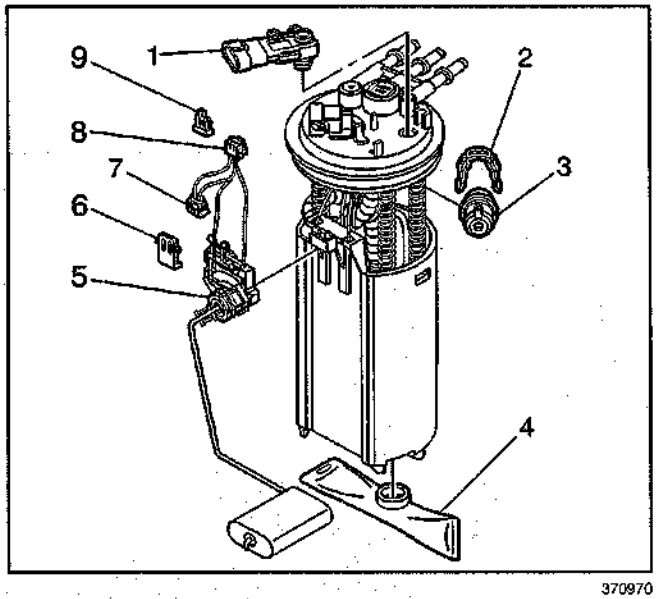
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9. Connect the fuel feed hose (2) to the fuel rail fuel pipe (1). Refer to *Quick Connect Fitting(s) Service (Metal Collar)*.
10. Tighten the fuel filler cap.
11. Connect the negative battery cable.
12. Inspect for leaks.
    12.1. Turn the ignition switch ON for 2 seconds.
    12.2. Turn the ignition switch OFF for 10 seconds.
    12.3. Turn the ignition switch ON.
    12.4. Check for fuel leaks.
13. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.



370970

Fuel Pressure Regulator 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

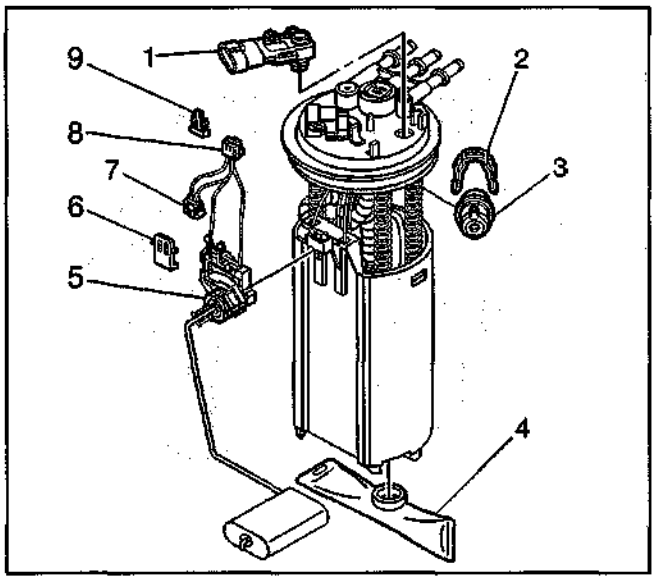
Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

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. Remove the fuel tank. Refer to *Fuel Tank Replacement*.
5. Remove the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*.
6. Remove the fuel pressure regulator retaining clip (2).
7. Remove the fuel pressure regulator (3) from the housing on the fuel return pipe.

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Installation Procedure

1. Lubricate the new fuel pressure regulator large and small O-rings with clean engine oil.
2. Install the new fuel pressure regulator large and small O-rings on the fuel pressure regulator.
3. Install the new fuel pressure regulator filter screen.
4. Install the fuel pressure regulator (3) into the housing on the fuel return pipe.
5. Install the new fuel pressure regulator retaining clip (2).
6. Install the fuel sender assembly. Refer to *Fuel Sender Assembly Replacement*.
7. Perform the fuel tank leak check. Refer to *Fuel Tank Leak Check*
8. Install the fuel tank. Refer to *Fuel Tank Replacement*.
9. Refill the fuel tank.
10. Install the fuel filler cap.
11. Connect the negative battery cable.
12. Inspect for leaks.
    - 12.1. Turn the ignition switch ON for 2 seconds.
    - 12.2. Turn the ignition switch OFF for 10 seconds.
    - 12.3. Turn the ignition switch ON.
    - 12.4. Check for fuel leaks.
13. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure*.



370970

Fuel Injector Replacement

Removal Procedure

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.

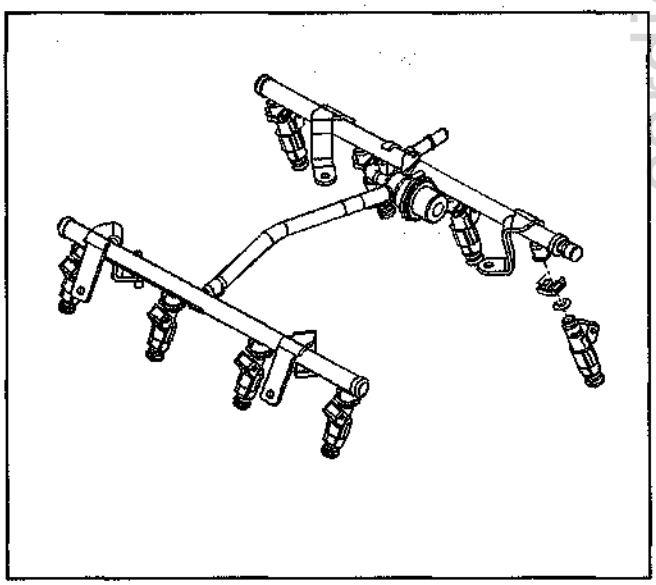
Important: The engine oil may be contaminated with fuel if the fuel injectors are leaking.

Tools Required

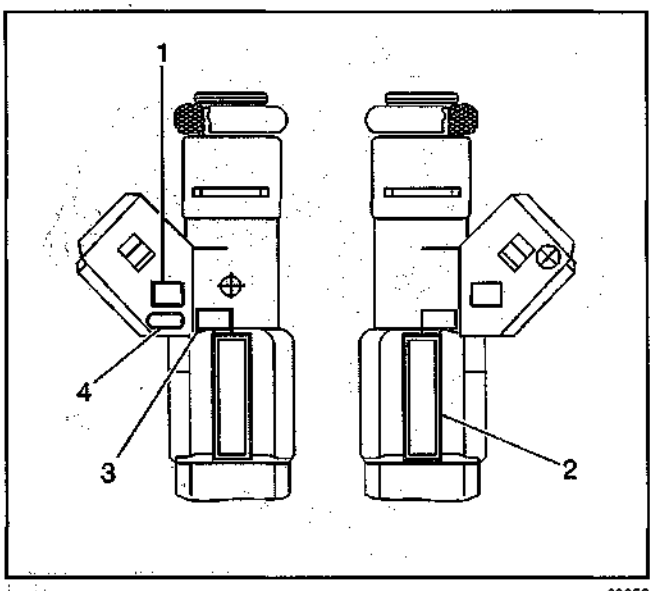
J 34730-1A Fuel Pressure Gauge

Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

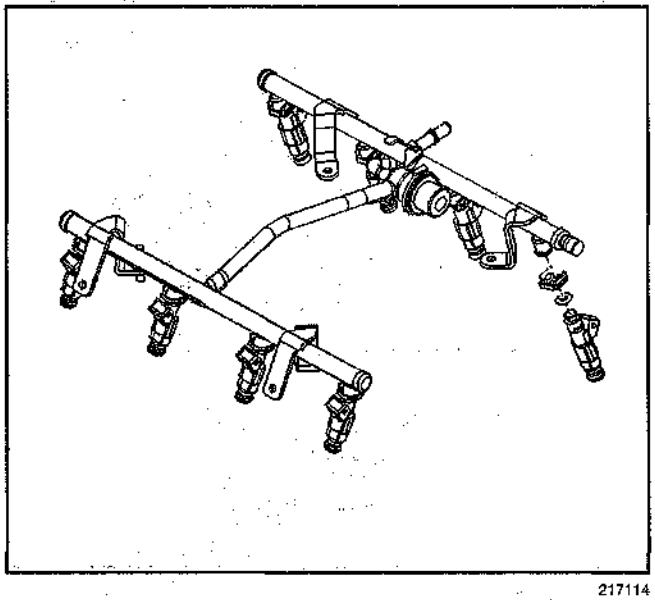
1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure*.
3. Remove the fuel rail assembly. Refer to *Fuel Rail Assembly Replacement*.
4. Spread the injector retainer clip to release the injector from the fuel rail.
5. Remove the fuel injector.
6. Discard the injector retainer clip.
7. Remove the injector O-ring seals from both ends of the injector. Discard the O-ring seals.


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Installation Procedure

Important: When ordering new fuel injectors, be sure to order the correct injector for the application being serviced.

The fuel injector assembly is stamped with a part number identification (2), a manufacturing date (3), a week code (1), and a production plant number (4).

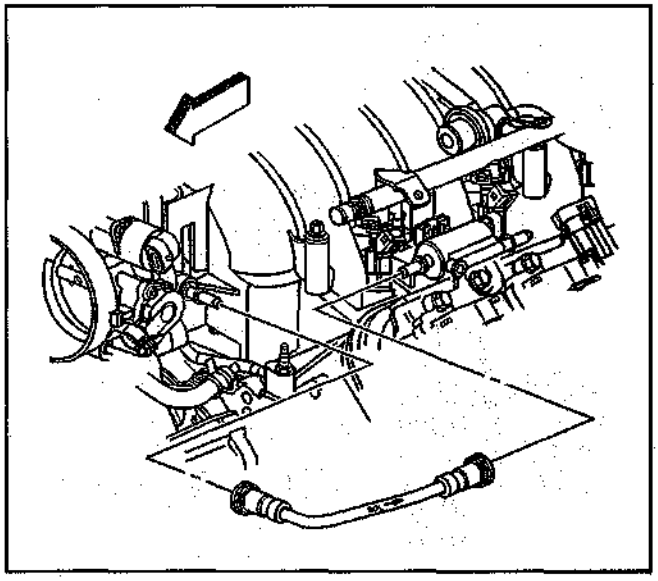
1. Lubricate the new injector O-ring seals with clean engine oil.
2. Install the new injector O-ring seals on the injector.
3. Install a new retainer clip on the injector.
4. Push the fuel injector into the fuel rail injector socket with the electrical connector facing outward. The retainer clip locks on to a flange on the fuel rail injector socket.
5. Install the fuel rail assembly. Refer to *Fuel Rail Assembly Replacement*.
6. Tighten the fuel filler cap.
7. Connect the negative battery cable.
8. Inspect for leaks.
   - 8.1. Turn the ignition switch ON for 2 seconds.
   - 8.2. Turn the ignition switch OFF for 10 seconds.
   - 8.3. Turn the ignition switch ON.
   - 8.4. Check for fuel leaks.
9. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.

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EVAP Canister Purge Solenoid Valve Replacement

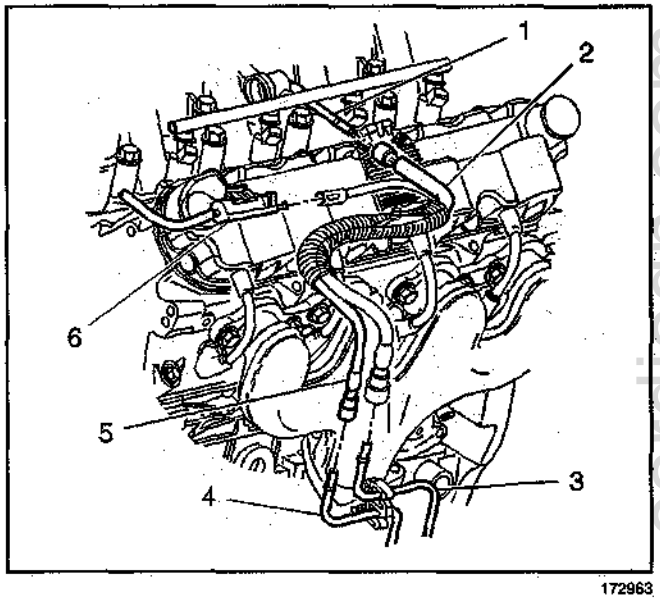
Removal Procedure

1. Disconnect the EVAP purge solenoid to throttle body pipe.



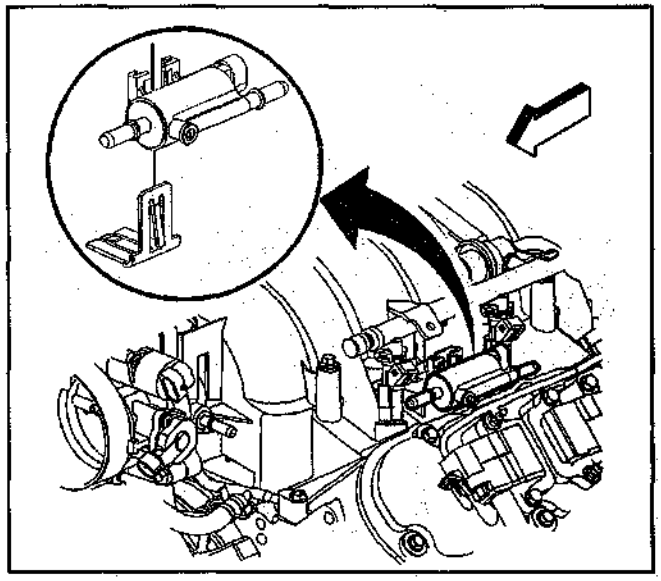
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2. Disconnect the engine compartment EVAP pipe (5) at the EVAP purge solenoid (6).



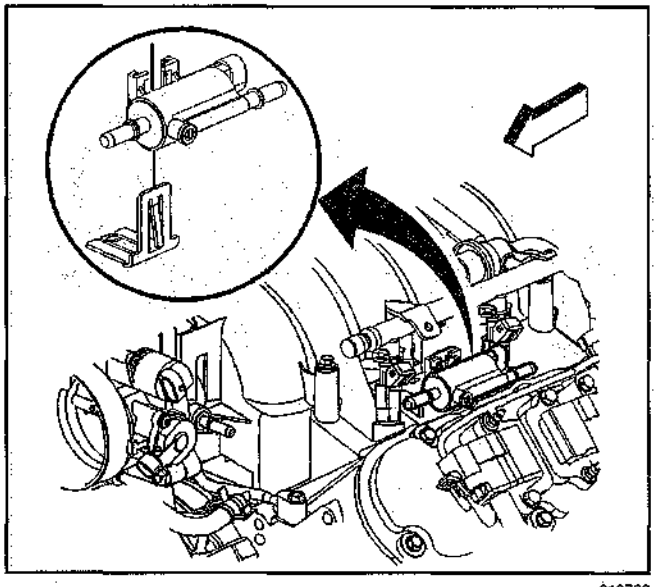
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3. Disconnect the EVAP purge solenoid electrical connector.
4. Remove the EVAP purge solenoid from the bracket.



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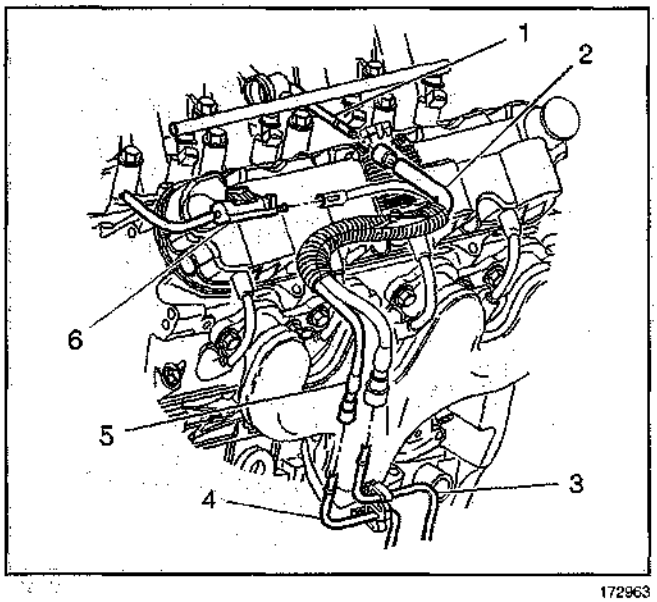
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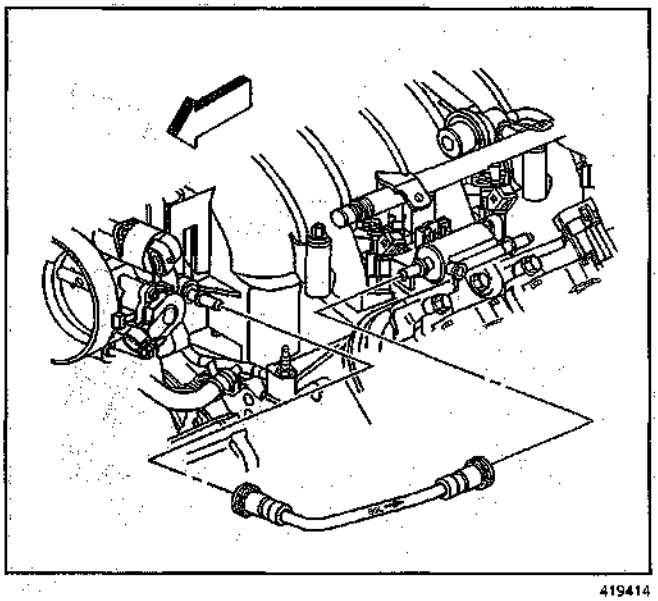
Installation Procedure

1. Install the EVAP purge solenoid valve to the bracket.
2. Connect the electrical connector to the EVAP purge solenoid valve.



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3. Connect the engine compartment EVAP pipe (5) at the EVAP purge solenoid (6).



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4. Connect the EVAP purge solenoid to throttle body pipe.

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EVAP Vent Valve Replacement

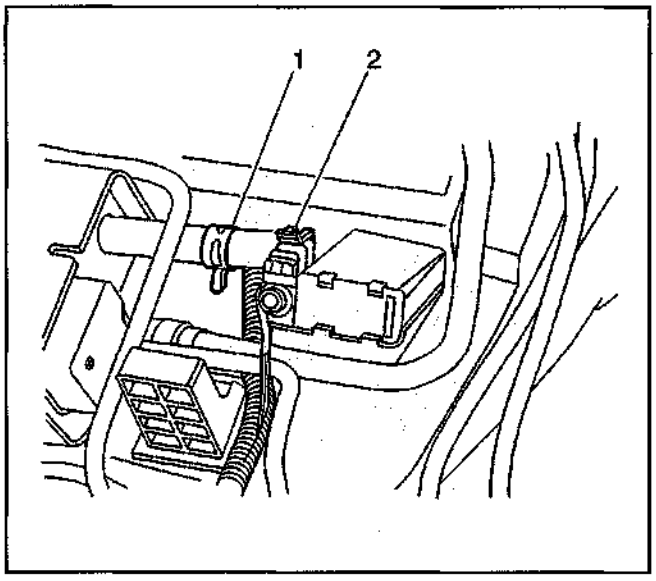
Removal Procedure

Tools Required

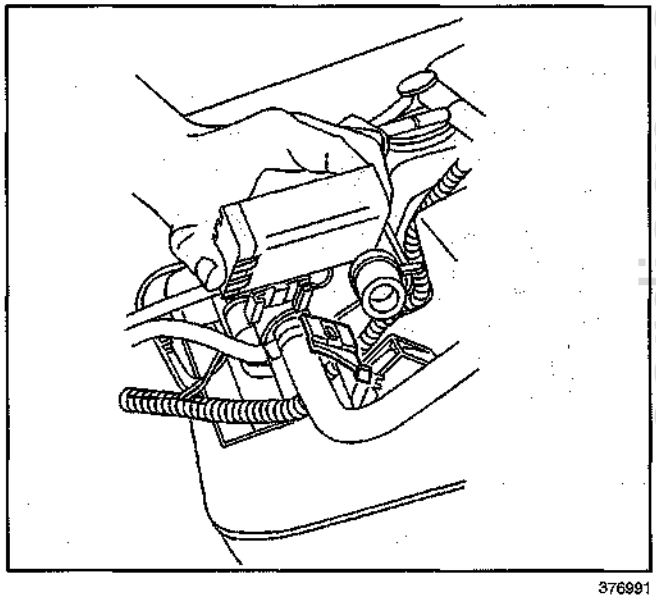
- *J 34730-1A* Fuel Pressure Gauge
- *J 42960-1* Fuel Tank Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

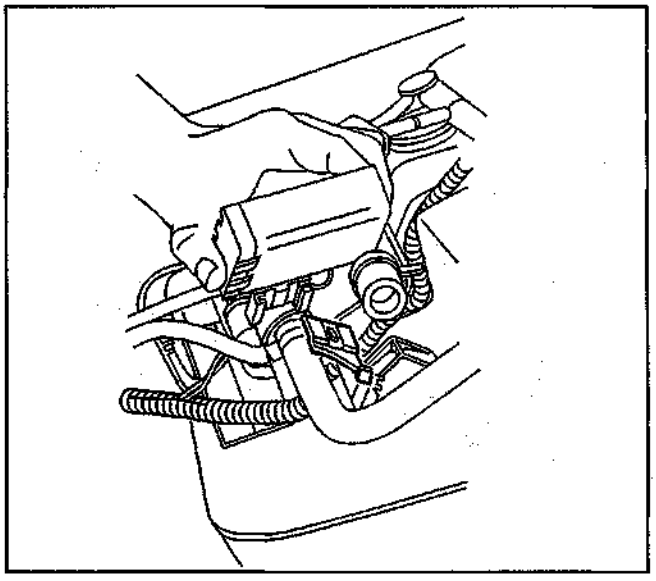
1. Disconnect the negative battery cable.
2. Relieve the fuel system pressure. Refer to the *Fuel Pressure Relief Procedure*.
3. Drain the fuel tank. Refer to *Fuel Tank Draining Procedure*.
4. Remove the fuel tank. Refer to *Fuel Tank Replacement*.
5. Disconnect the EVAP canister vent valve electrical 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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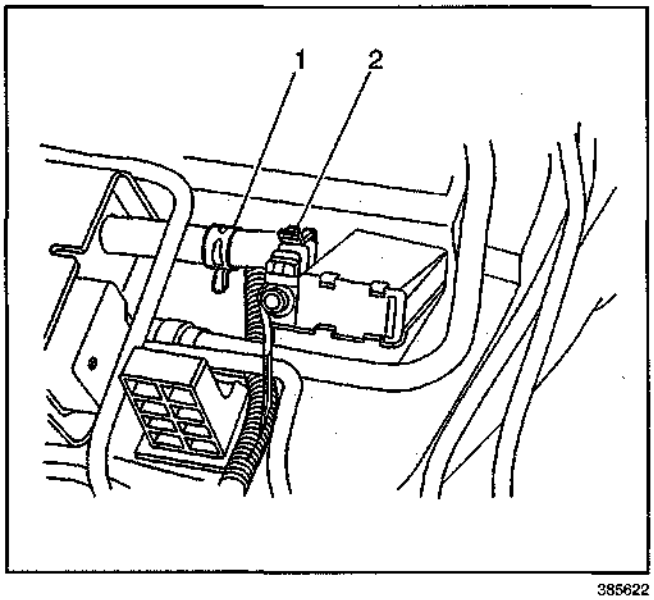

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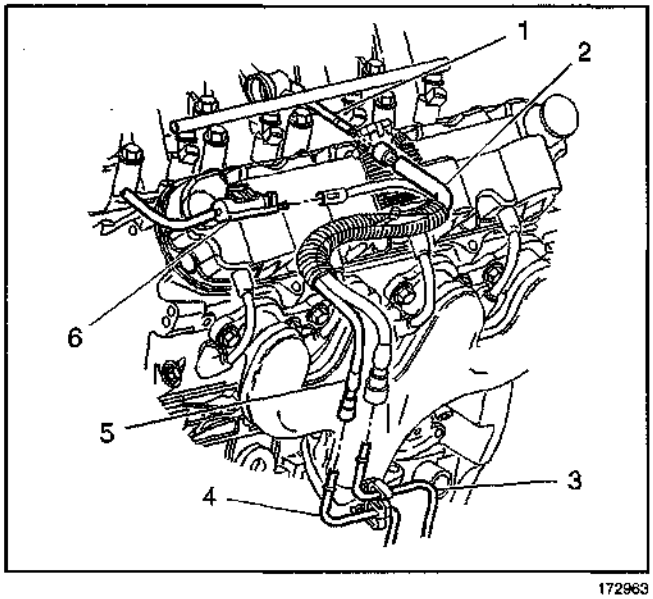
Installation Procedure

1. Install the EVAP canister vent valve to the EVAP canister vent valve bracket.



385622

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 the ignition switch ON for 2 seconds.
   9.2. Turn the ignition switch OFF for 10 seconds.
   9.3. Turn the ignition switch ON.
   9.4. Inspect for fuel leaks.
10. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.



172963

EVAP System Hoses/Pipes Replacement

Engine Compartment EVAP Pipe Removal Procedure

Tools Required

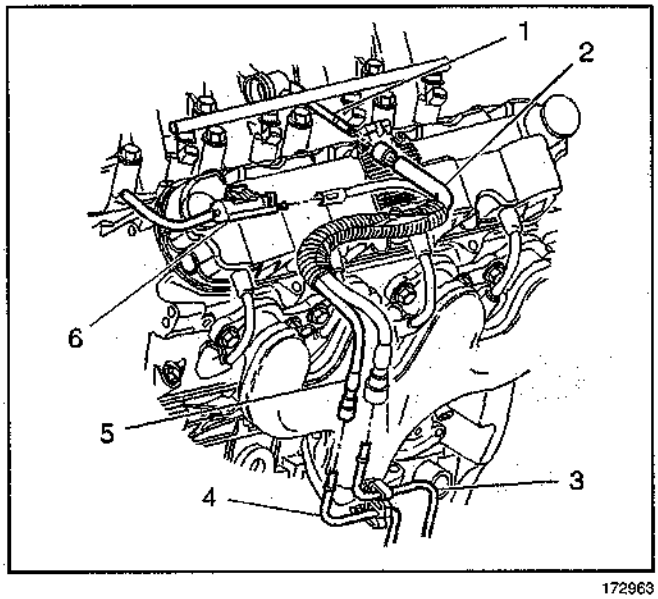
J 37088-A Tool Set, Fuel Line Quick-Connect Separator

1. Clean all the EVAP pipe connections and the surrounding areas before disconnecting in order to avoid possible contamination of the EVAP system.
2. Disconnect the engine compartment EVAP pipe (5) at the EVAP canister purge valve (6). Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
3. Disconnect the engine compartment EVAP pipe (5) at the chassis EVAP pipe (3). Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
4. Cap the EVAP pipes in order to prevent possible EVAP system contamination.

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Engine Compartment EVAP Pipe Installation Procedure

1. Remove the caps from the EVAP pipes.
2. Connect the engine compartment EVAP pipe (5) to the chassis EVAP pipe (4). Refer to *Quick Connect Fitting(s) Service (Plastic Collar).*
3. Connect the engine compartment EVAP pipe (5) to the EVAP canister purge valve (6). Refer to *Quick Connect Fitting(s) Service (Plastic Collar).*



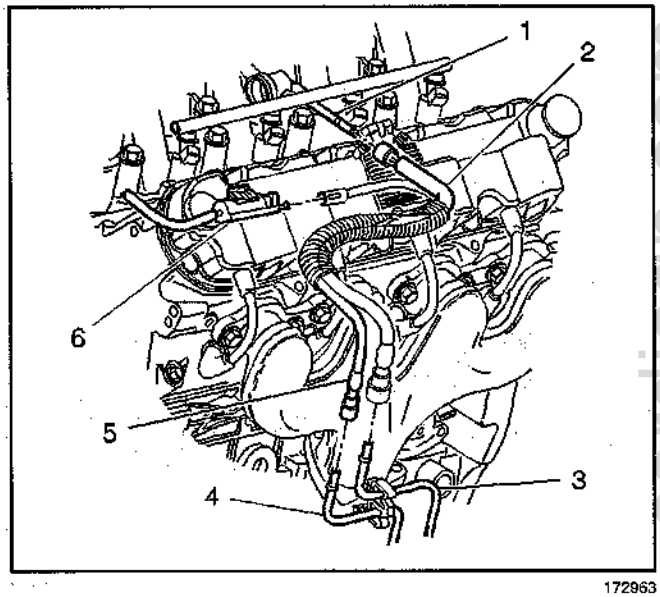
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Chassis EVAP Pipe Removal Procedure

Tools Required

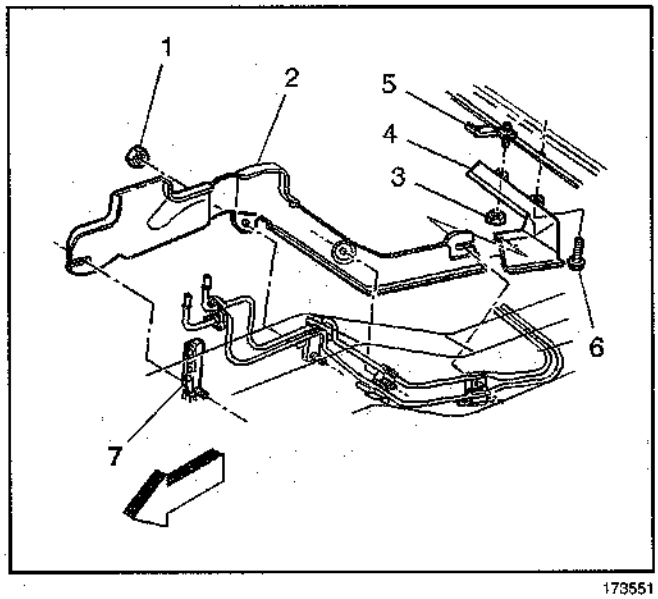
J 37088-A Tool Set, Fuel Line Quick-Connect Separator

1. Clean all the EVAP pipe connections and the surrounding areas before disconnecting the pipes in order to avoid possible contamination of the EVAP system.
2. Disconnect the engine compartment EVAP pipe (5) from the chassis EVAP pipe (4). Refer to *Quick Connect Fitting(s) Service (Plastic Collar).*
3. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.



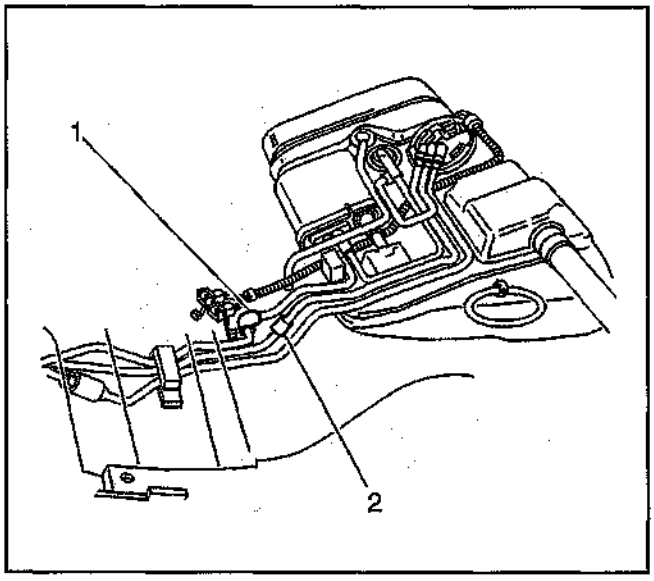
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4. Remove the rear fuel pipe shield attaching nuts (3) and bolt (6).
5. Remove the rear fuel pipe shield (4).
6. Remove the front fuel pipe shield attaching nuts (1).
7. Remove the front fuel pipe shield (2).



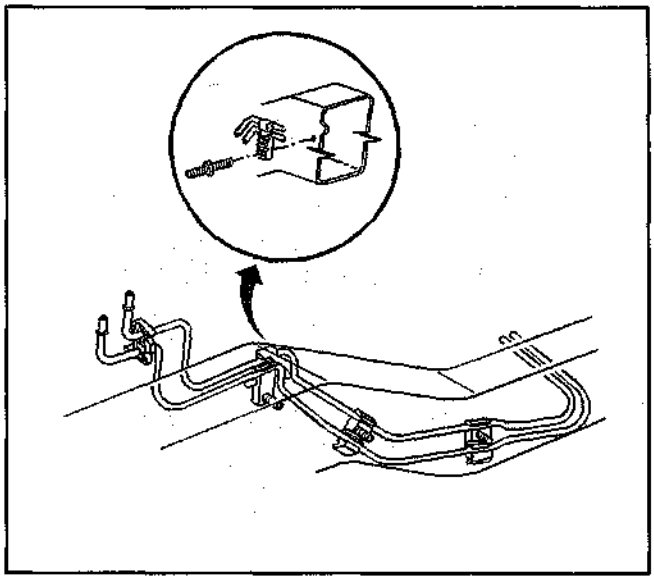
173551

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356450

8. Disconnect the EVAP purge pipe (1) at the rear quick connect fitting. Refer to *Quick Connect Fitting(s) Service (Plastic Collar)*.
9. Remove the EVAP pipe attaching hardware and the EVAP pipe. Note the position of the pipe for installation.


173403

Chassis EVAP Pipe Installation Procedure

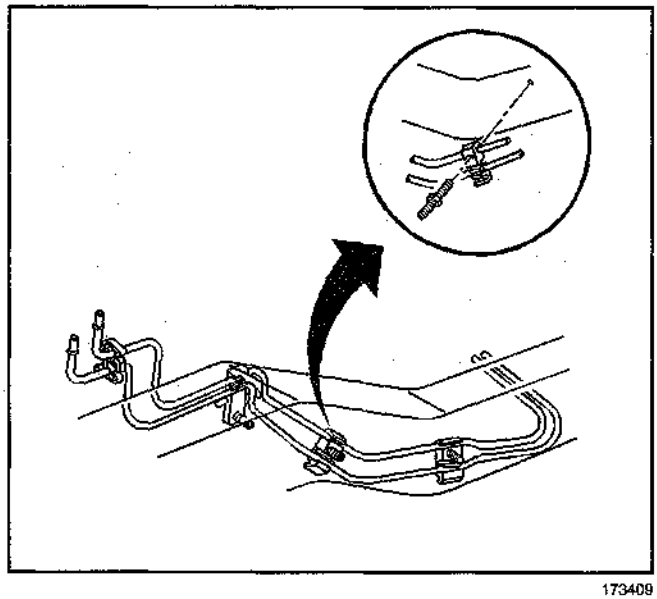
Important:

- When replacing the 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 EVAP pipe 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.

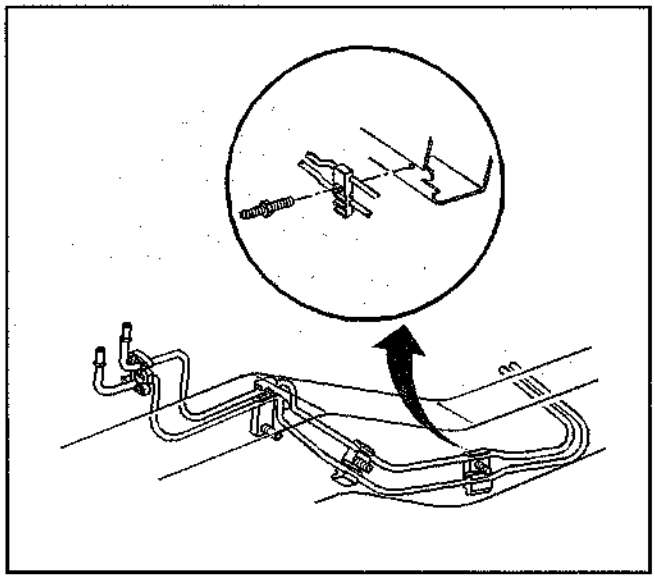

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4. Loosely install the number 3 position pipe clip stud.

   Tighten

   Tighten the 3 studs to 5 N·m (44 lb in).

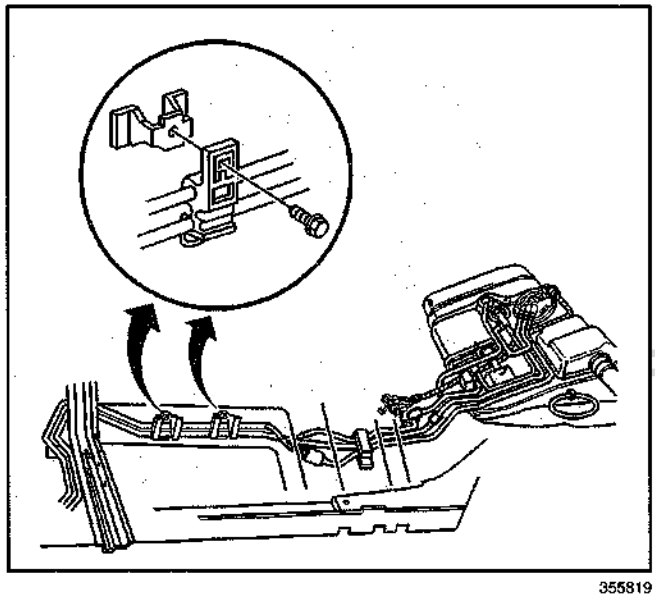


173412

5. Align the EVAP pipe 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).

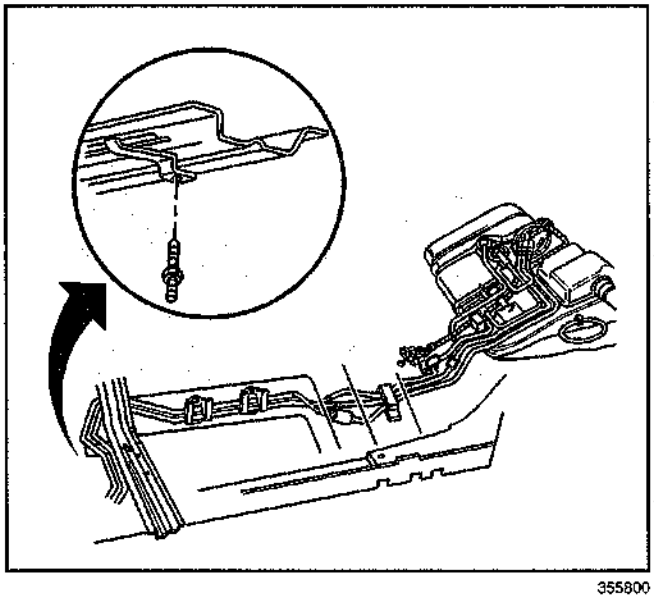


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7. Align the EVAP pipe to the number 4 position clamp.
8. Install the pipe clamp stud.

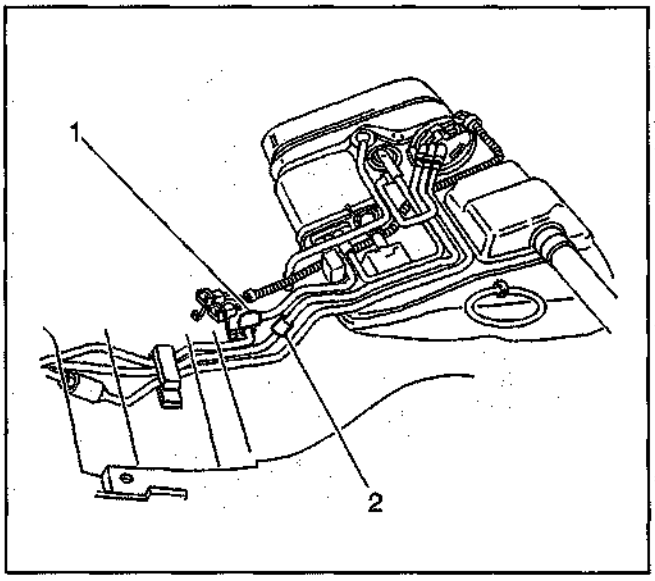
   Tighten

   Tighten the pipe clamp stud to 5 N·m (44 lb in).



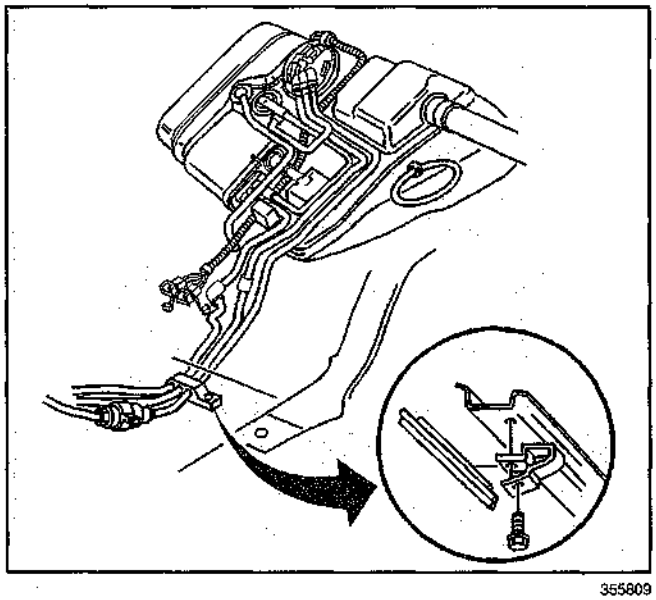
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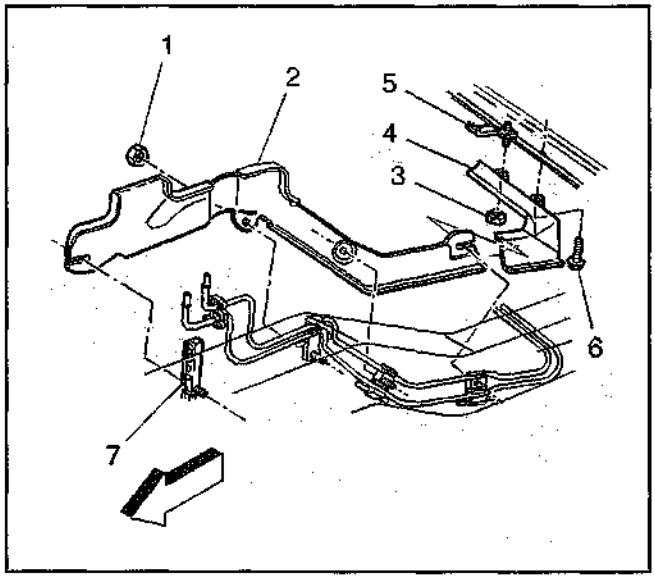
9. Connect the EVAP purge pipe (1) at the rear quick connect fitting. Refer to *Quick Connect Fitting(s) Service (Plastic Collar).*


355809

10. Install the EVAP pipe into the rear pipe clip.
11. Align the fuel and EVAP pipes in a flat position.
12. 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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13. Position the front fuel pipe shield (2) to the 3 fuel pipe clip studs and the brake pipe clip stud (7).
14. Install the pipe shield nuts (1).

    Tighten

    Tighten the pipe shield nuts to 5 N·m (44 lb in).
15. Position the rear fuel pipe shield (4) to the fuel pipe stud and the fuel pipe clip stud (5).
16. Loosely install the pipe shield nuts (3).
17. Install the pipe shield bolt (6).

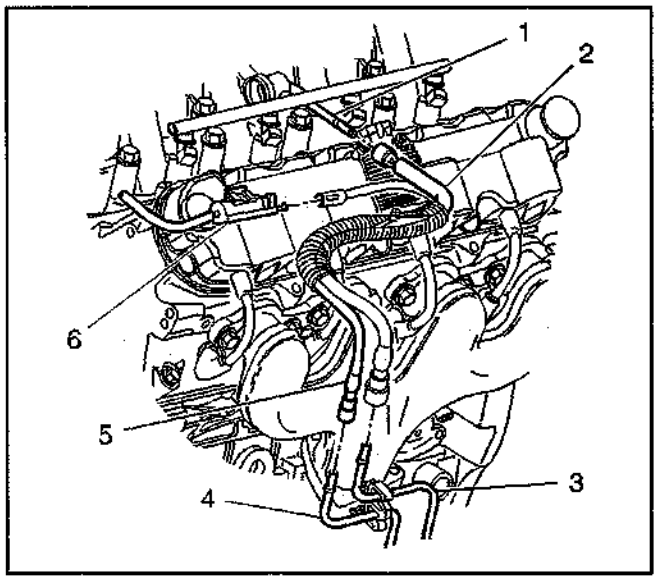
    Tighten

    17.1. Tighten the pipe shield bolt to 5 N·m (44 lb in).

    17.2. Tighten the pipe shield nuts to 5 N·m (44 lb in).
18. Lower the vehicle.

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19. Connect the engine compartment EVAP pipe (5) to the chassis EVAP pipe (4). Refer to *Quick Connect Fitting(s) Service (Plastic Collar).*



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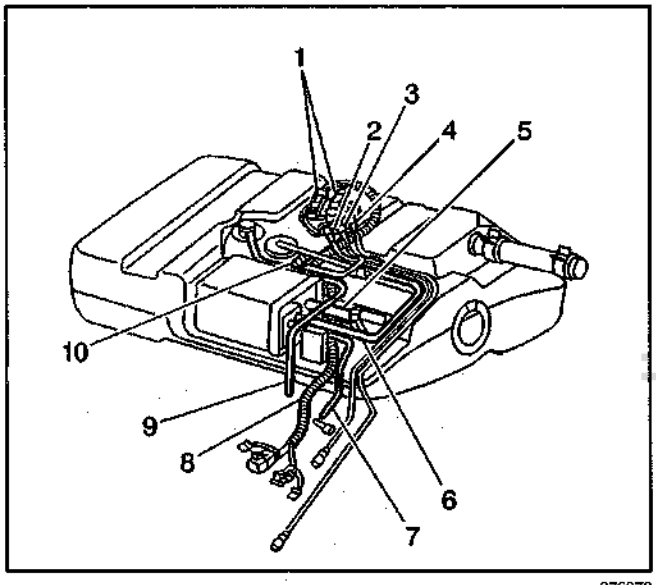
Rear EVAP Pipes and Hose Removal Procedure

Tools Required

- *J 34730-1A* Fuel Pressure Gauge
- *J 42960-1* Fuel Tank Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

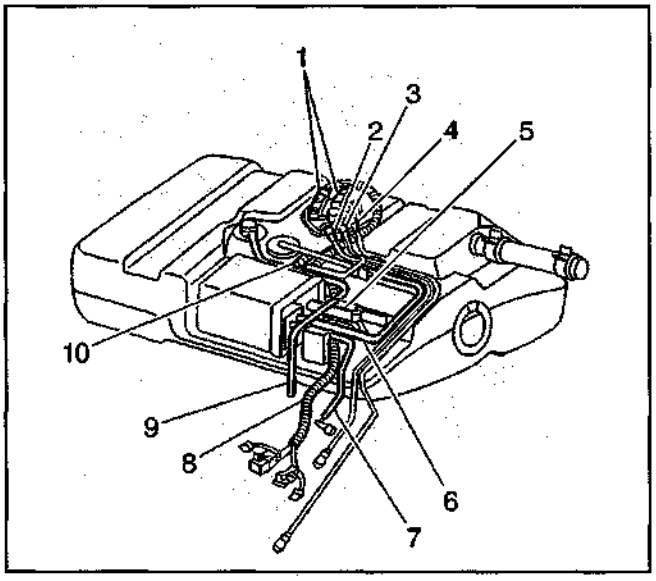
Caution: Refer to the Battery Disconnect Caution in Cautions and Notices.

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. Clean all the fuel and EVAP pipe and hose connections and the surrounding areas before disconnecting in order to avoid possible contamination of the fuel system.
6. Remove the fuel tank. Refer to *Fuel Tank Replacement.*
7. Remove the EVAP purge pipe (7) from the EVAP canister.
8. Remove the EVAP canister vent solenoid hose (5).
9. Remove the EVAP pipe to fill limiter vent valve pipe (3).
10. Cap the EVAP pipes in order to prevent possible EVAP system contamination.



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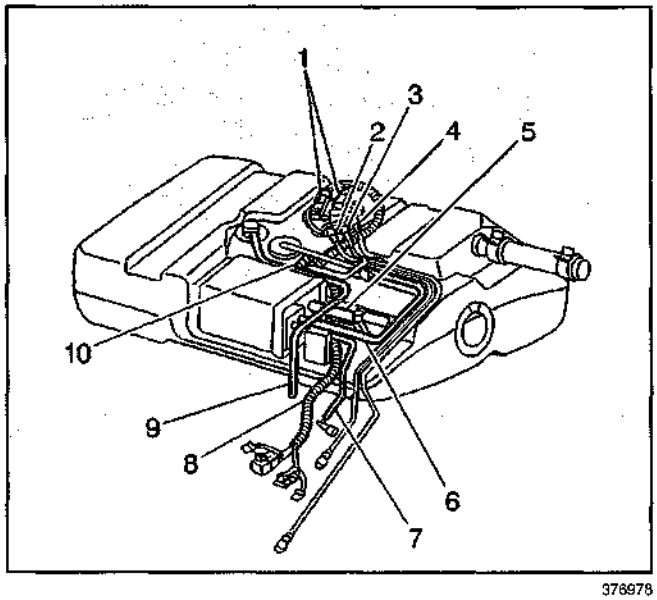
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Rear EVAP Pipes and Hose Installation Procedure

1. Remove the caps from the fuel and EVAP pipes.
2. Install the EVAP pipe to fill limiter vent valve pipe (3).
3. Install the EVAP canister vent solenoid hose (5).
4. Connect the EVAP purge pipe (7) to the EVAP canister.
5. Install the fuel tank. Refer to *Fuel Tank Replacement*.
6. Lower the vehicle.
7. Refill the fuel tank.
8. Connect the negative battery cable.
9. Tighten the fuel filler cap.
10. Inspect for leaks.
    - 10.1. Turn the ignition switch ON for 2 seconds.
    - 10.2. Turn the ignition switch OFF for 10 seconds.
    - 10.3. Turn the ignition switch ON.
    - 10.4. Inspect for fuel leaks.
11. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure*.



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EVAP Canister Replacement

Removal Procedure

Tools Required

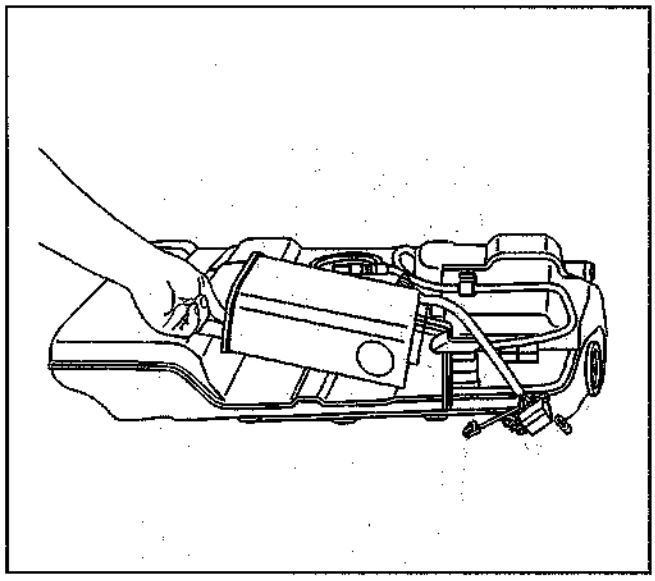
- *J 34730-1A* Fuel Pressure Gauge
- *J 42960-1* Fuel Tank Drain Hose
- *J 42960-2* Fuel Flapper Door Holder

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. 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.

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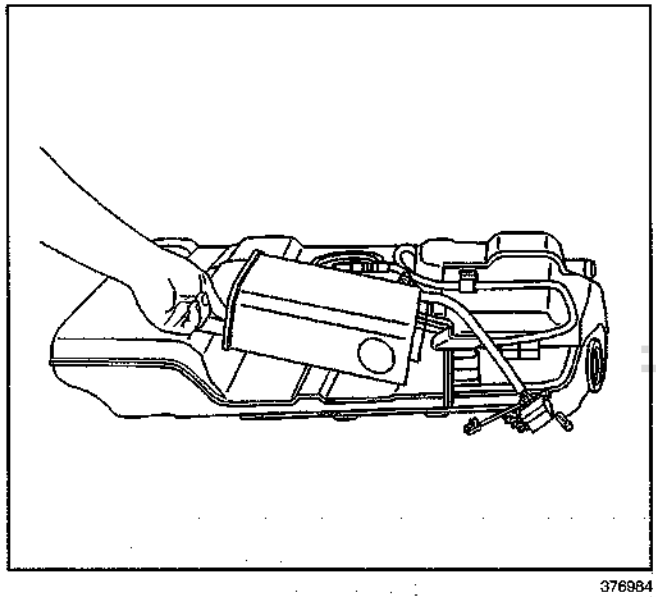
8. Carefully bend the bracket in order to remove the EVAP canister from the bracket.



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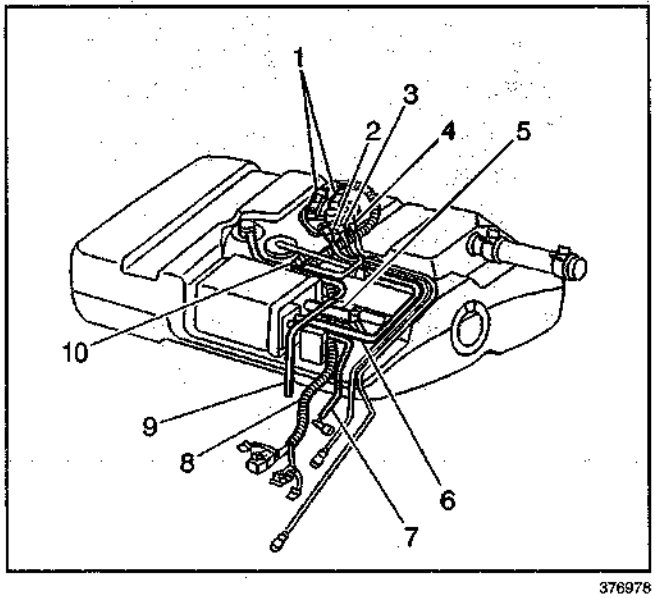
Installation Procedure

1. Install the EVAP canister to the bracket.



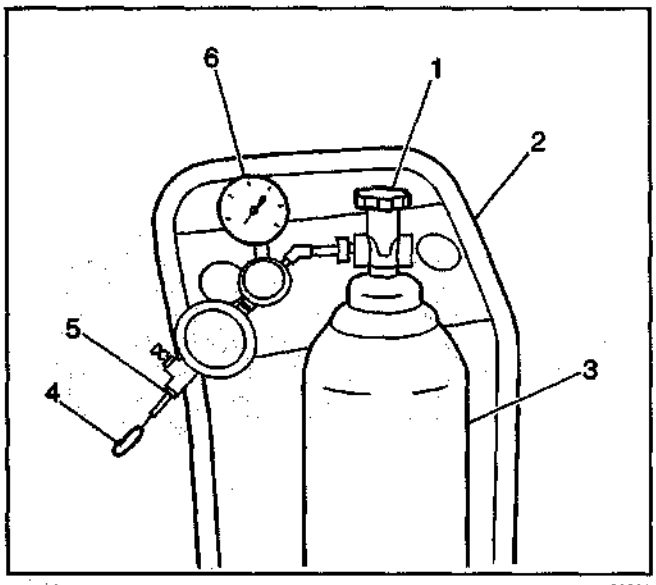
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2. Connect the vent hose (5) to the EVAP canister.
3. Connect the EVAP purge pipe (7) to the EVAP canister.
4. Connect the fill limiter vent valve pipe (6) to the EVAP canister.
5. Install the fuel tank. Refer to *Fuel Tank Replacement*.
6. Refill the fuel tank.
7. Install the fuel filler cap.
8. Connect the negative battery cable.
9. Inspect for leaks.
   - 9.1. Turn the ignition switch ON for 2 seconds.
   - 9.2. Turn the ignition switch OFF for 10 seconds.
   - 9.3. Turn the ignition switch ON.
   - 9.4. Check for fuel leaks.
10. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.



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EVAP System Cleaning

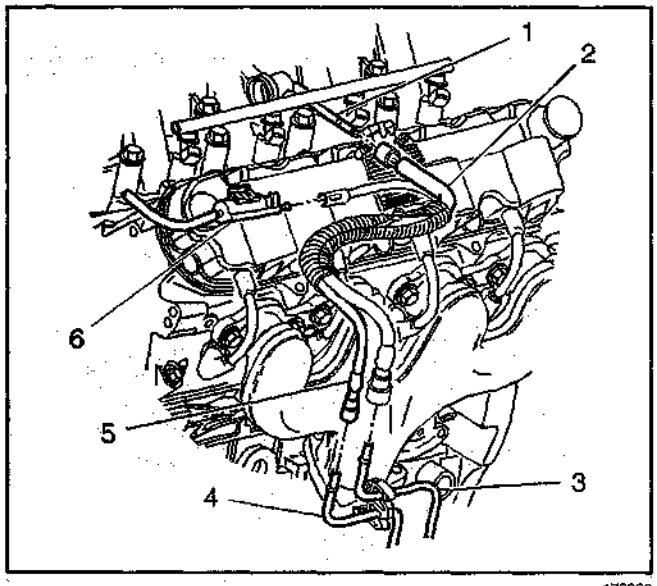
Tools Required

J 41413 EVAP Pressure/Purge Diagnostic Station

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.

Important: Whenever the DTC diagnostics lead to a no trouble found or to EVAP purge solenoid replacement, proceed with the following EVAP canister diagnostics.

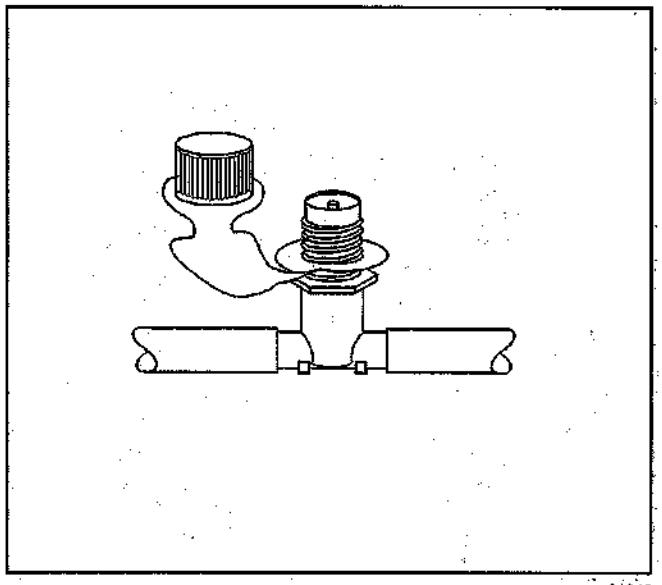
1. Remove the EVAP canister purge solenoid valve. Refer to *EVAP Canister Purge Solenoid Valve Replacement.*
2. Lightly tap the EVAP canister purge solenoid on a clean work area.
3. Look for carbon particles or carbon dust exiting from either of the vacuum ports.
   - Reinstall the EVAP purge solenoid if no carbon release is evident. Continue with the published service manual DTC procedures.
   - Continue with this service procedure if carbon is being released from the EVAP purge solenoid.
4. Remove the EVAP canister from the vehicle. Refer to *EVAP Canister Replacement.*
5. Turn off the main cylinder valve (1) on the *J 41413* EVAP purge/pressure diagnostic station.
6. Disconnect the black hose (4) that connects the nitrogen cylinder to the *J 41413* cart at the pressure regulator (5) by unscrewing the knurled nut on the regulator.
7. Connect a section of vacuum hose to the open fitting of the *J 41413* pressure regulator (5).
8. Disconnect the engine compartment EVAP pipe (5) at the chassis EVAP purge pipe (4)
9. Connect the other end of the vacuum hose to the chassis EVAP purge pipe (4).
10. Turn on the main nitrogen cylinder valve.
11. Continue to blow any debris from the purge pipe for 15 seconds.
12. Return the *J 41413* EVAP purge/pressure diagnostic station to its original condition by re–installing the black hose disconnected in step 6.
13. Replace the EVAP canister purge solenoid valve. Refer to *EVAP Canister Purge Solenoid Valve Replacement*
14. Replace the EVAP canister. Refer to *EVAP Canister Replacement.*



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15. Connect the *J 41413* EVAP purge/pressure diagnostic station to the vehicle EVAP service port.
16. Turn the 4 position switch to Purge.
17. Idle the engine at the normal operating temperature.
18. Open the throttle until engine speed reaches 2000 RPM.
19. Observe the H20 vacuum gauge on the EVAP cart. The vacuum should read greater than 15 in. H20.
    - Check the vacuum supply to the EVAP purge solenoid valve if the vacuum is less than 15 in. H20.
    - Continue with the published service diagnostics if the vacuum is greater than 15 in. H20.



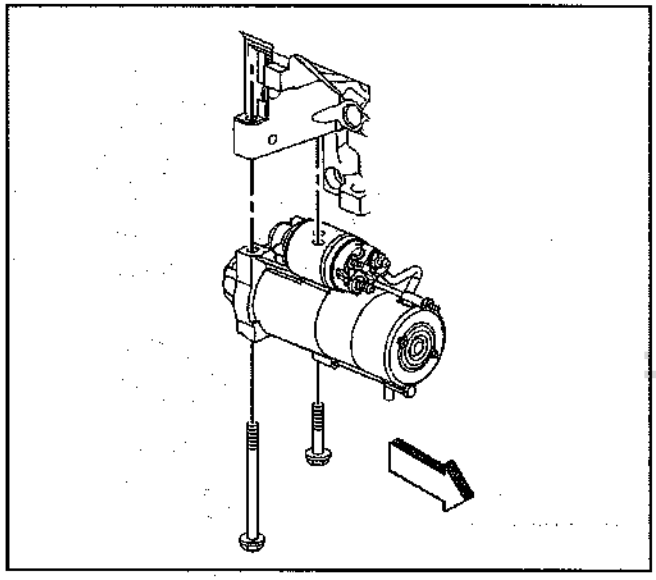
21046

Crankshaft Position (CKP) Sensor Replacement

Removal Procedure

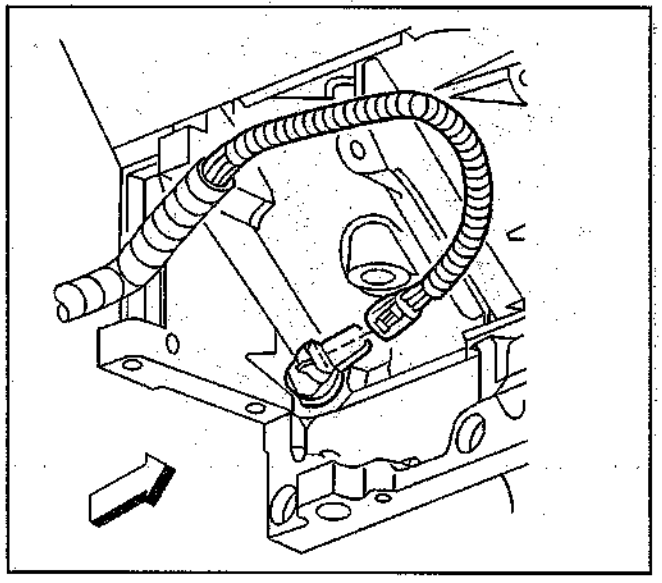
Important: The PCM Idle Learn Procedure must be performed whenever the battery is disconnected. Refer to *CKP System Variation Learn Procedure*. Perform the CKP System Variation Learn Procedure when the Crankshaft Position sensor is removed or replaced.

1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the starter. Refer to *Starter Motor Replacement (5.7 L)* in Engine Electrical.



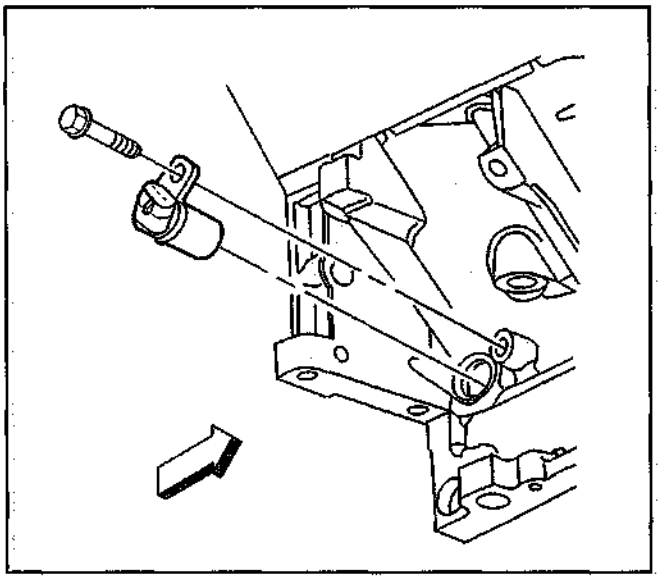
211621

3. Disconnect the Crankshaft Position (CKP) sensor electrical connector.

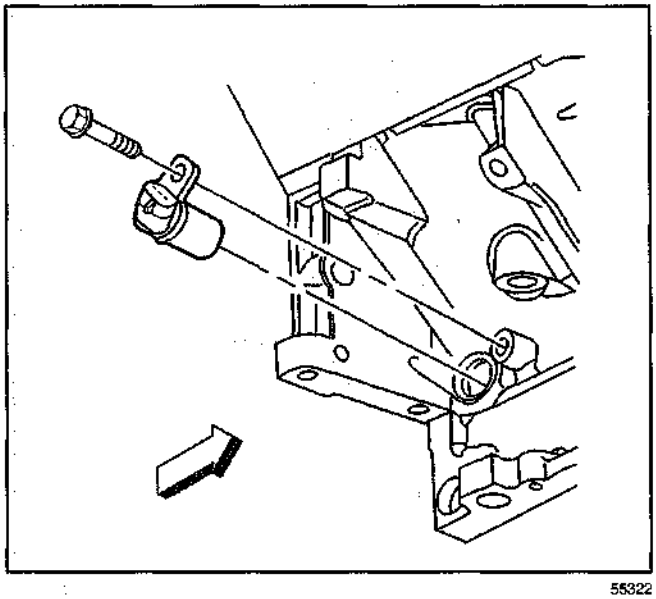


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4. Remove the CKP sensor retaining bolt.
5. Remove the CKP sensor.


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Installation Procedure

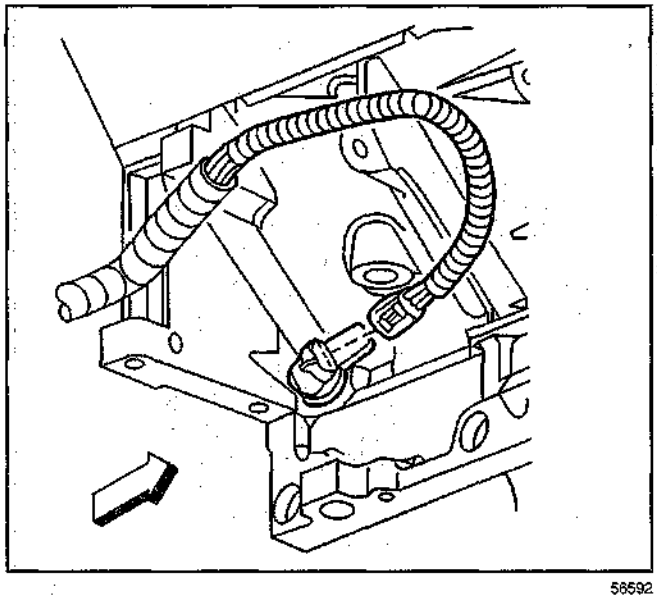
1. Install the CKP sensor.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the CKP sensor retaining bolt.

Tighten

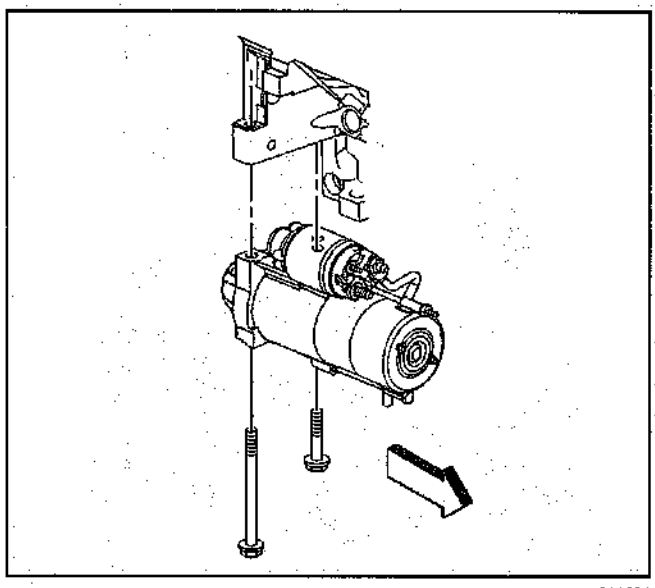
Tighten the CKP sensor to 25 N·m (18 lb ft).


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3. Connect the CKP sensor electrical connector.

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4. Install the starter. Refer to *Starter Motor Replacement (5.7 L)* in Engine Electrical.
5. Lower the vehicle.
6. Perform the CKP System Variation Learn Procedure. Refer to *CKP System Variation Learn Procedure*.
7. Perform the Idle Learn Procedure. Refer to *PCM Idle Learn Procedure*.



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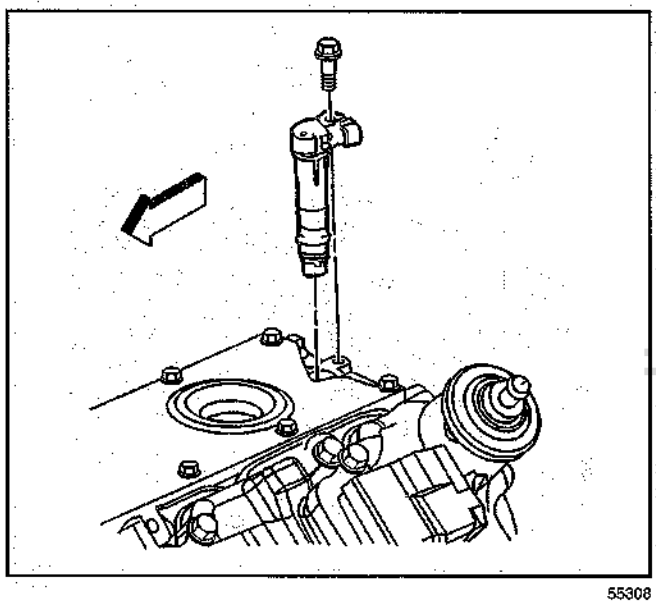
Camshaft Position (CMP) Sensor Replacement

Removal Procedure

1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
2. Remove the intake manifold. Refer to *Intake Manifold Replacement* in Engine Mechanical 5.7L.
3. Remove the Camshaft Position (CMP) sensor electrical connector.

Important: Clean the area around the CMP before removal in order to avoid debris from entering the engine.

4. Remove the CMP sensor retaining bolt.
5. Remove the CMP sensor.



55308

Installation Procedure

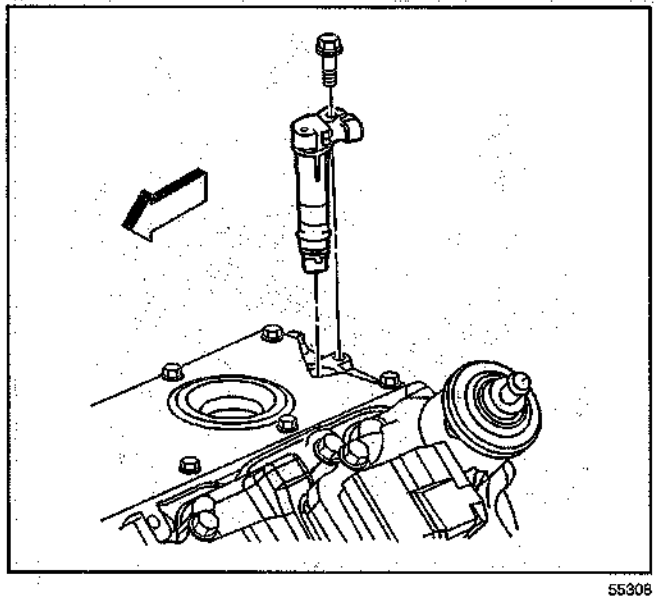
1. Install the CMP sensor.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the CMP sensor retaining bolt.

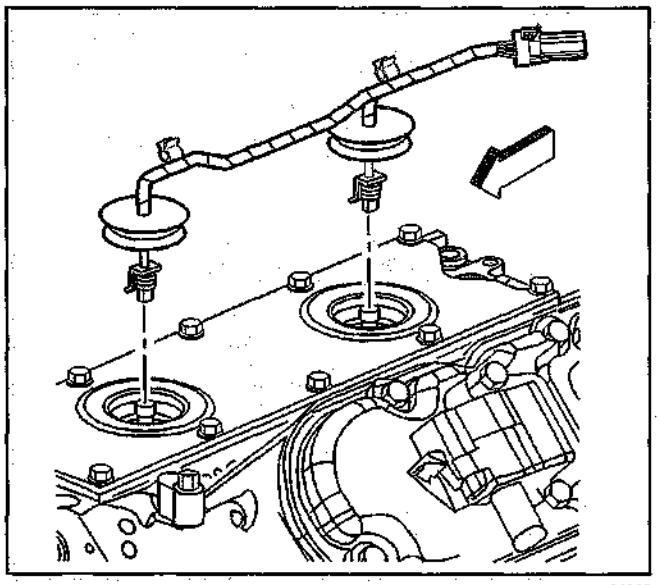
   Tighten

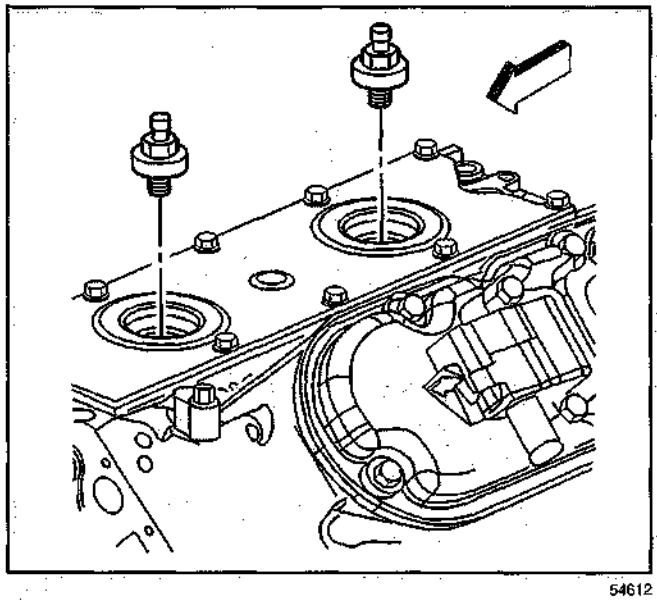
   Tighten the CMP retaining bolt to 25 N·m (18 lb ft).
3. Connect the CMP sensor electrical connector.
4. Install the intake manifold. Refer to *Intake Manifold Replacement* in Engine Mechanical 5.7L.
5. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
6. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure*.

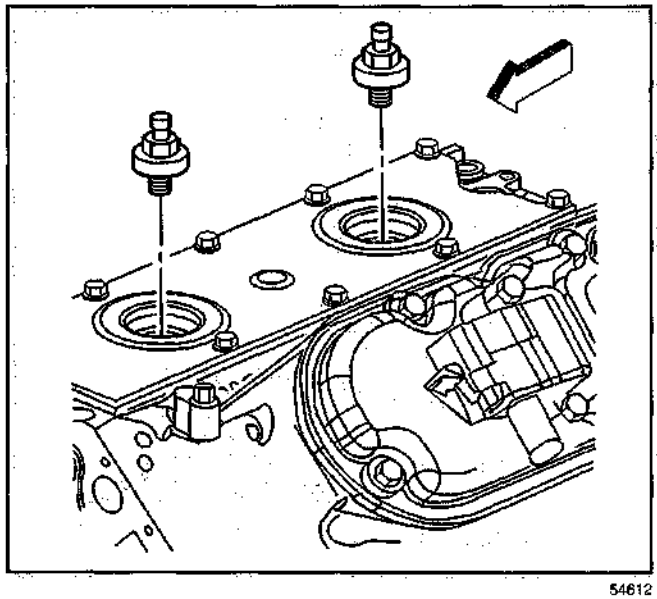


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Knock Sensor (KS) Replacement

Removal Procedure

1. Disconnect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
2. Remove the intake manifold. Refer to *Intake Manifold Replacement* in Engine Mechanical 5.7L.
3. Remove the Knock Sensor wiring harness assembly.
4. Remove the Knock Sensor.

Installation Procedure

Notice: Refer to *Fastener Notice* in Cautions and Notices.

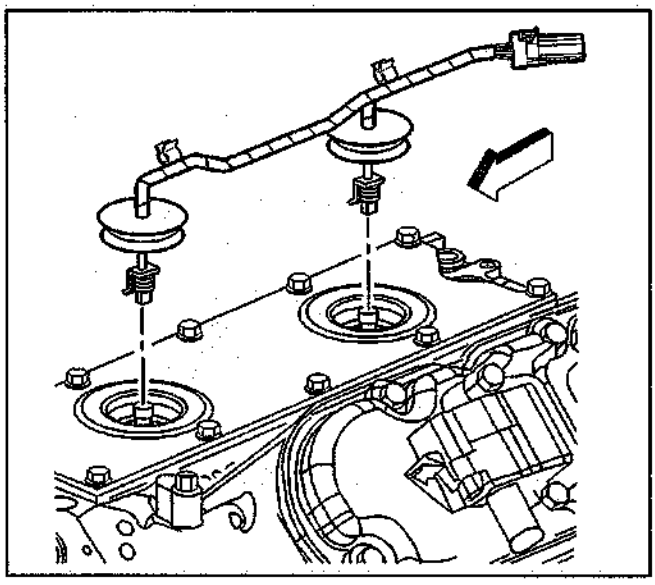
1. Install the Knock Sensor.

   Tighten

   Tighten the Knock Sensor to 15 N·m (11 lb ft).

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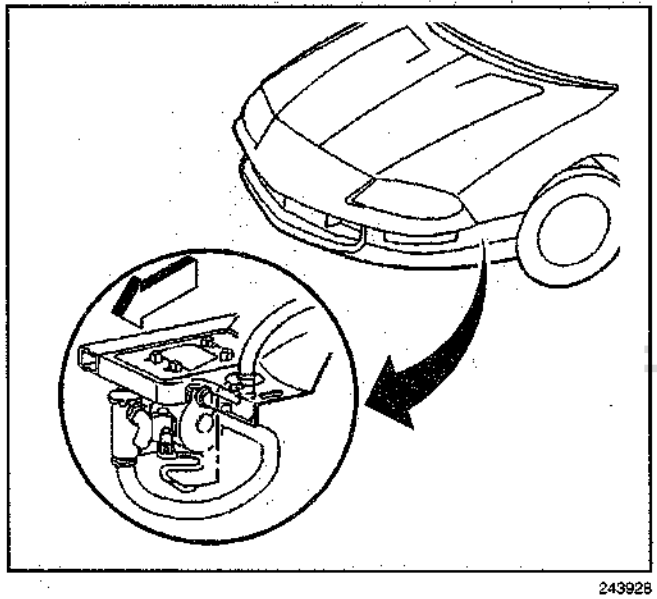
2. Install the Knock Sensor wiring harness assembly.
3. Install the intake manifold. Refer to *Intake Manifold Replacement* in Engine Mechanical 5.7L.
4. Connect the negative battery cable. Refer to *Battery Negative Cable Disconnect/Connect Procedure* in Engine Electrical.
5. Perform the idle learn procedure. Refer to *PCM Idle Learn Procedure.*


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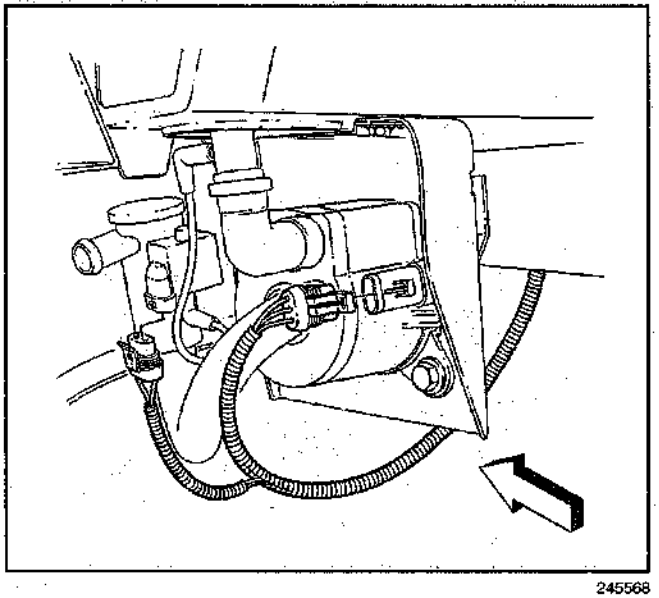
Secondary AIR Injection Pump Replacement

Removal Procedure

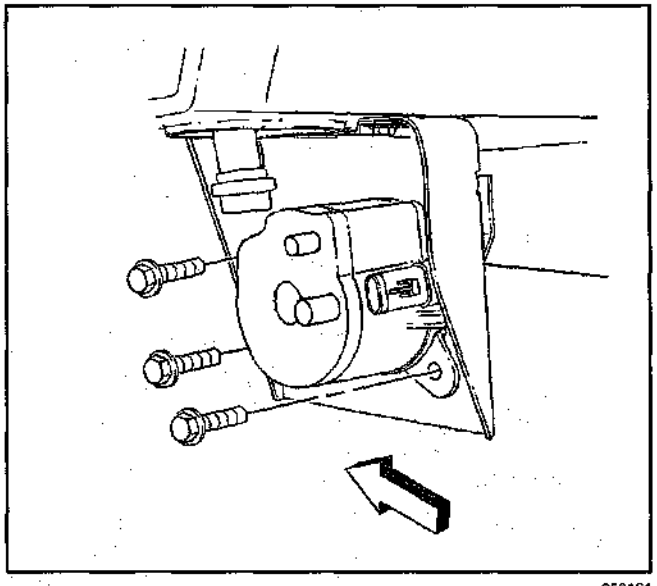
1. Raise the vehicle. Refer to *Lifting and Jacking the Vehicle* in General Information.
2. Remove the left hand side lower close-out panel.
3. Remove the hoses from the AIR pump.


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4. Disconnect the electrical connector from the AIR pump.
5. Disconnect the electrical connector from the AIR Bleed Valve Solenoid.

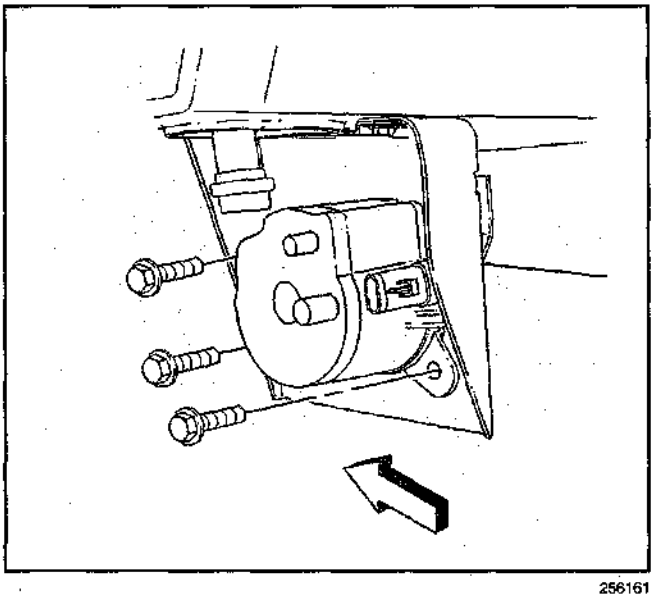

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256161

6. Remove the AIR pump mounting bolts from the bracket.
7. Remove the AIR pump.



256161

Installation Procedure

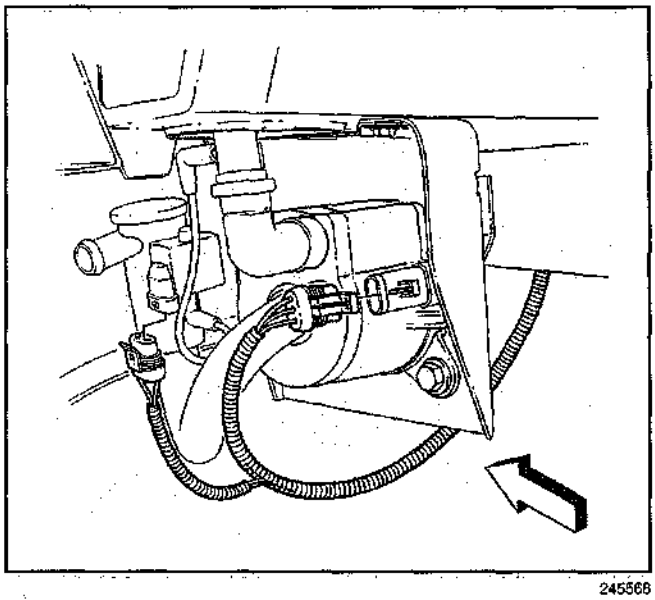
1. Install the AIR pump.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

2. Install the mounting bolts.

   Tighten

   Tighten the AIR pump bolts to 9.0 N·m (80 lb in).

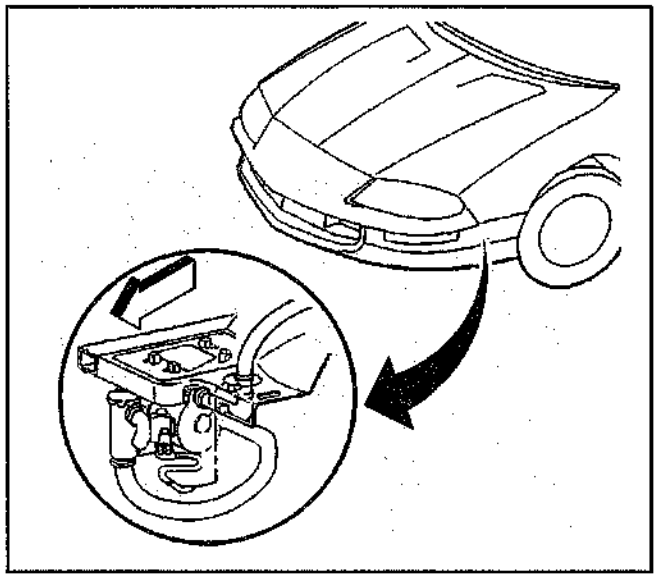


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3. Connect the electric connectors to the AIR pump.

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4. Connect the hoses to the AIR pump.
5. Install the left hand side close-out panel.
6. Lower the vehicle.
7. Check the AIR system for proper operation.

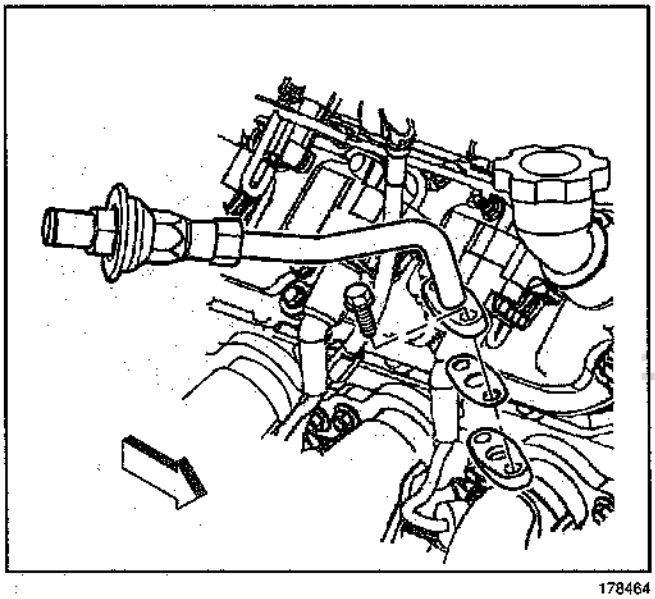

243928

AIR Check Valve/Pipe Replacement - Bank 2

Removal Procedure

Caution: Allow the engine to cool before servicing the secondary air injection AIR system in order to reduce the chance of severe burns.

1. Remove the clamps and AIR hoses from the AIR system right pipe.
2. Disconnect the AIR hose from the check valve.
3. Unscrew the check valve from the AIR pipe.
4. Remove the right AIR pipe from the manifold.
5. Before replacing a check valve, test the valve for proper operation.
   - 5.1. Install a vacuum pump to the nipple side of the check valve, AIR pump side.
   - 5.2. Pump the vacuum pump to 10 inches Hg. and observe the gauge.
   - 5.3. Replace the check valve if the vacuum bleeds down to zero within 5 seconds.


178464

Installation Procedure

Notice: Refer to *Fastener Notice* in Cautions and Notices.

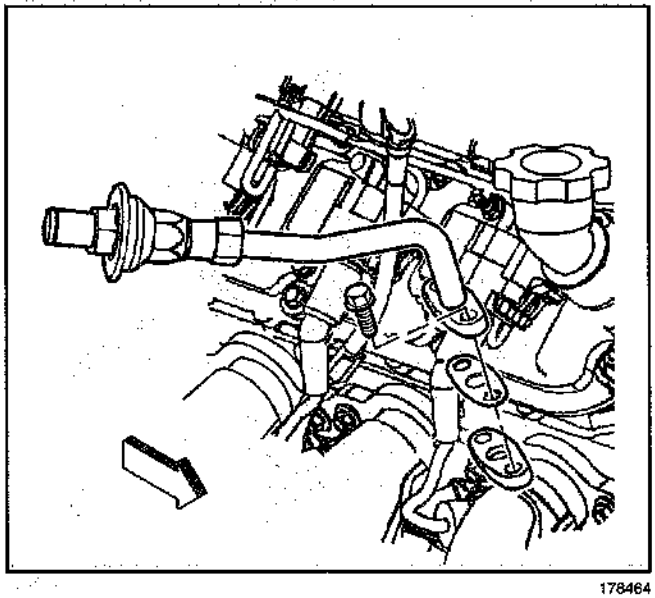
1. Screw the check valve onto the AIR pipe.

   Tighten

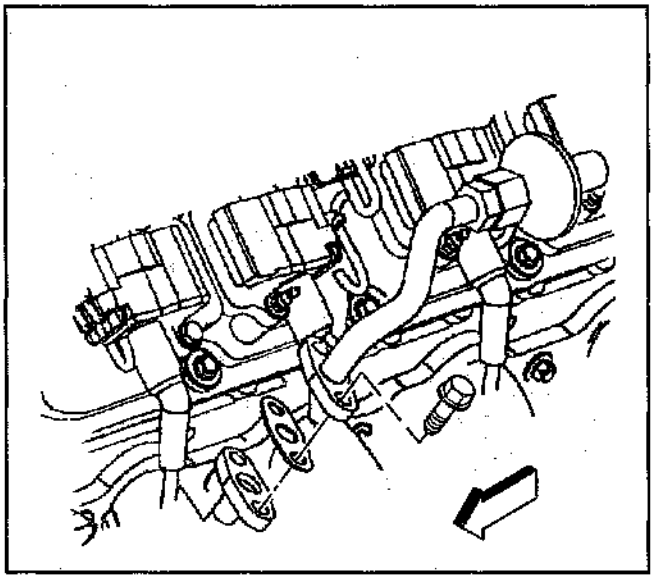
   Tighten the check valve to 23 N·m (17 lb ft).
2. Connect the right AIR pipe to the exhaust manifold.

   Tighten

   Tighten the AIR pipe to the exhaust manifold to 20 N·m (15 lb ft).
3. Install the hose and the clamp to the check valve.
4. Check the AIR system for proper operation.


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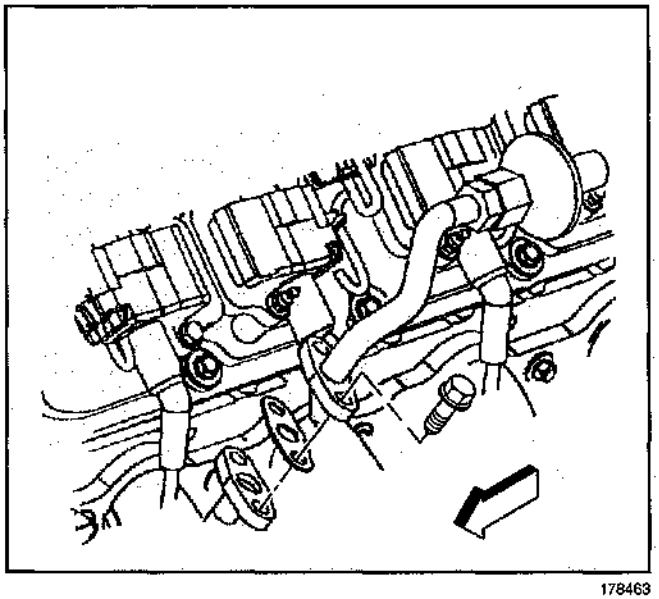

178463

AIR Check Valve/Pipe Replacement - Bank 1

Removal Procedure

Caution: Allow the engine to cool before servicing the secondary air injection AIR system in order to reduce the chance of severe burns.

1. Remove the check valve clamp.
2. Disconnect the AIR hose from the check valve.
3. Unscrew the check valve from the AIR pipe.
4. Remove the left AIR pipe from the manifold.
5. Before replacing a check valve, test the valve for proper operation.
   - 5.1. Install a vacuum pump to the nipple side of the check valve, AIR pump side.
   - 5.2. Pump the vacuum pump to 10 inches Hg. and observe the gauge.
   - 5.3. Replace the check valve if the vacuum bleeds down to zero within 5 seconds.


178463

Installation Procedure

Notice: Refer to *Fastener Notice* in Cautions and Notices.

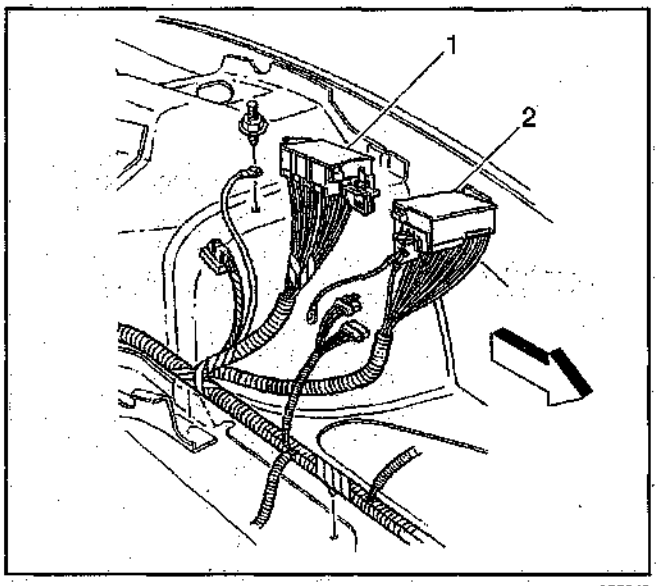
1. Screw the check valve onto the AIR pipe.

   Tighten

   Tighten the check valve to the AIR pipe to 23 N·m (17 lb ft).
2. Connect the AIR pipe to the exhaust manifold.

   Tighten

   Tighten the AIR pipe to the exhaust manifold to 20 N·m (15 lb ft).
3. Install the AIR hose to the check valve.
4. Install the check valve clamp.
5. Check the AIR system for proper operation.



255043

Secondary Air Injection Pump Relay Replacement

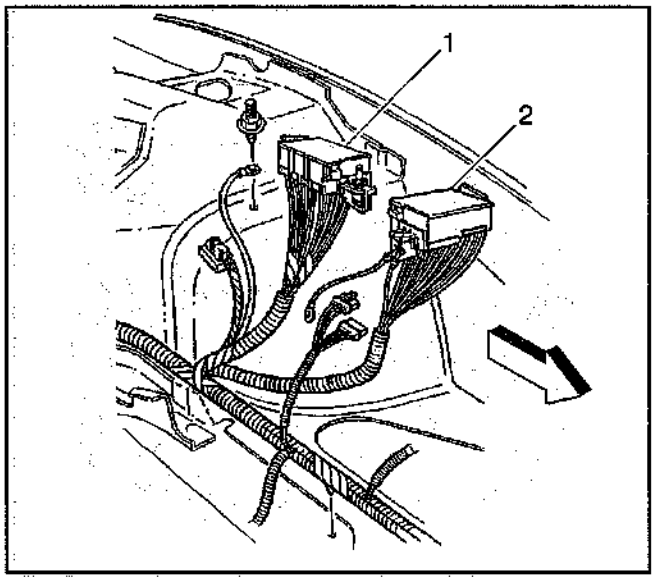
Removal Procedure

1. Turn OFF the ignition.
2. Remove the cover from the underhood electrical center #2 (2).
3. Remove the AIR pump relay.

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Installation Procedure

1. Turn OFF the ignition.
2. Install the AIR pump relay.
3. Install the cover to the underhood electrical center #2 (2).
4. Check the AIR system for proper operation.

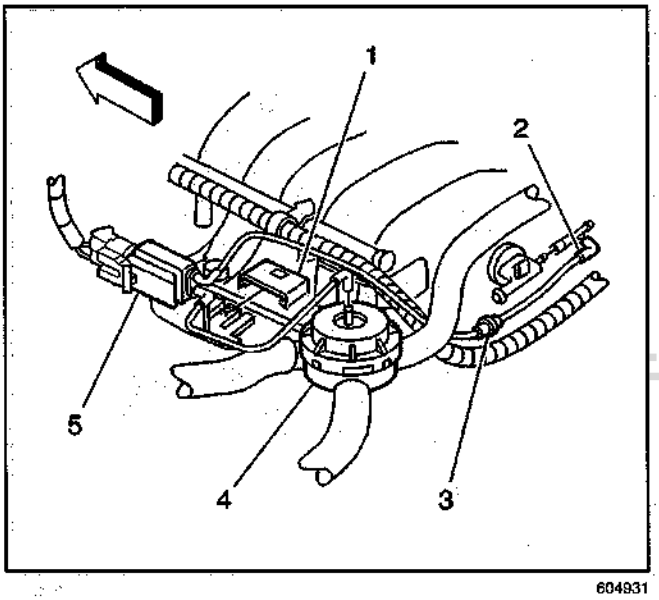


255043

Secondary AIR Injection Shut Off Valve Replacement

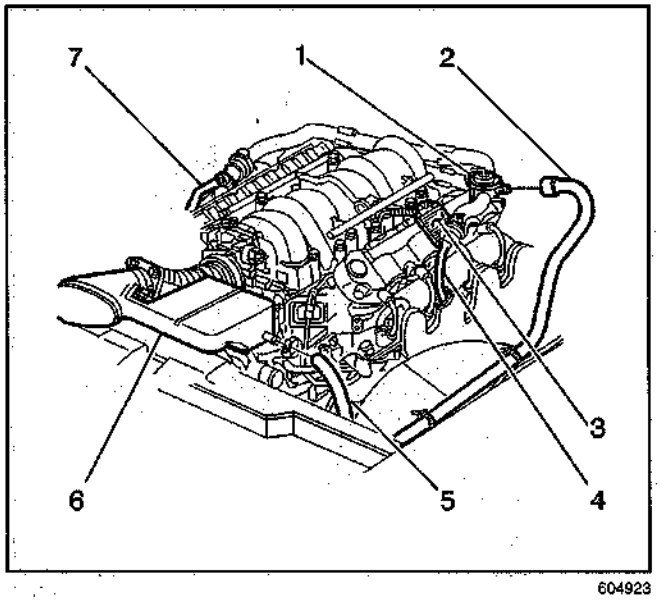
Removal Procedure

1. Remove the vacuum line from the AIR Pump Shut Off Valve (4) vacuum port.



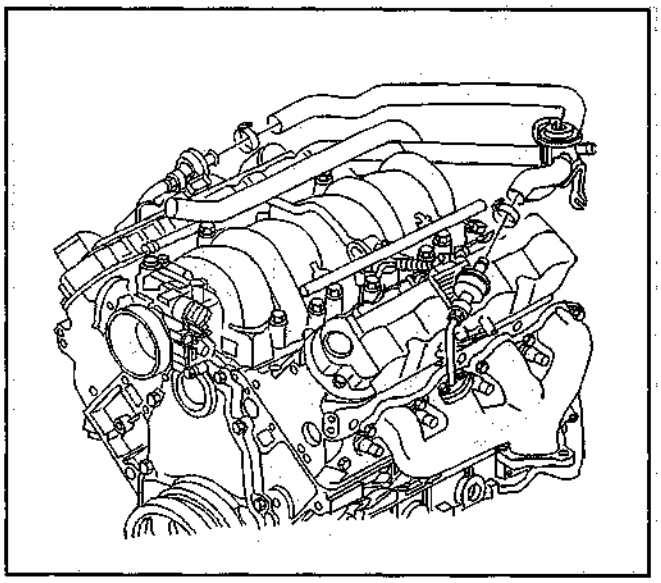
604931

2. Remove the AIR Hose (2) from the AIR Pump Shut Off Valve inlet port.

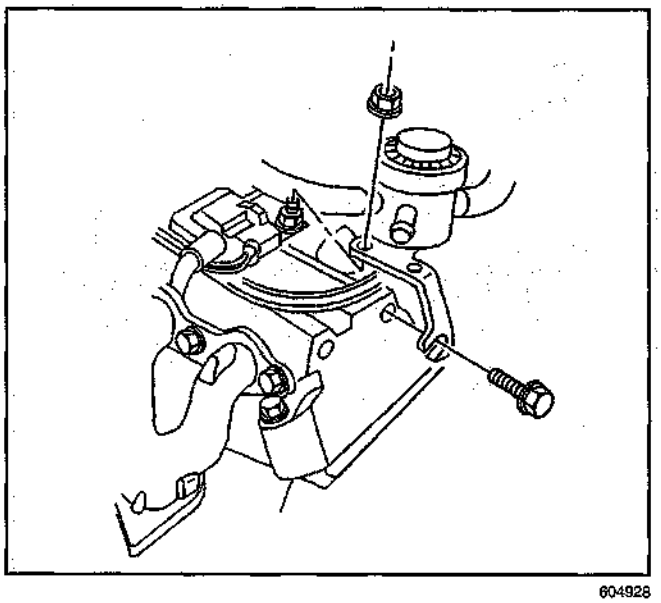


604923

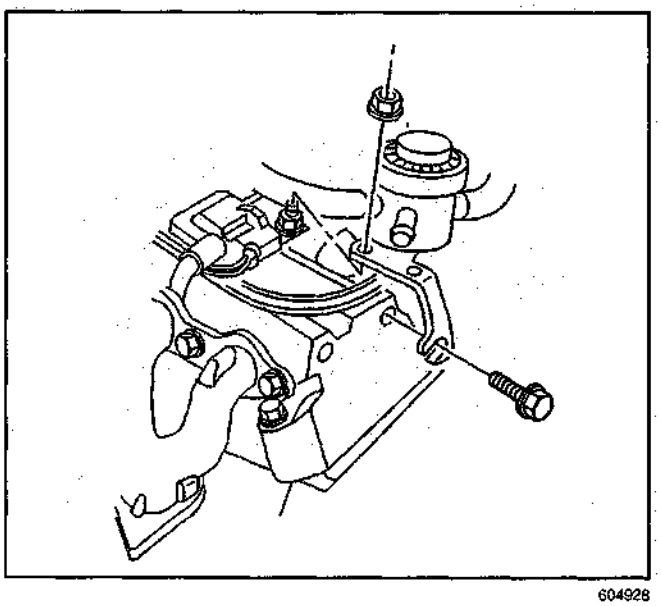
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604925

3. Remove the AIR Hoses from the AIR Pump Shut Off Valve outlet ports.


604928

4. Loosen but do not remove the retaining bolt at the rear of the cylinder head for the AIR Pump Shut Off Valve bracket.
5. Remove the retaining nut for the AIR Pump Shut Off Valve bracket.
6. Remove the AIR Pump Shut Off Valve.


604928

Installation Procedure

Notice: Refer to *Fastener Notice* in Cautions and Notices.

1. Install the AIR Pump Shut Off Valve.

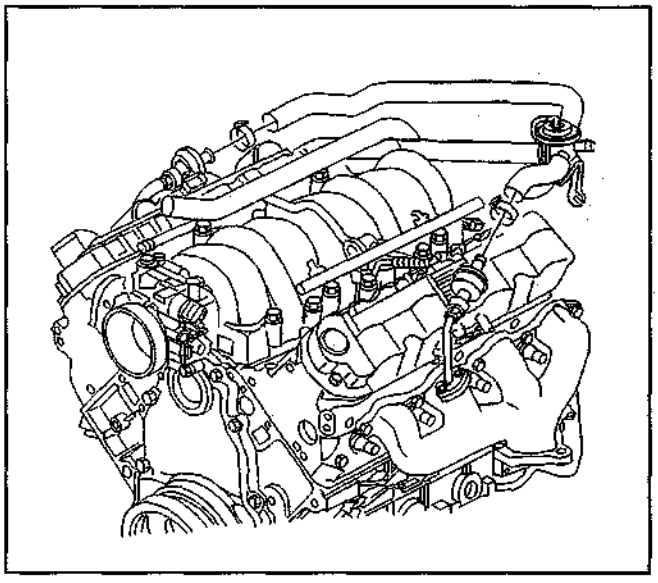
Tighten

1.1. Tighten the AIR Pump Shut Off Valve retaining bolt to 20 N·m (14 lb ft).

1.2. Tighten the AIR Pump Shut Off Valve retaining nut to 12 N·m (8 lb ft).

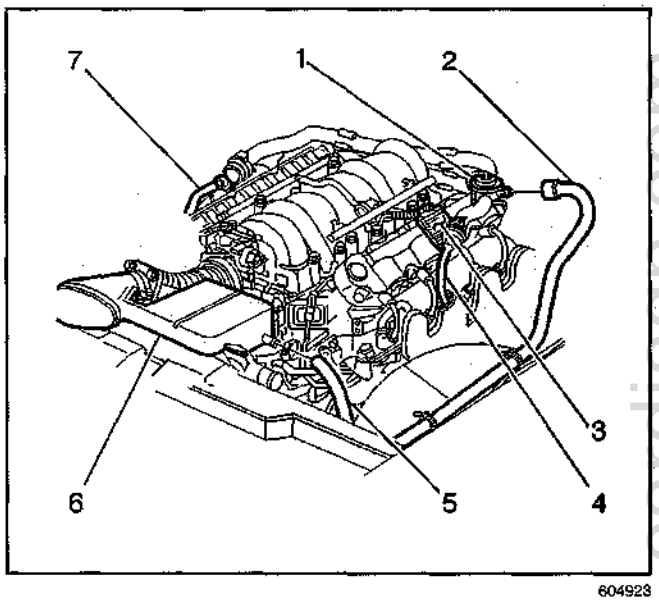
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2. Install the AIR Hoses to the AIR Pump Shut Off Valve outlet ports.



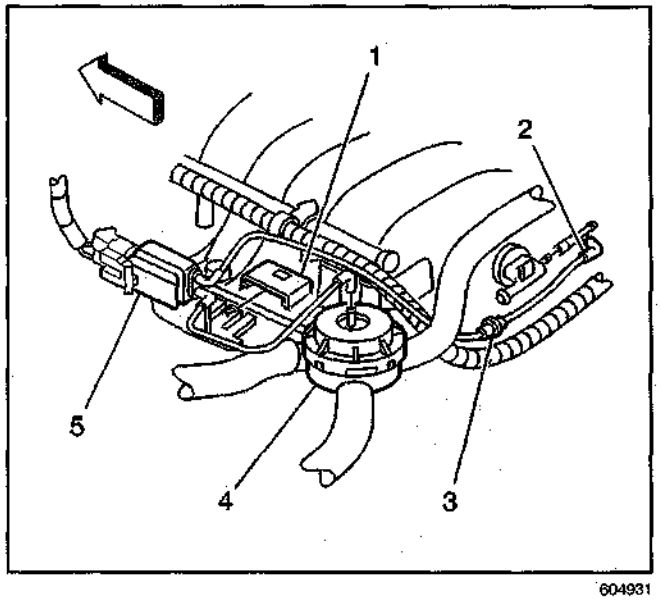
604925

3. Install the AIR Hose (2) to the AIR Pump Shut Off Valve inlet port.



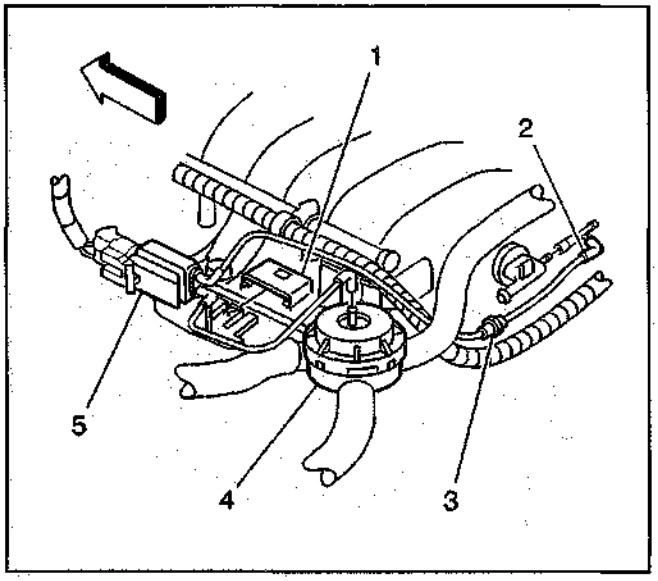
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4. Install the vacuum line to the AIR Pump Shut Off Valve (4) vacuum port.



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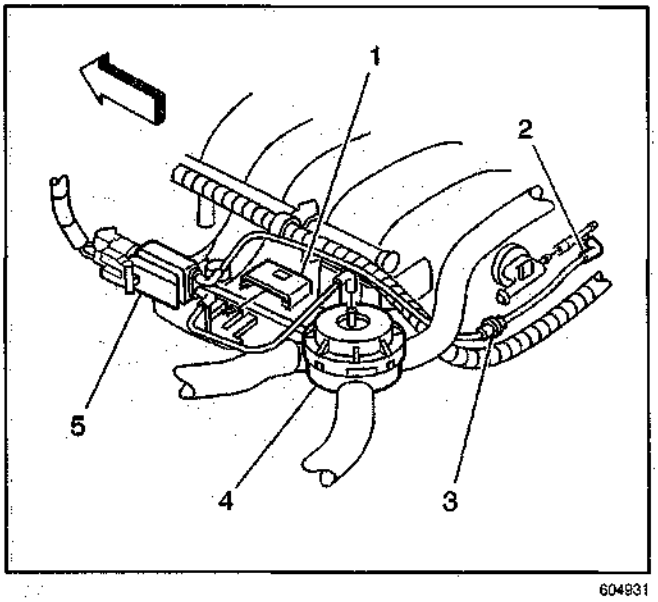


604931

AIR Solenoid Valve Replacement

Removal Procedure

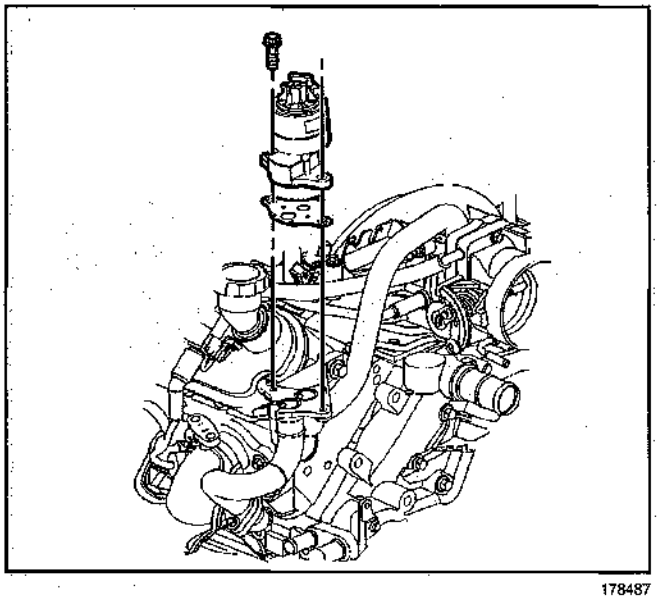
1. Disconnect the AIR solenoid valve (5) electrical connector.
2. Remove the vacuum hose from the AIR solenoid valve vacuum port.
3. Depress the locking tab for the AIR solenoid valve bracket.
4. Remove the AIR solenoid valve.



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Installation Procedure

1. Install the AIR solenoid valve.
2. Install the vacuum hoses to the AIR Solenoid valve vacuum ports.
3. Connect the AIR solenoid valve (5) electrical connector.


178487

EGR Valve Replacement

Removal Procedure

Important: Do not try to disassemble the EGR valve. Service only as a complete assembly.

Important: Carefully note the position of the EGR valve before removal. Do not rotate the EGR valve 180 degrees.

1. Remove the electrical connector.
2. Remove the valve to flange attaching bolts.

Notice: The EGR valve is an electrical component. Soaking the EGR valve in a liquid cleaner or a solvent causes damage to the valve.

3. Remove the EGR valve.
4. Remove the flange gasket.
5. Clean the EGR valve gasket surface.

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Installation Procedure

1. Install the new flange gasket
2. Install the linear EGR valve.

Notice: Refer to *Fastener Notice* in Cautions and Notices.

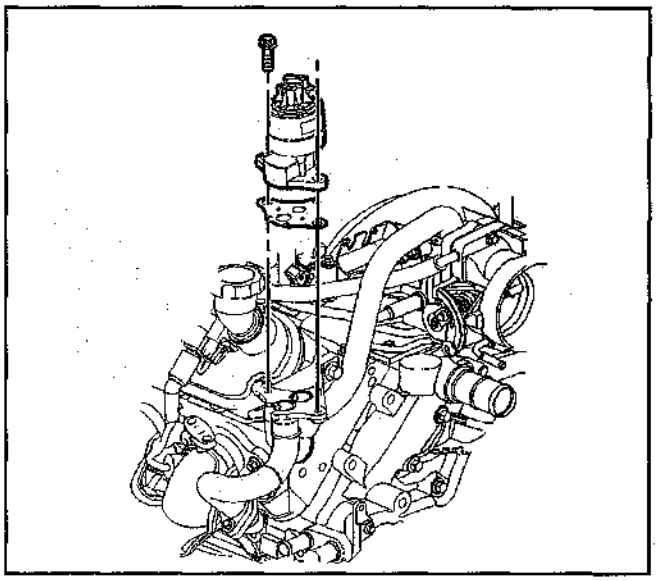
3. Install the valve to flange bolts.

   Tighten

   3.1. Tighten the bolts the first time to 10 N·m (89 lb in) each.

   3.2. Tighten the bolts a final time to 25 N·m (18 lb ft) each.

4. Install the electrical connector.



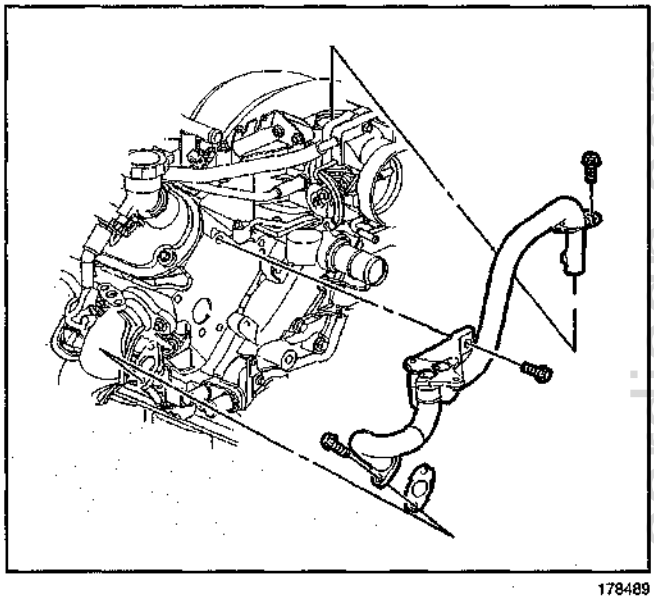
178487

EGR Pipe Replacement

Removal Procedure

Caution: Avoid breathing fumes and swallowing EGR exhaust deposits when removing components for cleaning as bodily injury may result.

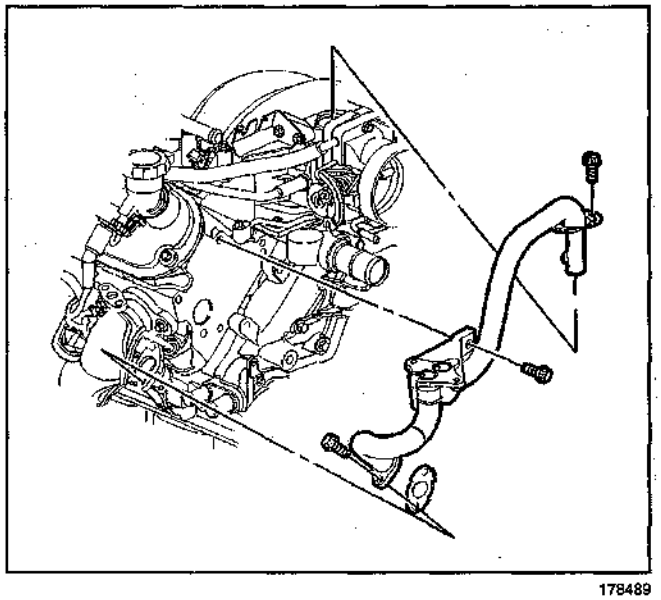
1. Remove the EGR valve. Refer to *EGR Valve Replacement.*
2. Remove the EGR pipe to intake manifold bolts.
3. Remove the EGR pipe to exhaust manifold bolts.
4. Remove the EGR pipe mounting bolts from the right cylinder head.
5. Remove the EGR pipe.



178489

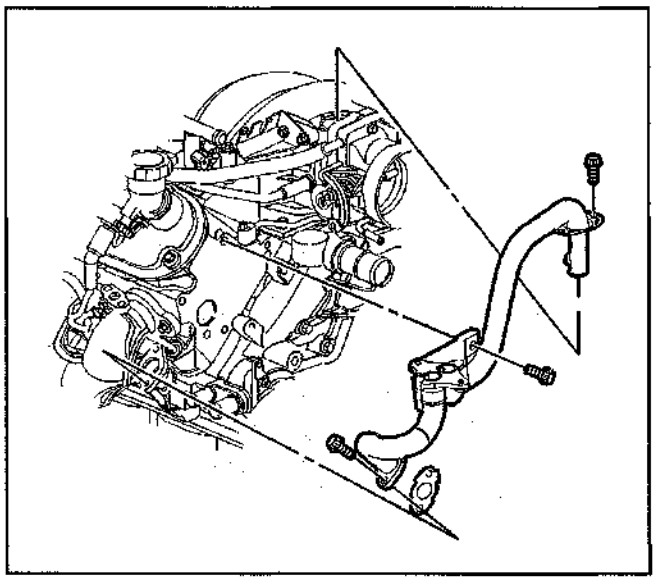
Installation Procedure

1. Install the EGR pipe.
2. Install the EGR pipe to exhaust manifold bolts.
3. Install the EGR pipe to intake manifold bolts.
4. Install the EGR valve. Refer to *EGR Valve Replacement.*



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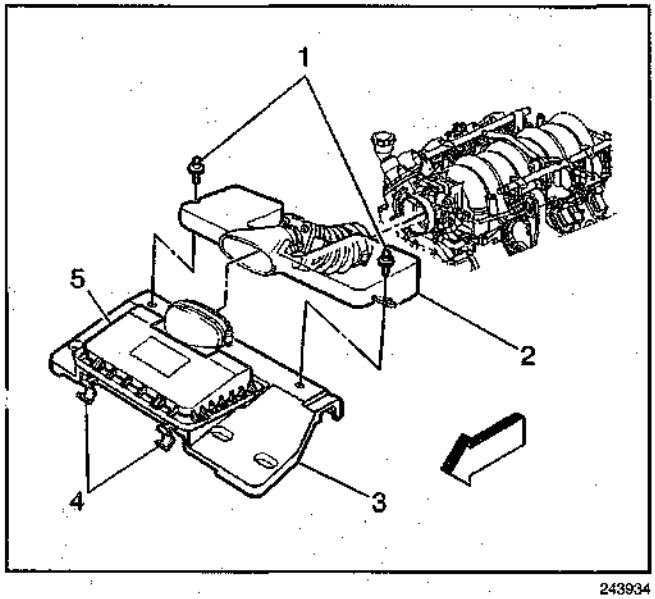


178489

EGR System Cleaning

Caution: Avoid breathing fumes and swallowing EGR exhaust deposits when removing components for cleaning as bodily injury may result.

1. Remove the EGR valve.
2. Depress the pintle several times using a pencil eraser or other suitable soft instrument. The pintle should move in and out smoothly. Replace the valve if it exhibits tendencies to stick. Refer to *EGR Valve Replacement*.
3. Try to rotate the EGR valve connector housing. Repeat for the coil housing. Replace the valve if it exhibits any looseness. Refer to *EGR Valve Replacement*.
4. Inspect the EGR valve pintle and seat for deposits. Use a cloth or other suitable soft device to remove the deposits. Remove all loose particles. Replace the valve if the deposits are such that the pintle/base interface can not be cleaned adequately to allow the pintle to seal against the seat. Damage to the powdered metal EGR valve base occurs if cleaned with solvents, sharp tools, wire brush/wheel or sand blasting. Cleaning by these methods is not recommended.
5. Remove the EGR pipe.
6. Clean the passages with a wire brush. Remove all loose particles.
7. Install the EGR pipe.



243934

Air Cleaner Element Replacement

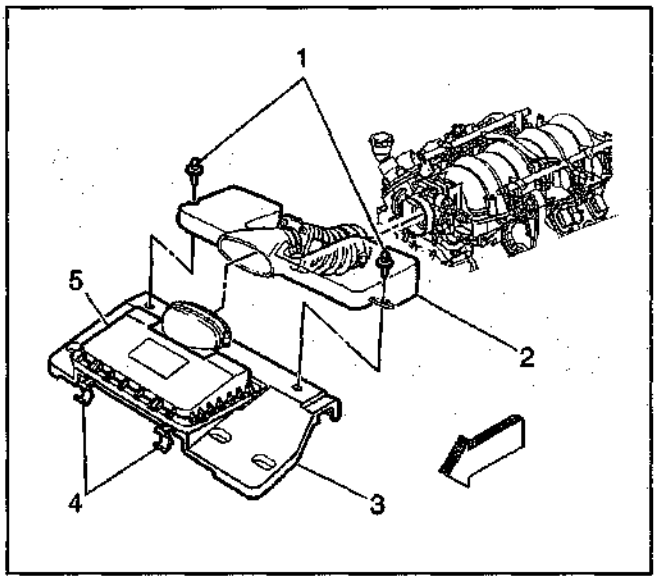
Removal Procedure

1. Release the top cover latches (4).
2. Lift the top of the air cleaner housing (5) up.
3. Pull out the air filter element. Ensure the air filter frame remains with the housing.
4. Inspect the air filter element for dust, dirt, or water. Clean or replace the air filter element if required.

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Installation Procedure

1. Install the air filter element into the air cleaner housing.
2. Install the air cleaner housing top cover (5) to the lower assembly. Ensure the rear locating tabs on the air cleaner cover slip into the retainers located on the lower portion of the air cleaner housing.
3. Secure the top cover latches (4).



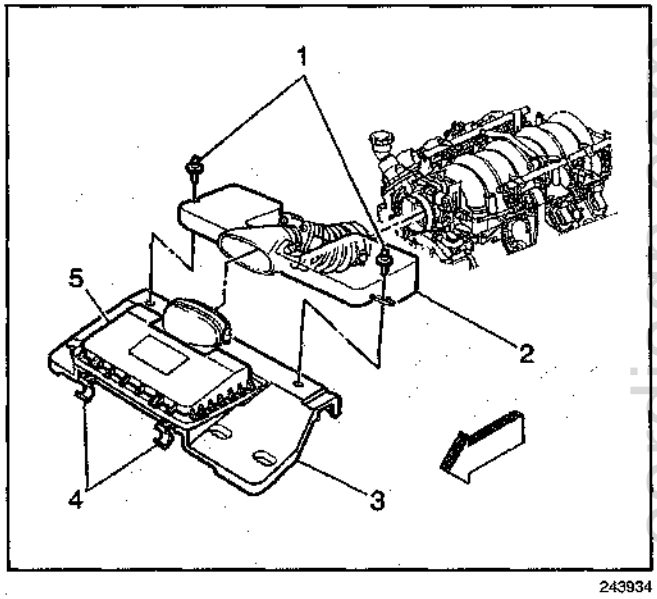
243934

Air Cleaner Assembly Replacement

Removal Procedure

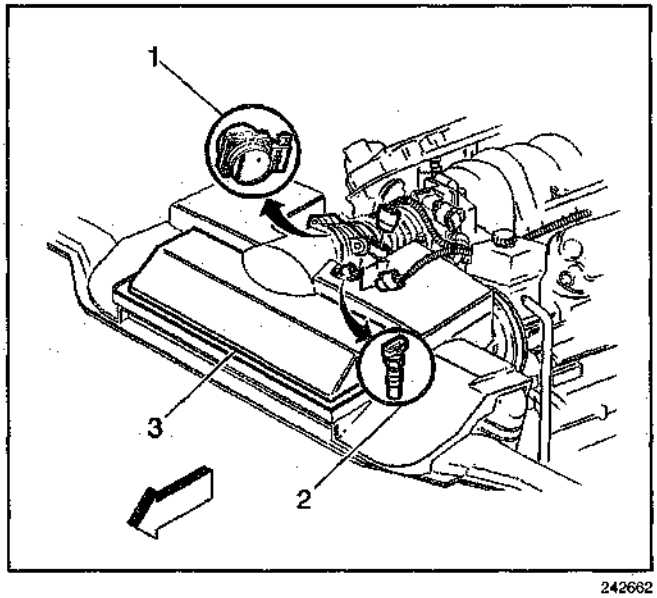
Notice: If the mass air flow (MAF) sensor is installed backwards, the system will go rich. An arrow cast into the plastic portion of the sensor indicates proper air flow direction. The arrow must point toward the engine.

1. Release the top cover latches (4).
2. Remove the plastic rivets (1) securing the air intake resonator (2).
3. Loosen the clamp at the air duct between the MAF sensor and the resonator (2).



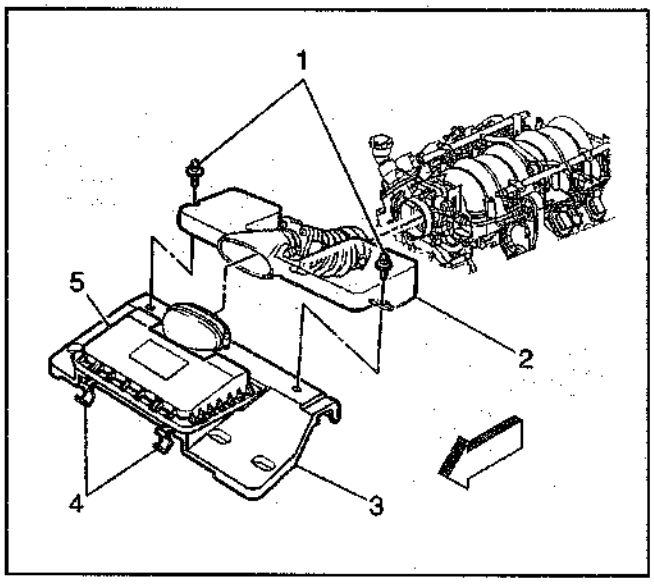
243934

4. Disconnect the IAT sensor (2) connector.
5. Lift the top of the air cleaner housing and the resonator off as an assembly.



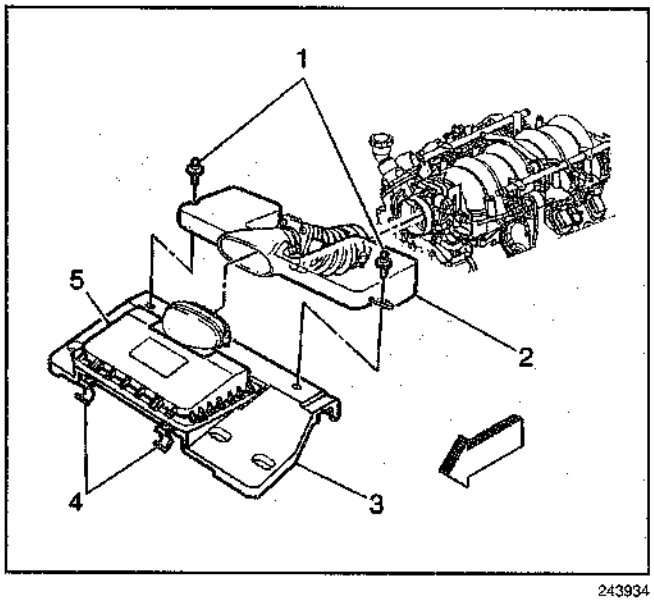
242662

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243934

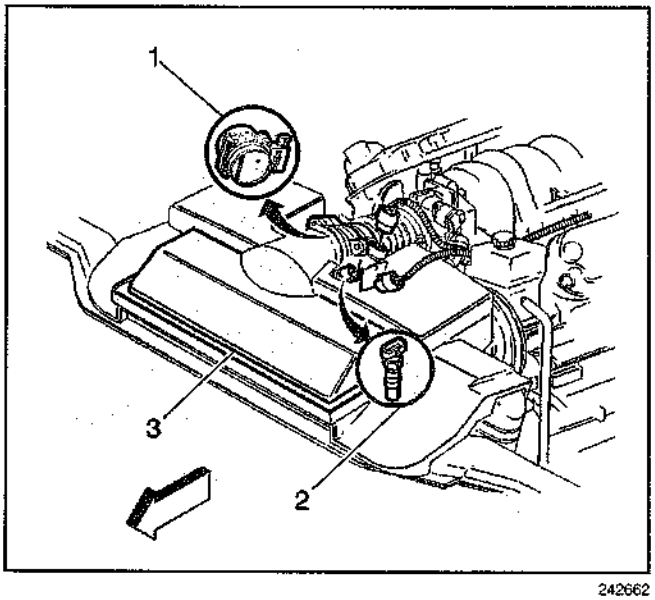
6. Remove the 4 fasteners securing the air cleaner assembly (3) to the tie bar.
7. Lift the lower air cleaner assembly off.



243934

Installation Procedure

1. Position the lower air cleaner assembly (3) onto the tie bar. Ensure the rubber isolators fit properly on to the top of the radiator.
2. Fasten the lower air cleaner assembly (3) to the tie bar support.
3. Secure the upper air cleaner and resonator assembly (2) to the MAF sensor
4. Secure the resonator to the lower air cleaner assembly using the plastic rivets (1).

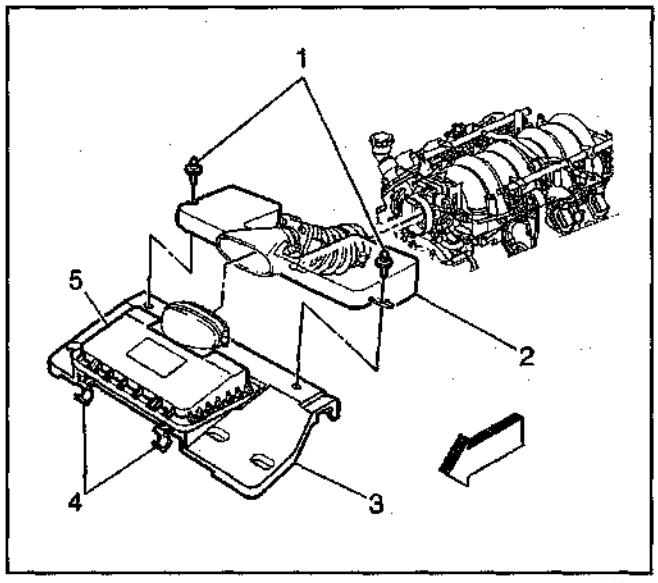


242662

5. Connect the IAT sensor (2) connector.
6. Tighten the clamp on the air duct at the MAF sensor (1).

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7. Secure the top cover latches (4). Ensure the rear locating tabs on the air cleaner cover slip into the retainers located on the lower portion of the air cleaner housing.



243934

Engine Oil Life Monitor Reset Procedure

Description

The PCM monitors various engine parameters to determine when an oil change should be done. The PCM sends a message to the Instrument Panel Cluster (IPC) when an oil change is needed. The PCM monitors the following to determine when an oil change should occur:

- Engine Speed
- Engine coolant temperature
- Engine load
- Intake Air Temperature
- Vehicle mileage

Resetting The Oil Life Monitor

Important:

- Repair any TP sensor DTCs before proceeding with the reset procedure.
- If the Engine Oil Life Monitor is reset due to a PCM replacement, advise the customer. The customer has two options:
  - Change the engine oil and filter.
  - Determine when the last engine oil change occurred. Monitor the vehicle mileage and change the engine oil and filter at the next recommended service interval.

1. Turn ON the ignition leaving the engine OFF.
2. Cycle the accelerator pedal from a closed throttle to a wide open throttle (WOT) 3 times within 5 seconds. The Change Oil message flashes for 5 seconds when reset.
3. Change the engine oil and filter. Refer to *Engine Oil and Oil Filter Change* in Engine Mechanical.

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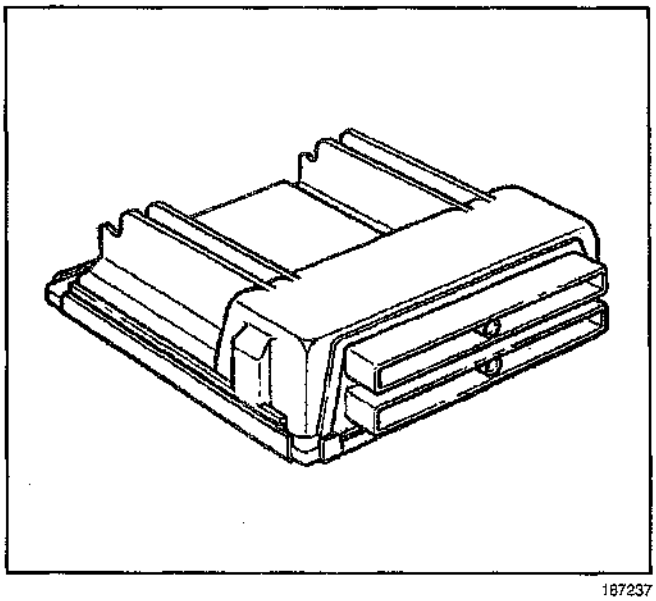
Description and Operation

Powertrain Control Module Description

The Powertrain Control Module (PCM) is designed to maintain exhaust emission levels while maintaining excellent driveability and fuel efficiency. The PCM controls the following operations:

- Fuel control
- Ignition Control (IC)
- Knock Sensor (KS) system
- Automatic transmission shift functions
- Manual transmission: 1–4 Upshift and Reverse Inhibit
- Cruise Control Enable (if so equipped)
- Generator
- Evaporative Emission (EVAP) Purge
- A/C Clutch Control
- Cooling Fan Control
- Secondary Air Injection (AIR)
- Exhaust Gas Recirculation (EGR)
- On-board diagnostics for powertrain functions.

Powertrain Control Module



187237

The Powertrain Control Module (PCM) is located in the engine compartment. The PCM is the control center of the vehicle.

The PCM constantly monitors the information from various sensors and controls the systems that affect vehicle performance and emissions. The PCM also performs the diagnostic functions for those systems. It can recognize operational problems and will alert the driver through the MIL (Malfunction Indicator Lamp) when a malfunction has occurred. When the PCM detects a malfunction, it stores a diagnostic trouble code (DTC) which will help identify problem areas. This is done to aid the technician in making repairs.

The PCM supplies either 5.0 or 12.0 volts to power various sensors or switches. This is done through resistances in the PCM. The resistance is so high in value that a test lamp will not illuminate when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, a digital voltmeter (J 39200) with a minimum of 10 megaohms input impedance is required to ensure accurate voltage readings.

The PCM controls output circuits such as the injectors, IAC, cooling fan relays, etc. by controlling the ground or the power feed circuit through transistors or a device called an Output Driver Module.

Torque Management

Torque Management is a function of the PCM that reduces engine power under certain conditions. Torque Management is performed for the following reasons:

- To prevent over stressing the powertrain components.
- To prevent damage to the vehicle during certain abusive maneuvers.
- To reduce engine speed when the IAC is out of the normal operating range.

The PCM monitors the following sensors and engine parameters to calculate engine output torque:

- Air/Fuel ratio
- Mass Air Flow
- Manifold Absolute Pressure
- Intake Air Temperature
- Spark Advance
- Engine Speed
- Engine Coolant Temperature
- A/C Clutch Status

The PCM monitors the torque converter status, the transmission gear ratio, and the engine speed in order to determine if torque reduction is required. The PCM retards the spark as appropriate to reduce engine torque output if torque reduction is required. The PCM also shuts off the fuel to certain injectors to reduce the engine power In the case of an abusive maneuver.

The following are instances when engine power reduction is likely to be experienced:

- During transmission upshifts and downshifts.
- Heavy acceleration from a standing start.
- The IAC is out of the normal operating range.
- When the driver is performing harsh or abusive maneuvers such as shifting into gear at high throttle angles or shifting the transmission from reverse to drive to create a rocking motion.

The driver is unlikely to notice the torque management actions in the first two instances. The engine power output will be moderate at full throttle in the other two cases.

The PCM calculates the amount of spark retard necessary to reduce the engine power by the desired amount. The PCM disables the fuel injectors for cylinders 1, 4, 6, and 7 in the case of an abusive maneuver.

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PCM Function

The PCM supplies a buffered voltage to various sensors and switches. The PCM controls most components with electronic switches which complete a ground circuit when turned ON.

PCM Service Precautions

The PCM is designed to withstand normal current draws associated with vehicle operations. Avoid overloading any circuit. When testing for opens or shorts, do not ground any of the PCM circuits unless instructed. When testing for opens or shorts, do not apply voltage to any of the PCM circuits unless instructed. Test these circuits with a digital voltmeter *J 39200* only, while the PCM connectors remain connected.

Aftermarket (Add-On) Electrical And Vacuum Equipment

Aftermarket (Add-On) Electrical and Vacuum Equipment is defined as any equipment installed on a vehicle after leaving the factory that connects to the vehicle's electrical or vacuum systems. No allowances have been made in the vehicle design for this type of equipment.

Notice: Do not attach add-on vacuum operated equipment to this vehicle. The use of add-on vacuum equipment may result in damage to vehicle components or systems.

Notice: Connect any add-on electrically operated equipment to the vehicle's electrical system at the battery (power and ground) in order to prevent damage to the vehicle.

Add-On electrical equipment, even when installed to these strict guidelines, may still cause the Powertrain system to malfunction. This may also include equipment not connected to the vehicle's electrical system such as portable telephones and radios. Therefore, the first step in diagnosing any Powertrain problem is to eliminate all aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, diagnose the problem in the normal manner.

Engine Controls Information

The driveability and emissions information describes the function and operation of the PCM.

The engine controls Information contains the following:

- Component Locations
- Wiring Diagrams
- PCM Terminal End View and Terminal Definitions
- Powertrain On-Board Diagnostic (OBD) System Check
- Diagnostic Trouble Code Tables (DTCs)

The Component System includes the following items:

- Component and circuit description
- On-vehicle service for each sub-system
- Functional checks and Diagnostic Tables

The DTCs also contain diagnostic support information containing circuit diagrams, circuit or system information, and helpful diagnostic information.

Maintenance Schedule

Refer to the General Motors Maintenance Schedule of the appropriate service category for the maintenance that the owner or technician should perform in order to retain emission control performance.

Visual and Physical Underhood Inspection

Perform a careful visual and physical underhood inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual and physical inspection:

- Inspect all vacuum hoses for the following conditions:
  - Correct routing
  - Pinches
  - Cuts
  - Disconnected
- Inspect all wires in the engine compartment for the following items:
  - Proper connections
  - Burned or chafed spots
  - Pinched wires
  - Contact with sharp edges
  - Contact with hot exhaust manifolds

This visual and physical inspection is very important. Preform the inspection carefully and thoroughly.

System Status and Drive Cycle For Inspection/Maintenance

The System Status selection is included in the scan tool System Info menu.

Several states require that the I/M (OBD II system) pass on-board tests for the major diagnostics prior to having a vehicle emission inspection. This is also a requirement to renew license plates in some areas.

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 to comply with local area requirements. Using the System Status display, any of the following systems or combination of systems may be monitored for I/M Readiness:

- The Catalyst
- The EVAP system
- The HO2S
- The HO2S Heater
- The EGR System
- The AIR system

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Important: The System Status display indicates only whether or not the test has been completed. The System Status display does not necessarily mean that the test has passed. If a Failed Last Test indication is present for a DTC associated with one of the above systems, diagnosis and repair is 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. Refer to the Typical Drive Cycle table (more than one drive cycle may be needed) to use as a guide to complete the I/M System Status tests.

Following a DTC info clear, System Status will clear for one or all of these systems. Following a battery disconnect or a PCM replacement, all System Status information will clear.

Typical Drive Cycle

Diagnostic Time Schedule for I/M Readiness	
Vehicle Drive Status	**What is Monitored?**
Cold Start, coolant temperature less than 50°C (122°F)	—
Idle 2.5 minutes in Drive (Auto) Neutral (Man), A/C and rear defogger ON	HO2S Heater, Misfire, Secondary Air, Fuel Trim, EVAP Purge
A/C off, accelerate to 90 km/h (55 mph), 1/2 throttle.	Misfire, Fuel Trim, Purge
3 minutes of Steady State - Cruise at 90 km/h (55 mph)	Misfire, EGR, Secondary Air, Fuel Trim, HO2S, EVAP Purge
Clutch engaged (Man), no braking, decelerate to 32 km/h (20 mph)	EGR, Fuel Trim, EVAP Purge
Accelerate to 90–97 km/h (55–60 mph), 3/4 throttle	Misfire, Fuel Trim, EVAP Purge
5 minutes of Steady State Cruise at 90–97 km/h (55–60 mph)	Catalyst Monitor, Misfire, EGR, Fuel Trim, HO2S, EVAP Purge
Decelerate, no braking. End of Drive Cycle	EGR, EVAP Purge
Total time of OBD II Drive Cycle 12 minutes	—

Primary System Based Diagnostics

There are primary system based diagnostics which evaluate the system operation and their effect on vehicle emissions. The primary system based diagnostics are listed below with a brief description of the diagnostic functionality.

Oxygen Sensor Diagnosis

Diagnose the Fuel Control Heated Oxygen Sensors for the following conditions:

- Heater Performance (time to activity on cold start)
- Slow Response
- Response Time (time to switch R/L or L/R)
- Inactive Signal (output steady at bias voltage - approximately 450 mV)
- Signal Fixed High
- Signal Fixed Low

Diagnose the Catalyst Monitor Heated Oxygen Sensors for the following functions:

- Heater Performance (time to activity on cold start)
- Signal fixed low during steady state conditions.
- Inactive Sensor.

Heated Oxygen Sensors (Pre-Catalyst)

The main function of the Pre-Catalyst Heated Oxygen Sensor (HO2S) is to provide the PCM with exhaust stream information in order to maintain proper fueling to hold emissions within acceptable levels. These oxygen sensors are always located between the exhaust manifold and the catalytic converter. After the sensor reaches the operating temperature, the sensor generates a voltage inversely proportional to the amount of oxygen present in the exhaust gases. The PCM uses the signal voltage from the fuel control heated oxygen sensors in a closed loop in order to adjust the fuel injector pulse width. While in a closed loop, the PCM can adjust fuel delivery in order to maintain an air to fuel ratio which allows the best combination of emission control and driveability.

If the oxygen sensor pigtail wiring, connector or terminal are damaged, replace the entire oxygen sensor assembly. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, the sensor must have a clean air reference provided to it. This clean air reference is obtained by way of the oxygen sensor wires. Any attempt to repair the wires, connectors or terminals could result in the obstruction of the air reference. Any attempt to repair the wires, connectors or terminals would degrade oxygen sensor performance.

Catalyst Monitor Heated Oxygen Sensors

In order to control emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), the system uses a three-way catalytic converter. The catalyst 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. Catalyst Monitor HO2S (Post Catalyst HO2S) are always located downstream of the catalytic converter.

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The PCM has the ability to monitor this process using the post catalyst heated oxygen sensors. The pre-sensors produce an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The post 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 pre HO2S signal will be far more active than that produced by the post HO2S.

In addition to catalyst monitoring, the post heated oxygen sensor has a limited role in controlling fuel delivery. If the post HO2S signal indicates a high or low oxygen content for an extended period of time while in a closed loop, the PCM adjusts the fuel delivery slightly in order to compensate.

Catalyst Monitor Diagnostic Operation

The catalyst monitor diagnostic measures oxygen storage capacity of the catalyst converter. In order to do this, the heated sensors are installed before and after the Three-Way Catalyst (TWC). Voltage variations between the sensors allow the PCM to determine the catalyst emission performance.

As a catalyst becomes less effective in promoting chemical reactions, the catalyst's capacity to store and release oxygen generally degrades. The catalyst monitor diagnostic is based on a correlation between conversion efficiency and oxygen storage capacity.

A good catalyst (e.g. 95% hydrocarbon conversion efficiency) shows a relatively flat output voltage on the post-catalyst heated oxygen sensor (HO2S) signal circuit. A degraded catalyst (65% hydrocarbon conversion) shows a greatly increased activity in output voltage from the post catalyst HO2S.

The post-catalyst HO2S is used to measure the oxygen storage and release capacity of the catalyst. A high oxygen storage capacity indicates a good catalyst. Low oxygen storage capacity indicates a failing catalyst. The TWC and the HO2S must be at operating temperature in order to achieve reliable oxygen sensor voltages like those shown in the Three-Way Catalyst Oxygen Storage Capacity graphic.

The PCM performs the catalyst diagnostic at idle when the conditions for running the diagnostic are met. Refer to Conditions for Running the DTC in *DTC P0420 Catalyst System Low Efficiency Bank 1* or *DTC P0430 Catalyst System Low Efficiency Bank 2.* During the catalyst diagnostic the PCM captures the current rear HO2S rich/lean status. The Air Fuel ratio transitions from rich to lean or lean to rich depending on the initial captured rich/lean status. The Air Fuel ratio transitions a second time opposite the first Air Fuel ratio transition. During this diagnostic the scan tool will display HO2S voltages going from full rich to full lean. This condition is normal during this diagnostic.

The catalyst monitor diagnostic is sensitive to the following conditions:

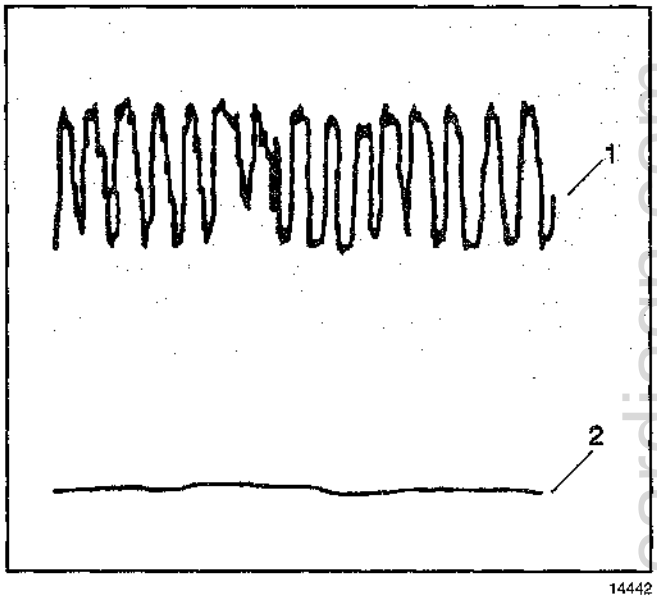
- Exhaust leaks
- HO2S Contamination
- Alternative fuels (Ethanols and Methanols)

Exhaust system leaks may cause the following:

- Prevent a degraded catalyst from failing the diagnostic
- Cause a false failure for a normally functioning catalyst
- Prevent the diagnostic from running

Some of the contaminants that may be encountered are phosphorus, lead, silica, and sulfur. The presence of any of these contaminants will reduce catalyst efficiency and lead to emission failures.

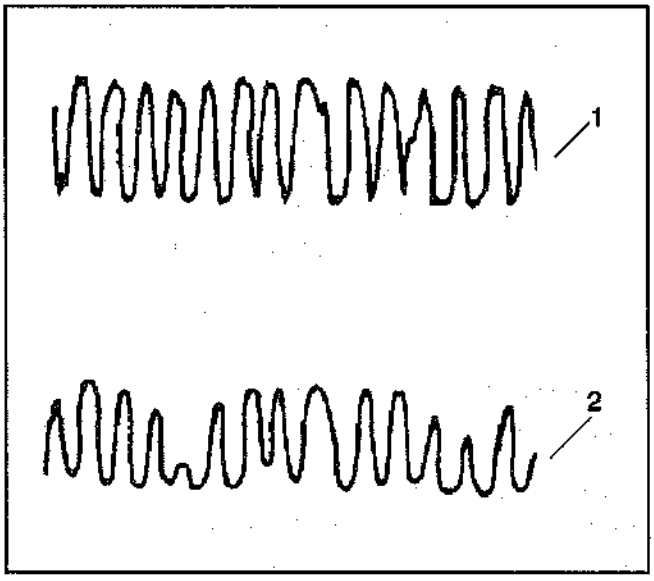
Three-Way Catalyst Oxygen Storage Capacity



14442

The PCM must monitor the Three-Way Catalyst system (TWC) for efficiency. In order to accomplish this, the PCM monitors the pre-catalyst and post-catalyst oxygen sensors. When the TWC is operating properly, the post-catalyst (2) oxygen sensor will have significantly less activity than the pre-catalyst (1) oxygen sensor. The TWC stores oxygen during its normal reduction and oxidation process. The TWC releases oxygen during its normal reduction and oxidation process. The PCM calculates the oxygen storage capacity using the difference between the pre-catalyst and post-catalyst oxygen sensor's voltage levels.

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Whenever the sensor activity of the post-catalyst (2) oxygen sensor nears the sensor activity of the pre-catalyst (1) oxygen sensor, the catalysts efficiency is degraded.

Aftermarket HO2S characteristics may be different from the original equipment manufacturer sensor. This may lead to a false pass or a false fail of the catalyst monitor diagnostic. Similarly, if an aftermarket catalyst does not contain the same amount of precious metal content as the original part, the correlation between oxygen storage and conversion efficiency may be altered enough to set a false DTC.

Misfire Monitor Diagnostic Operation

The misfire monitor diagnostic is based on crankshaft rotational velocity (reference period) variations. The PCM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the PCM can calculate when a misfire occurs.

For a non-catalyst damaging misfire, the diagnostic is required to monitor a misfire present for between 1000–3200 engine revolutions.

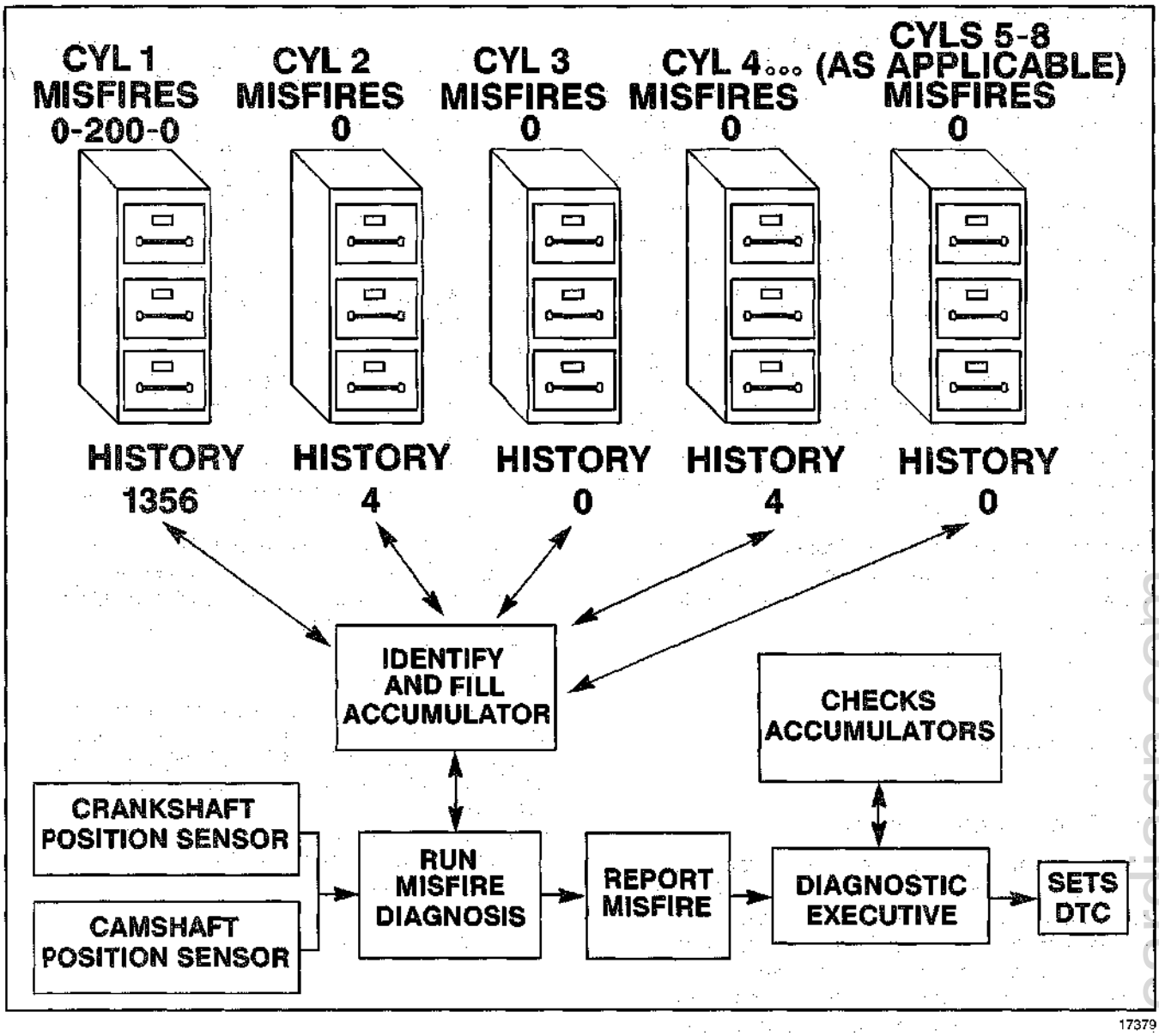
For catalyst damage misfire, the diagnostic responds to the misfire within 200 engine revolutions.

Rough roads may cause false misfire detection. A rough road applies sudden torque variations to the drive wheels and drivetrain. This torque can intermittently decrease the crankshaft rotational velocity. The ABS system detects uneven speed between the vehicles wheels and sends data via the serial data bus to the PCM to disable the misfire monitor until the rough road is no longer detected.

On automatic transmission equipped vehicles, the Torque Converter Clutch (TCC) will disable whenever a misfire is detected. Disabling the TCC isolates the engine from the rest of the drive line and minimizes the effect of the drive wheel inputs on crankshaft rotation.

When the TCC is disabled as a result of misfire detection, the TCC will re-enabled after approximately 3200 engine revolutions if no misfire is detected. The TCC remains disabled whenever the misfire is detected, with or without a DTC set. This allows the misfire diagnostic to reevaluate the system.

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Whenever a cylinder misfires, the misfire diagnostic counts the misfire and notes the crankshaft position at the time the misfire occurred.

A current and a history misfire counter is maintained for each cylinder. The misfire current counters (Misfire Cur #1 - 8) indicate the number of firing events out of the last 200 cylinder firing events which were misfires. The misfire current counters displays real time data without a misfire DTC stored. The misfire history counters (Misfire Hist #1 - 8) indicate the total number of cylinder firing events which were misfires. The misfire history counters displays 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC sets, the misfire history counters will be updated every 200 cylinder firing events. The Misfire counters graphic illustrates how these misfire counters are maintained.

When crankshaft rotation is erratic, the PCM detects a misfire condition. Because of this erratic condition, the data that is collected by the diagnostic can sometimes incorrectly identify which cylinder is misfiring. The Misfire Counters graphic shows there are misfires counted from more than one cylinder. Cylinder #1 has the majority of counted misfires. In this case, the Misfire Counters would identify cylinder #1 as the misfiring cylinder. The misfires in the other counters were just background noise caused by the erratic rotation of the crankshaft. If the number of accumulated misfires is sufficient for the diagnostic to identify a true misfire, the diagnostic will set DTC P0300 - Misfire Detected. The illustration depicts an accumulation in the history buffers.

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If two cylinders in sequential firing order are both misfiring, the first misfiring cylinder will accumulate misfires in its buffer but the second misfiring cylinder will not. This is because the PCM compares a misfiring cylinder with the cylinder 90 degrees prior to it in the firing order. Therefore the PCM would be comparing crankshaft speed of the second misfiring cylinder to an already suspect cylinder. The PCM however, will be able to detect both misfiring cylinders after the engine exceeds 2000 RPM. This is because the PCM then starts to compare misfires to the opposing cylinder rather than the previous cylinder in the firing order.

Use Techline equipment to monitor the misfire counter data on applicable vehicles. Knowing which specific cylinder(s) misfire can lead to the root cause. Using the information in the misfire counters, will identify which cylinder(s) are misfiring. If the counters indicate cylinders number 1 and 4 misfired, look for a circuit or component common to both cylinders.

The misfire diagnostic may indicate a fault due to a temporary fault not necessarily caused by a vehicle emission system malfunction. Examples include the following items:

- Contaminated fuel
- Running out of fuel
- Fuel fouled spark plugs
- Basic engine fault

Fuel Trim System Operation

The Fuel Trim system monitors the averages of short-term and long-term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the average of short and long-term fuel trim values. If either value is within the thresholds, a pass is recorded. If either value is outside the thresholds, a rich or lean fuel Trim DTC will set.

Comprehensive Component Monitor Diagnostic

Comprehensive component monitoring diagnostics are required to monitor emissions-related input and output Powertrain components.

Input Components

The PCM monitors the input components for circuit continuity and out-of-range values. This includes performance checking. Performance checking refers to indicating a fault when the signal from a sensor does not seem reasonable (i.e. a Throttle Position (TP) sensor that indicates high throttle position at low engine loads or MAP voltage). The input components may include but are not limited to the following sensors:

- The Vehicle Speed (VSS) sensor
- The Accelerator Pedal Position (APP) sensor (if so equipped)
- Mass Air Flow (MAF) sensor
- Intake Air Temperature (IAT) sensor
- Crankshaft Position (CKP) sensor
- Knock Sensor (KS)
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor
- Camshaft Position (CMP) sensor
- Manifold Absolute Pressure (MAP) sensor

In addition to the circuit continuity and rationality check, the ECT sensor is monitored for its ability to achieve a steady state temperature to enable closed loop fuel control.

Output Components

Diagnose the output components for the proper response to PCM commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out-of-range values if applicable.

Output components to be monitored include, but are not limited to the following circuits:

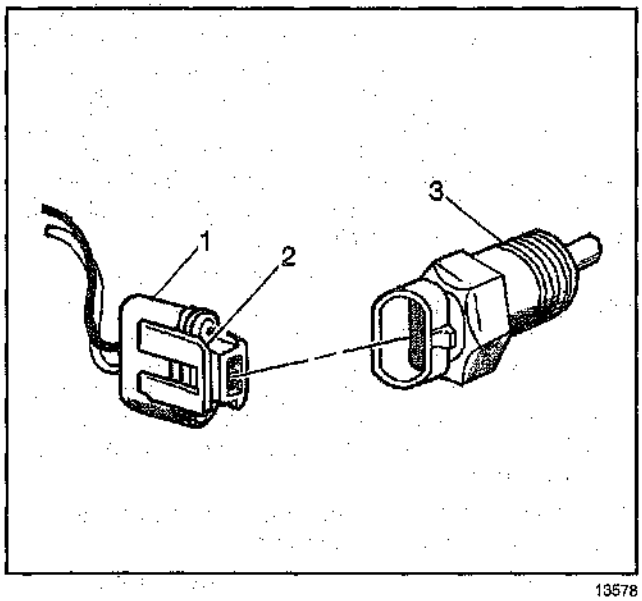
- Idle Air Control (IAC) Motor
- EVAP system
- Electronic transmission controls
- A/C relay
- Cooling fan relay
- VSS output
- MIL control
- Cruise control inhibit (if so equipped)

Information Sensors/Switches Description

All of the sensors and the input switches can be diagnosed through the use of a scan tool. The following is a short description of how the sensors and switches can be diagnosed by using a scan tool. The scan tool can also be used in order to compare the values for a normal running engine with the engine being diagnosed.

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Engine Coolant Temperature (ECT) Sensor



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Legend

(1) ECT Electrical Connector
(2) Connector Tab
(3) Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature sensor is a thermistor (a resistor which changes value based on temperature) mounted in the left cylinder head. Low coolant temperature produces a high resistance, 100,000 ohms at –38°C (–39°F), while high temperature causes low resistance, 70 ohms at 130°C (266°F).

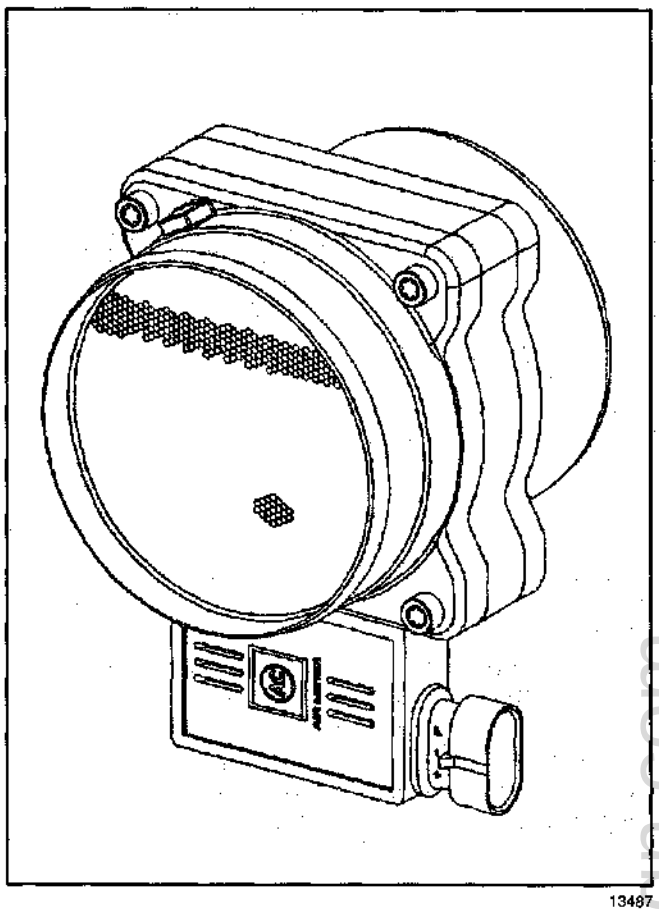
The PCM supplies a 5.0 volt signal to the engine coolant temperature sensor through a resistor in the PCM and measures the voltage. The voltage will be high when the engine is cold. The voltage will be low when the engine is hot. The PCM calculates the engine coolant temperature by measuring the voltage. The engine coolant temperature affects most systems the PCM controls.

The scan tool displays engine coolant temperature in degrees. When the engine starts the engine coolant temperature should rise steadily to about 90°C (194°F) then stabilize when the thermostat opens. The engine coolant temperature and intake air temperature parameter displays should be close to each other if the engine has not been run for several hours (overnight). The following DTCs set when the PCM detects a malfunction in the ECT sensor circuit:

- DTC P0117 ECT Sensor Circuit Low Voltage.
- DTC P0118 ECT Sensor Circuit High Voltage.
- DTC P0125 Excessive Time to Closed Loop.
- DTC P1114 ECT Sensor CKT Intermittent Low Voltage.
- DTC P1115 ECT Sensor CKT Intermittent High Voltage.

Specifications contains a table to check for sensor resistance values relative to temperature.

Mass Air Flow (MAF) Sensor



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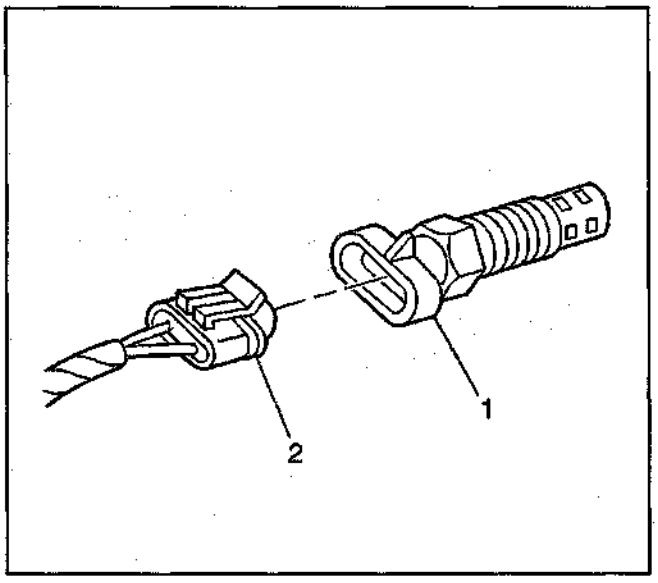
The Mass Air Flow (MAF) sensor measures the amount of air which passes through it. The PCM uses this information to determine the operating condition of the engine in order to control the fuel delivery. A large quantity of air indicates acceleration. A small quantity of air indicates deceleration or idle.

The scan tool reads the MAF value and displays it in grams per second (g/s). The MAF sensor displays between 6 – 9 g/s at idle on a fully warmed up engine. The MAF sensor values should change rather quickly on acceleration, but the MAF sensor values should remain fairly stable at any given engine speed. One or more of the following DTCs set when the PCM detects a malfunction in the MAF sensor circuit:

- DTC P0101 Mass Air Flow System Performance.
- DTC P0102 MAF Sensor Circuit Low Frequency.
- DTC P0103 MAF Sensor Circuit High Frequency.

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Intake Air Temperature (IAT) Sensor



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Legend

(1) Intake Air Temperature (IAT) Sensor
(2) Electrical Harness Connector

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 –38°C (–39°F). A high temperature causes low resistance, 70 ohms at 130°C (266°F). The PCM supplies a 5.0 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. The PCM calculates the incoming air temperature by measuring the IAT voltage. The IAT sensor signal is used to adjust spark timing according to incoming air density.

The scan tool displays the temperature of the air entering the engine, which should be close to ambient air temperature when the engine is cold. The temperature should rise as underhood temperature increases. The engine coolant temperature and intake air temperature parameter displays should be close to each other if the engine has not been run for several hours (overnight).

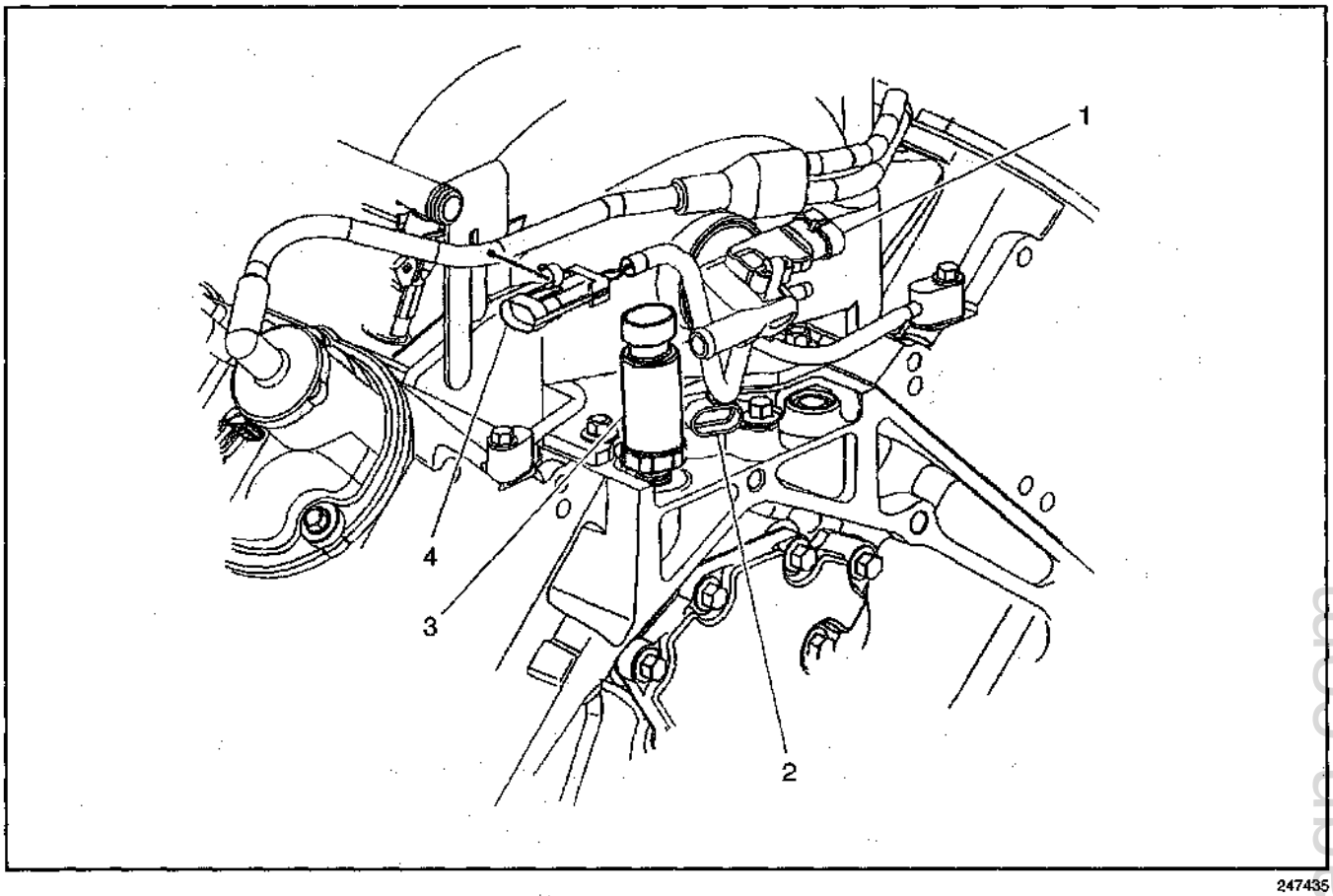
The following DTCs set when the PCM detects a malfunction in the IAT sensor circuit:

- DTC P0112 IAT Sensor Circuit Low Voltage.
- DTC P0113 IAT Sensor Circuit High Voltage.
- DTC P1111 IAT Sensor Circuit Intermittent High Voltage.
- DTC P1112 IAT Sensor Circuit Intermittent Low Voltage.

Specifications contains a table to check for sensor resistance values relative to temperature.

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Manifold Absolute Pressure (MAP) Sensor



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The Manifold Absolute Pressure (MAP) sensor (1) responds to changes in the intake manifold pressure. The pressure changes as a result of engine load and speed. The map sensor converts this to a voltage output.

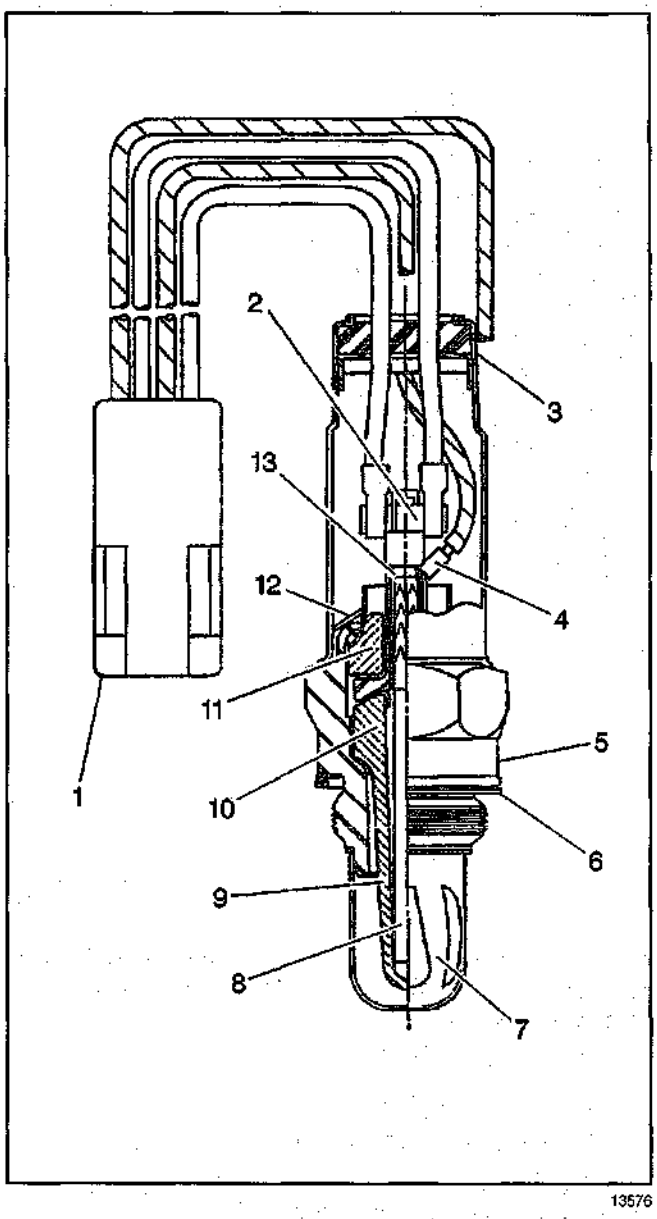
A closed throttle on engine coast down produces a relatively low MAP output voltage. A wide open throttle produces a high MAP output voltage. This high output voltage is produced because the pressure inside the manifold is the same as outside the manifold. The MAP is inversely proportional to what is measured on a vacuum gauge. The MAP sensor is used for the following:

- Altitude determination.
- Ignition timing control.
- Speed density fuel management default.

DTC P0107 MAP Sensor Circuit Low Voltage or DTC P0108 MAP Sensor Circuit High Voltage set when the PCM detects a malfunction in the MAP sensor circuit.

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Heated Oxygen Sensors (HO2S) Cutaway



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Legend

(1) Four Wire In-Line Connector
(2) Heater Termination
(3) Water Shield Assembly
(4) Sensor Lead
(5) Flat Seat Shell
(6) Seat Gasket
(7) Outer Electrode and Protective Coating
(8) Rod Heater
(9) Inner Electrode
(10) Zirconia Element
(11) Insulator
(12) Clip Ring
(13) Gripper

Front Heated Oxygen Sensors (HO2S)

The Heated Oxygen Sensors are mounted in the exhaust system 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 100 mV (high oxygen content = lean mixture) to 900 mV (low oxygen content = rich mixture). The heated oxygen sensor voltage can be monitored with a scan tool. By monitoring the voltage output of the oxygen sensor, the PCM calculates the fuel pulse width command to give to the injectors (lean mixture/low HO2S voltage = rich command, rich mixture/high HO2S voltage = lean command).

The PCM sets the following DTCs when the PCM detects an HO2S signal circuit that is low:

- DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1.
- DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1.
- DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2.
- DTC P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2.

The PCM sets the following DTCs when the PCM detects an HO2S signal circuit that is high:

- DTC P0132 HO2S Circuit High Voltage Bank 1 Sensor 1.
- DTC P0152 HO2S Circuit High Voltage Bank 2 Sensor 1.
- DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2.
- DTC P0158 HO2S Circuit High Voltage Bank 2 Sensor 2.

The PCM sets the following DTCs when the PCM detects no HO2S activity:

- DTC P0134 HO2S Insufficient Activity Bank 1 Sensor 1.
- DTC P0154 HO2S Insufficient Activity Bank 2 Sensor 1.
- DTC P0140 HO2S Insufficient Activity Bank 1 Sensor 2.
- DTC P0160 HO2S Insufficient Activity Bank 2 Sensor 2.

A fault in the heated oxygen sensor heater element or its ignition feed or ground results in an increase in time to Closed Loop fuel control. This may cause increased emissions, especially at start-up. The following DTCs set when the PCM detects a malfunction in the HO2S heater circuits:

- DTC P0135 HO2S Heater Circuit Bank 1 Sensor 1.
- DTC P0155 HO2S Heater Circuit Bank 2 Sensor 1.
- DTC P0141 HO2S Heater Circuit Bank 1 Sensor 2.
- DTC P0161 HO2S Heater Circuit Bank 2 Sensor 2.

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The PCM also has the ability to detect the following HO2S problems:

- HO2S response
- Switching
- Transition time
- Incorrect ratio voltages

The PCM stores a DTC that indicates degraded HO2S performance if any of the above is detected.

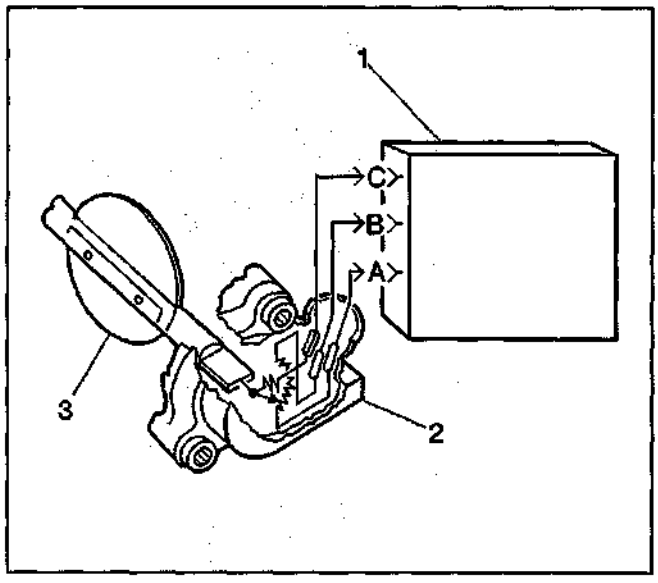
Rear Heated Oxygen Sensors (HO2S)

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 and the Bank 2 HO2S 2 heated oxygen sensors. The front HO2S sensors produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The rear HO2S sensors 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 catalyst is operating efficiently, the front sensors will produce a far more active signal than that produced by the rear sensors.

The catalyst monitor sensors operate the same as the fuel control sensors. Although the Bank 1 HO2S 2 and Bank 2 HO2S 2 sensors main function is catalyst monitoring, they also play a limited role in fuel control. If a 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.

The PCM performs the catalyst diagnostic at idle when the conditions for running the diagnostic are met. During the catalyst diagnostic the PCM captures the current rear HO2S rich/lean status. The Air Fuel ratio transitions from rich to lean or lean to rich depending on the initial captured rich/lean status. The Air Fuel ratio transitions a second time opposite the first Air Fuel ratio transition. During this diagnostic the scan tool will display HO2S voltages going from full rich to full lean. This condition is normal during this diagnostic.

Throttle Position (TP) Sensor



13572

The Throttle Position (TP) sensor (2) is a potentiometer. The TP sensor is connected to the throttle shaft (3) on the throttle body. The PCM (1) calculates throttle position by monitoring the voltage on the signal line. The TP sensor signal changes as the throttle valve angle is changed (accelerator pedal moved). The TP sensor signal voltage is low at a closed throttle position. The TP sensor signal voltage increases as the throttle valve opens so that at Wide Open Throttle (WOT), the output voltage should be above 4.0 volts.

The PCM calculates fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor may cause intermittent bursts of fuel from an injector. This may cause an unstable idle because the PCM detects the throttle is moving.

The following DTCs set when the PCM detects a malfunction with the TP sensor circuits:

- DTC P0121 TP Sensor Circuit Insufficient Activity.
- DTC P0122 TP Sensor Circuit Low Voltage.
- DTC P0123 TP Sensor Circuit High Voltage.
- DTC P1121 TP Sensor CKT Intermittent High Voltage.
- DTC P1122 TP Sensor CKT Intermittent Low Voltage.

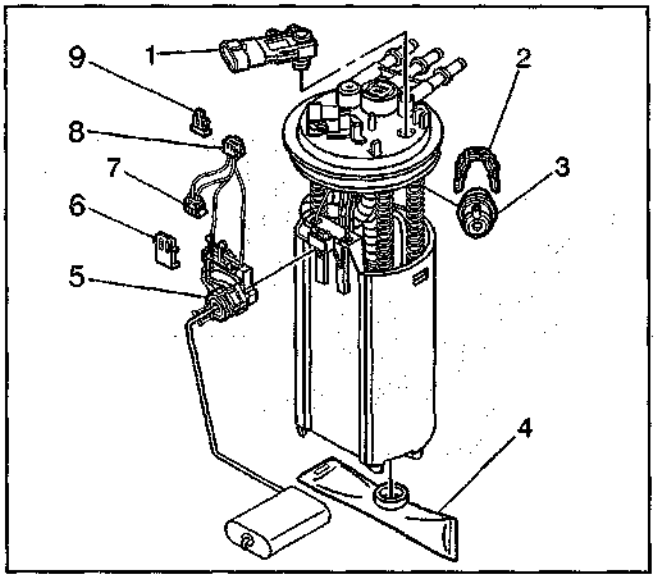
Park/Neutral Position (PNP) Switch (Automatic Transmission)

The PNP switch indicates to the PCM when the transmission is in park, neutral, or drive. This information is used for the EGR and IAC valve operation. The PNP switch is part of the neutral/start and backup light switch assembly.

Important: Idle quality will be affected if the vehicle is driven with the PNP switch disconnected. Having the switch disconnected may also cause a VSS DTC to set.

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Fuel Level Sensor



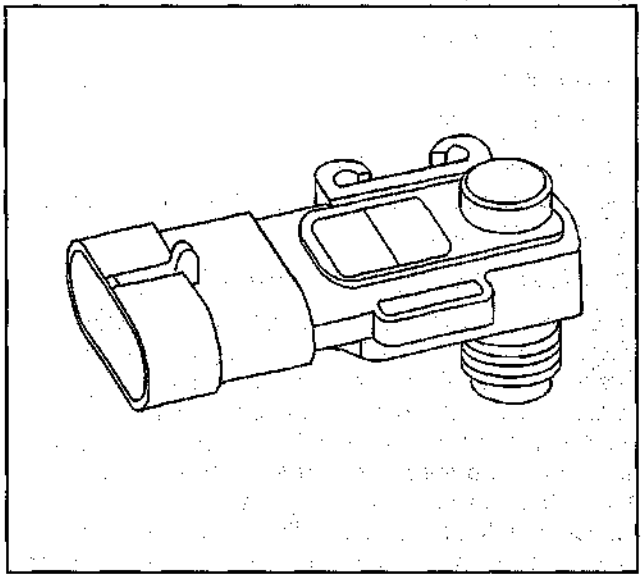
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Legend

(1) Fuel Pressure Sensor
(2) Fuel Pressure Regulator Retaining Clip
(3) Fuel Pressure Regulator
(4) Fuel Strainer
(5) Fuel Level Sensor
(6) Fuel Pump Electrical Connector Retaining Clip
(7) Fuel Pump Electrical Connector
(8) Fuel Level Sensor Electrical Connector
(9) Fuel Level Sensor Electrical Connector Retaining Clip

The PCM uses the fuel level sensor input in order to determine the amount of fuel in the fuel tank. The PCM disables the engine misfire diagnostic when the fuel level is too low and the EVAP system diagnostic when the fuel level is either too high or too low. The PCM also controls the fuel gauge based on the fuel level input.

Fuel Tank Pressure Sensor

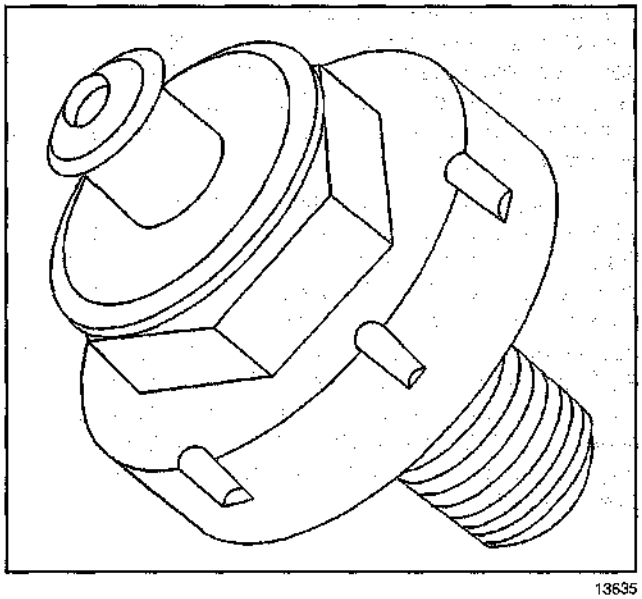


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The Fuel Tank Pressure sensor is a sensor much like the MAP sensor. The Fuel Tank Pressure sensor measures the difference between the outside air pressure and the air pressure (or vacuum) in the fuel tank.

The Fuel Tank Pressure sensor mounts to the fuel tank sending unit. A three wire electrical harness connects the sensor to the PCM. The PCM supplies a 5.0 volt reference voltage and a ground to the sensor. The sensor will return a voltage between 0.1 and 4.9 volts on the signal circuit.

Knock Sensors (KS)



13635

A Knock Sensor (KS) system is used in order to control spark knock. The KS system is designed to retard spark timing up to 20 degrees in order to reduce spark knock in the engine. This allows the engine to use maximum spark advance to improve driveability and fuel economy.

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The knock sensor system is used to detect engine detonation. The knock sensors produce an AC voltage which is sent to the PCM. The PCM retards the spark timing based on signals from the KS sensors. The amount of AC voltage produced by the sensors is determined by the amount of knock. The PCM then adjusts the Ignition Control (IC) to reduce the spark knock.

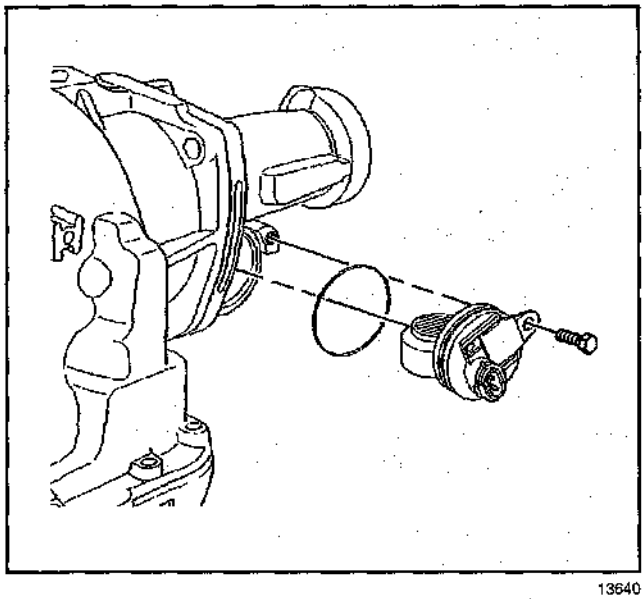
A/C Request Signal

The A/C request circuit signals the PCM when an A/C mode is selected at the A/C control head. The PCM uses this information in order to enable the A/C compressor clutch and to adjust the idle speed before turning ON the A/C clutch. The PCM disables the A/C compressor clutch if the A/C request signal is not available to the PCM.

A/C Refrigerant Pressure Sensor

This signal is used by the PCM in order to control the cycling of the compressor. It will also enable the cooling fans when the A/C compressor head pressure reaches a predetermined value. DTC P0530 sets if a fault is present in the A/C refrigerant pressure sensor circuit. The PCM disables the A/C compressor clutch when the PCM sets an A/C system DTC.

Vehicle Speed Sensor (VSS)



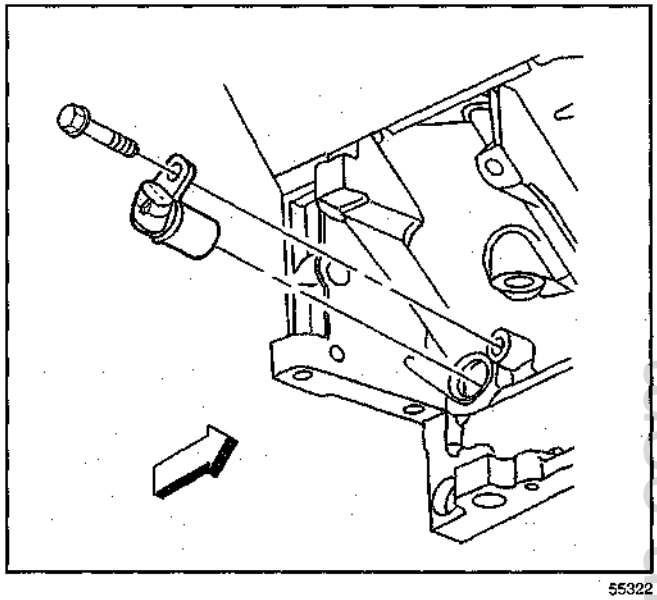
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The Vehicle Speed Sensor (VSS) is a pulse counter type input that informs the PCM how fast the vehicle is traveling. The VSS system uses an inductive sensor mounted in the tail housing of the transmission and a toothed reluctor wheel on the tail shaft. The teeth of the reluctor wheel alternately interfere with the magnetic field of the sensor creating an induced voltage pulse as the reluctor rotates.

The VSS produces an AC voltage signal that increases with vehicle speed. The PCM processes this signal and sends it to the following components:

- Instrument Panel
- Radio control head
- Chime Module
- Cruise Control Module

Crankshaft Position Sensor (CKP)



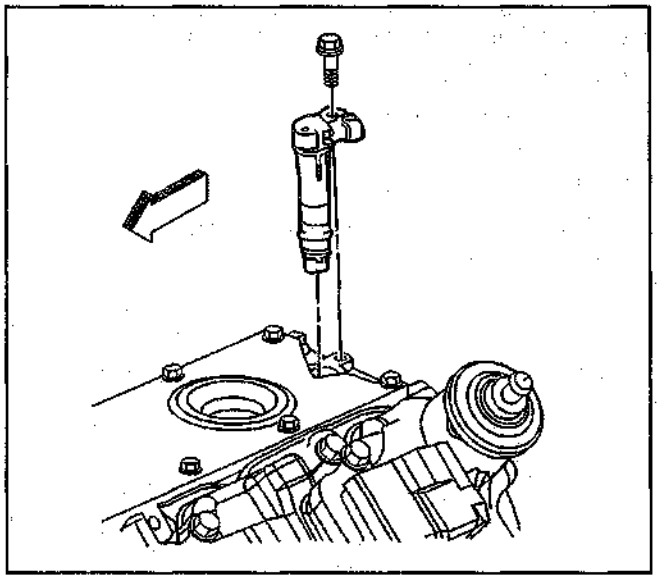
55322

The crankshaft position sensor provides the PCM with crankshaft speed and crankshaft position. The PCM utilizes this information in order to determine if an engine misfire is present. The PCM monitors the CKP sensor for momentarily drop in crankshaft speed in order to determine if a misfire is occurring. A DTC P0300 sets when the PCM detects a misfire.

The PCM also monitors the CKP sensor signal circuit for malfunctions. The PCM sets a DTC P0335 or a DTC P0336 when the CKP sensor is out of the normal operating range.

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Camshaft Position Sensor (CMP)



55308

The Camshaft Position sensor is mounted through the top of the engine block at the rear of the valley cover and works in conjunction with a 1X reluctor wheel on the camshaft. The reluctor wheel is inside the engine immediately in front of the rear cam bearing. The PCM provides a 12 volt power supply to the CMP sensor as well as a ground and a signal circuit.

The PCM uses the Camshaft Position sensor in order to determine whether a cylinder is on a firing or exhaust stroke. The reluctor wheel interrupts a magnetic field produced by a magnet within the CMP sensor as the camshaft rotates. The CMP sensor's internal circuitry detects this and produces a signal which is the PCM reads. The PCM uses this 1X signal in combination with the Crankshaft Position sensor 24X signal in order to determine the crankshaft position and stroke. This diagnostic for the Camshaft Position sensor checks for a loss of Camshaft Position sensor signal. The PCM also monitors the CMP sensor signal circuit for malfunctions. The following DTCs set when the PCM detects a CMP sensor that is out of the normal operating range.

- DTC P0341 Camshaft Position Sensor (CMP) Circuit Performance.
- DTC P0342 Camshaft Position Sensor (CMP) Circuit Low Voltage.
- DTC P0343 Camshaft Position Sensor (CMP) Circuit High Voltage.

PCM Controlled Air Conditioning Description

In order to improve engine operation, and protect the A/C compressor and A/C clutch during Wide Open Throttle (WOT) performance, the A/C compressor operation is controlled by the PCM.

This A/C system consists of the following components:

- The heater and A/C control
- The A/C refrigerant pressure sensor
- The A/C clutch relay
- The A/C compressor clutch
- The PCM

When the heater and A/C control is placed in the A/C mode, a request signal is sent to the PCM. The PCM then energizes the A/C clutch relay, unless abnormally high or low A/C pressure is detected by the A/C refrigerant pressure sensor. The PCM also turns the cooling fans ON when A/C is requested. The A/C clutch relay is controlled by the PCM so that the PCM can increase idle speed before turning ON the A/C compressor clutch or disable the A/C compressor clutch during WOT, or high coolant temperature.

The PCM energizes the A/C clutch whenever the engine is running less than 3950 RPM and A/C has been requested. The PCM will not energize the A/C clutch whenever any of the following conditions are present:

- Throttle Angle greater than 86 percent.
- A/C head pressure greater than 414 psi or less than 0 psi (as determined by the A/C refrigerant pressure sensor). The PCM re-enables the A/C system when the A/C high side pressure is less than 249 psi.
- Ignition voltage less than 10 volts.
- Engine speed greater than 4294 RPM.
- ECT greater than 125°C (257°F). The PCM re-enables the A/C at 121°C (250°F).

The scan tool is used in diagnosing the A/C system. The PCM has the ability to display the following parameters:

- A/C request input to the PCM
- A/C compressor status
- A/C system refrigerant pressure
- A/C clutch ON or OFF status

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Engine Cooling Fan Description - Electric

The electric cooling fans are used to cool engine coolant flowing through the radiator. The fans are also used to cool the refrigerant flowing through the A/C condenser.

The electric cooling fans are controlled by the PCM. The PCM controls the ground path for the three cooling fan relays. The relays are used to control the high current flow to power the cooling fan motors. Both fans operate together. When minimum cooling is required, the PCM energizes cooling fan relay #1 and both fans operate at low speed, since the fans are connected in series through cooling fan relay #3. Cooling fan relay #2 is open (not energized) and is not used for low speed operation of the fans. When maximum cooling is required, the PCM energizes all three cooling fan relays. The left fan is still powered through cooling fan relay #1, but is now grounded through cooling fan relay #3. The right fan is now powered directly through cooling fan relay #2 and both fans operated at high speed.

The PCM will also enable the cooling fans after the ignition is turned off. When the engine coolant temperature exceeds 113°C (235°F) and the ignition is turned off, the cooling fans will be enabled on low speed for 150 seconds.

Low Speed Cooling Fans

The low speed cooling fans are controlled by the PCM based on the following inputs:

- The A/C system.
- The Engine Coolant Temperature (ECT) sensor.
- The Vehicle Speed Sensor (VSS).

The PCM will turn the cooling fans on low speed when any of the following conditions exist at idle:

- Certain PCM Diagnostic Trouble Codes (DTCs) are set.
- The ECT above 108°C (226°F).
- The A/C high side pressure above 215 psi.

Once the low speed fans are turned ON by Engine Coolant Temperature, the PCM will turn the fans OFF when that temperature has dropped about 4°C (7°F). If the low speed cooling fans are turned ON by high A/C head pressure, the PCM will turn the fans OFF when the pressure has dropped to 190 psi. The minimum ON time for the low speed cooling fans is 50 seconds.

The cooling fans are turned OFF at certain vehicle speeds. Adequate airflow through the A/C condenser and radiator occurs with vehicle movement to properly cool the A/C refrigerant and engine coolant without the assistance of the cooling fans.

High Speed Cooling Fans

The High Speed Cooling Fans are controlled by the PCM based on the following inputs:

- The A/C system.
- The Engine Coolant Temperature (ECT) sensor.
- The Vehicle Speed Sensor (VSS).

The PCM will enable both fans on high speed when any of the following conditions exist:

- Certain PCM Diagnostic Trouble Codes (DTCs) set.
- The ECT above 112°C (234°F).
- The A/C high side pressure above 248 psi.

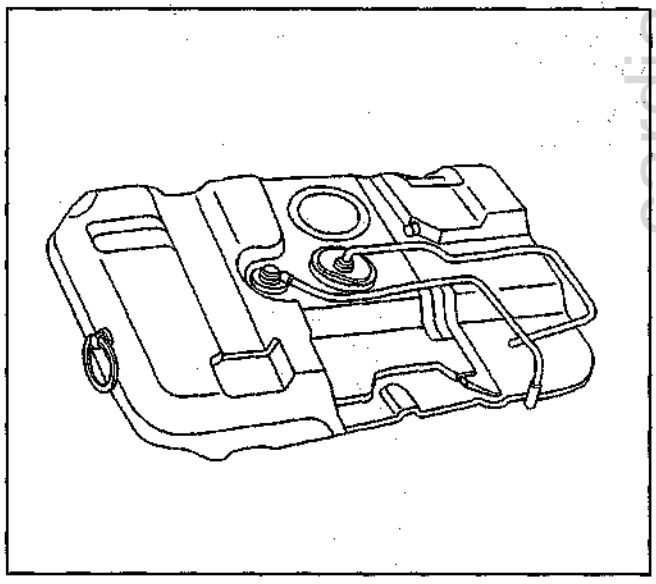
Once the high speed cooling fans are turned ON by the Engine coolant temperature, the PCM will turn the fans OFF when that temperature has dropped about 4°C (7°F). If the high speed cooling fans are turned ON by high A/C head pressure, the PCM will turn the fans OFF when the pressure has dropped to 208 psi. The minimum ON time for the high speed cooling fans is 30 seconds.

Fuel Supply Component Description

System Overview

The fuel tank stores the fuel supply. An electric fuel pump, located in the fuel tank with the fuel sender assembly, pumps fuel through an in-line fuel filter to the fuel rail assembly. The pump provides fuel at a pressure greater than is needed by the injectors. The fuel pressure regulator, part of the fuel sender assembly, keeps fuel available to the injectors at a regulated pressure. A separate pipe returns unused fuel to the fuel tank.

Fuel Tank



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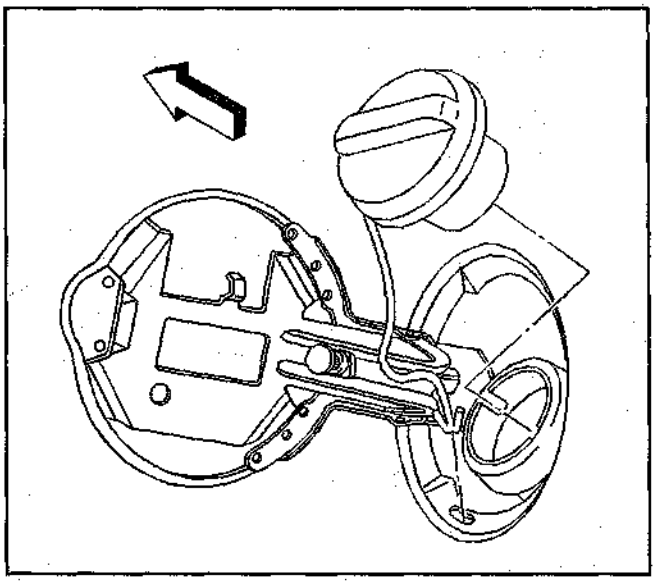
The fuel tank stores the fuel supply. The fuel tank is located in the rear of the vehicle. The fuel tank is held in place by two metal straps that attach to the frame. The fuel tank is molded from high density polyethylene.

Fuel Tank Filler Pipe

The fuel tank filler pipe has a built-in restrictor and deflector in order to prevent refueling with leaded fuel.

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Fuel Filler Cap

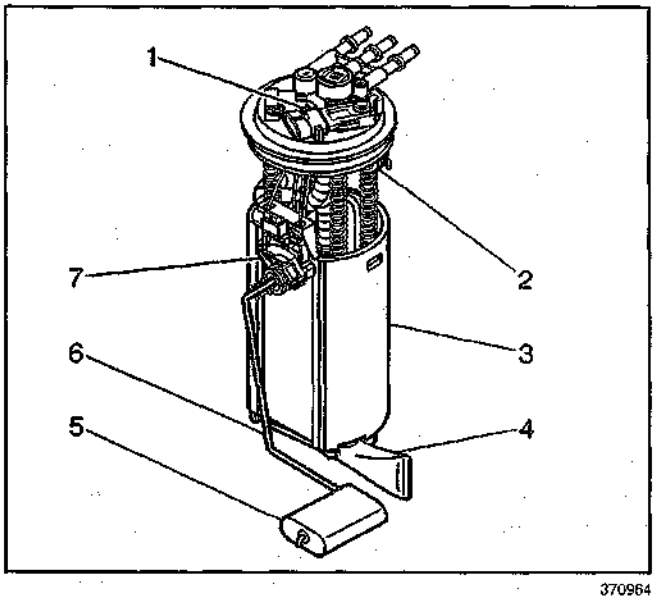


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Notice: If a fuel tank filler cap requires replacement, use only a fuel tank filler cap with the same features. Failure to use the correct fuel tank filler cap can result in a serious malfunction of the fuel and EVAP system.

The fuel tank filler pipe has a tethered fuel filler cap. The cap requires a quarter of a turn to remove it. A torque-limiting device prevents the cap from being over tightened. To install the cap, turn the cap clockwise until you hear three audible clicks. This indicates that the cap is correctly torqued and fully seated.

Fuel Sender Assembly

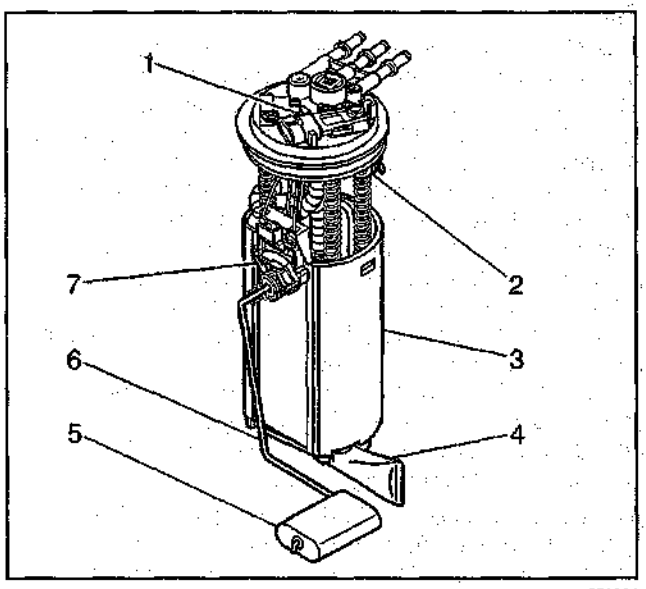


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The fuel sender assembly is inside the fuel tank attached to the top of the fuel tank. The fuel sender assembly consists of the following major components:

- The fuel level sensor (7).
- The fuel tank pressure sensor (1).
- The fuel pump and reservoir assembly (3).
- The fuel pressure regulator (2).
- The fuel pump strainer (4).

Fuel Sender



370964

The fuel sender consists of a float (5), a wire float arm (6), and a fuel level sensor (7). The position of the float arm indicates the fuel level and a signal is sent to the display in the vehicle instrument cluster. The EVAP pipe of the fuel sender has a pressed in roll-over valve. The roll-over valve prevents fuel from entering the evaporative emission canister if the vehicle rolls over by shutting OFF the EVAP pipe to the canister.

Fuel Pump

The fuel pump is mounted inside the fuel reservoir on the fuel sender. The fuel pump is an electric high pressure gerotor pump. The fuel pump pumps fuel to the fuel rail assembly at a specified flow and pressure. Excess fuel returns to the fuel tank by the return pipe. The fuel pump delivers a constant flow of fuel to the engine even during low fuel conditions and aggressive vehicle maneuvers. The PCM controls the electric fuel pump operation through a fuel pump relay. The fuel pump flex pipe acts to dampen the fuel pulses and noise generated by the fuel pump.

Fuel Pressure Regulator Assembly

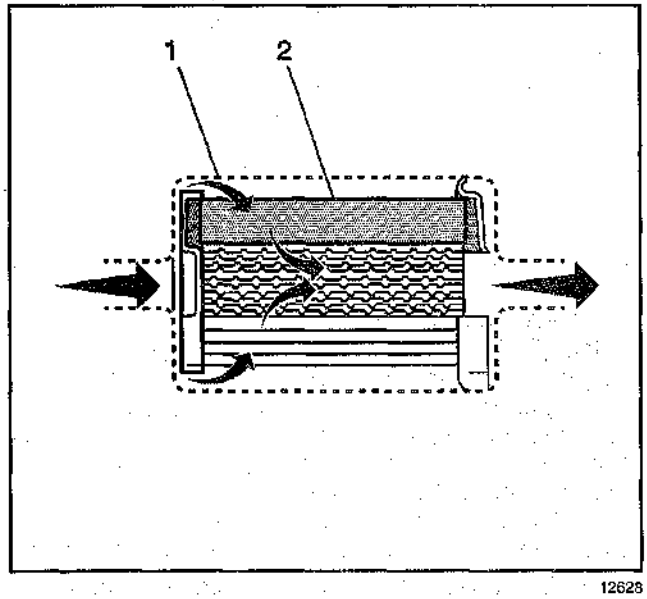
The fuel pressure regulator attaches to the fuel return pipe on the fuel sender assembly. The fuel pressure regulator is a diaphragm operated relief valve. A software bias compensates the injector on-time because the fuel pressure regulator is not referenced to manifold vacuum. The injector pulse width varies with the signal from the MAP sensor. With the ignition ON and the engine OFF, system fuel pressure at the pressure test connection should be 380–410 kPa (55–60 psi). If the pressure is too low, poor performance could result. If the pressure is too high, excessive odor and a Diagnostic Trouble Code (DTC) P0132, P0152, P0172 or P0175 may result. Refer to *Fuel System Diagnosis* for information on diagnosing fuel pressure conditions.

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Fuel Pump Strainer

The fuel pump strainer attaches to the lower end of the fuel pump and reservoir assembly. The fuel pump strainer is made of woven plastic. The functions of the fuel pump strainer are to filter contaminants and to wick fuel. The fuel pump strainer 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. Clean the fuel tank and replace a plugged fuel pump strainer with a new one.

In-Line Fuel Filter



12628

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 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 T-connector located on the outlet side of the fuel filter back to the fuel tank. The fuel 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. The chassis fuel feed pipe connects the rear fuel feed pipe to the engine compartment connecting fuel feed pipe. The chassis fuel return pipe connects the fuel feed pipe at the outlet of the fuel filter to the rear fuel return pipe. These pipes are constructed of steel.
- The engine compartment connecting fuel pipe connects the chassis fuel feed pipe to the engine fuel rail. This fuel pipe is 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 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. 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.

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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.

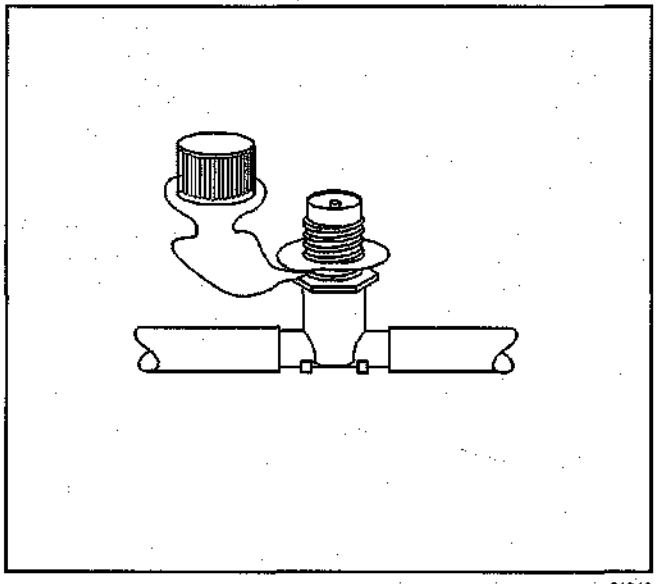
Fuel Pipe O-Rings

O-rings seal the threaded connections in the fuel system. Fuel system O-ring seals are made of special material. Service the O-ring seals with the correct service part.

EVAP Pipes and Hoses

The EVAP pipes extend from the fuel sender assembly and the EVAP canister vent solenoid to the EVAP canister. These pipes are located on top of the fuel tank. The EVAP purge pipe extends from the EVAP canister on top of the fuel tank to the EVAP purge solenoid in the engine compartment. The rear pipes and the engine compartment pipe are constructed of nylon. The chassis EVAP purge pipe is constructed of steel. The EVAP canister vent solenoid connects to the EVAP canister with a section of rubber hose.

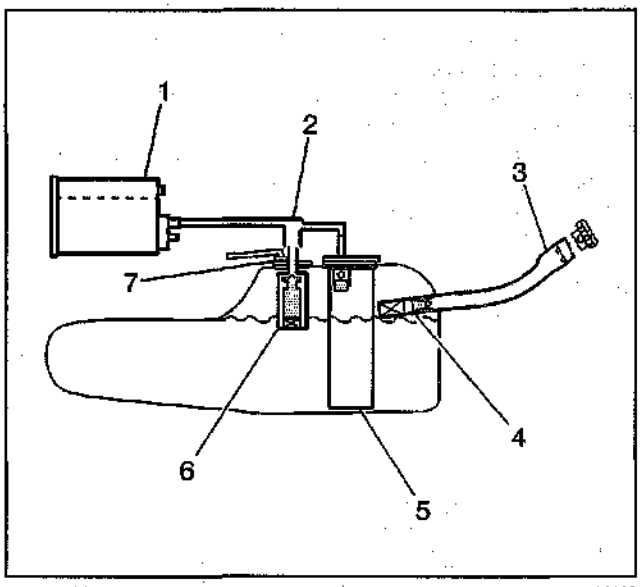
Enhanced Evaporative Emission (EVAP) Service Port



21046

The enhanced EVAP service port is located in the EVAP pipe in the engine compartment near the purge solenoid. The service port is identified by a green colored cap. The port contains a schrader valve and a fitting to allow the connection of the *J 41413* EVAP Pressure/Purge Diagnostic Station for diagnosis of the evaporative emission system.

On-Board Refueling Vapor Recovery System (ORVR)



178033

The On-Board Refueling Vapor Recovery System (ORVR) is an on board vehicle system designed to recover fuel vapors during the vehicle refueling operation. The flow of liquid fuel down the fuel filler pipe provides a liquid seal which prevents vapor from leaving the fuel filler pipe. An EVAP pipe transports the fuel vapor to the EVAP canister for use by the engine. Listed below are the ORVR system components with a brief description of their operation:

- EVAP Canister (1) — the EVAP canister receives refueling vapor from the fuel system, stores the vapor and releases the vapor to the engine upon demand.
- EVAP Pipes (2) — transports fuel vapor from the fuel tank to the EVAP canister.
- Fuel Filler Pipe (3) — the pipe which carries fuel from the fuel nozzle to the fuel tank.
- Check Valve (4) — the check valve limits fuel "spit back" from the fuel tank during the refueling operation by allowing fuel flow only into the fuel tank. This check valve is located at the bottom of the fuel filler pipe.
- Modular Fuel Sender Assembly (5) — this assembly pumps fuel to the engine from the fuel tank.

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- Fill Limiter Vent Valve (FLVV) (6) — this valve acts as a shut off valve. The FLVV is located on the top of the fuel tank. This valve is not serviced separately. The FLVV has the following functions:
  - Controls the fuel tank fill level by closing the primary vent from the fuel tank.
  - Prevents fuel from exiting the fuel tank via the EVAP pipe to the canister.
  - Provides fuel-spillage protection in the event of a vehicle rollover by closing the vapor path from the tank to the EVAP canister.
- Over Pressure Relief Valve (7) — the over pressure relief valve provides venting of excessive fuel tank pressure. The valve is located on top of the fuel tank next to the FLVV. This valve is not serviced separately.

Fuel Metering Modes of Operation

Modes of Operation

The PCM looks at voltages from several sensors to determine how much fuel to give the engine. The fuel is delivered under one of several conditions called modes. The PCM controls all modes.

Starting Mode

With the ignition switch in the ON position (before engaging the starter), the PCM energizes the fuel pump relay for two seconds allowing the fuel pump to build up pressure. The PCM first checks speed density, then switches to the Mass Air Flow (MAF) sensor. The PCM also uses the Engine Coolant Temperature (ECT), Throttle Position (TP), and Manifold Absolute Pressure (MAP) sensors to delermine the proper air/fuel ratio for starting. This ranges from 1.5:1 at -36°C (-33°F) to 14.7:1 at 94°C (201°F) running temperature. The PCM controls the amount of fuel delivered in the starting mode by changing the pulse width of the injectors. This is done by pulsing the injectors for very short times.

Clear Flood Mode

If the engine floods, clear the engine by pushing the accelerator pedal down all the way. The PCM then pulses the injectors at an air/fuel ratio of 20:1. The PCM holds this injector rate as long as the throttle stays wide open and the engine speed is below 300 RPM. If the throttle position becomes less than 80 percent, the PCM returns to the starting mode.

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 a predetermined RPM, the system begins Open Loop operation. The PCM ignores the signal from the HO2S and calculates the air/fuel ratio based on inputs from the ECT, MAF, MAP, and TP sensors. The system stays in Open Loop until meeting the following conditions:

- Both HO2S have varying voltage output, showing that they are hot enough to operate properly. (This depends on temperature.)
- The ECT sensor is above a specified temperature.
- A specific amount of time has elapsed after starting the engine.

Specific values for the above conditions exist for each different engine, and are stored in the Electrically Erasable Programmable Read Only Memory (EEPROM). The system begins Closed Loop operation after reaching these values. In Closed Loop, the PCM calculates the air/fuel ratio (injector on-time) based on the signal from various sensors, but mainly the HO2S. This allows the air/fuel ratio to stay very close to 14.7:1.

Acceleration Mode

When the driver pushes on the accelerator pedal, air flow into the cylinders increases rapidly, while fuel flow tends to lag behind. To prevent possible hesitation, the PCM increases the pulse width to the injectors to provide extra fuel during acceleration. The PCM determines the amount of fuel required based on throttle position, coolant temperature, manifold air pressure, mass air flow and engine speed.

Deceleration Mode

When the driver releases the accelerator pedal, air flow into the engine is reduced. The PCM looks at the corresponding changes in throttle position, manifold air pressure and mass air flow. The PCM shuts OFF fuel completely if the deceleration is very rapid, or for long periods (such as long closed throttle coast-down). The fuel shuts OFF in order to protect the warm-up three-way catalytic converters.

Battery Voltage Correction Mode

When battery voltage is low, the PCM compensates for the weak spark delivered by the ignition system in the following ways:

- Increasing the amount of fuel delivered.
- Increasing the idle RPM.
- Increasing ignition dwell time.

Fuel Cutoff Mode

To prevent possible engine damage from over-speed, the PCM cuts off fuel from the injectors when the engine speed is above approximately 5800 RPM. Also, see Rapid Deceleration in Deceleration Mode.

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Fuel Metering System Component Description

The fuel metering system consists of the following parts:

- The fuel supply components (fuel tank, pump, pipes).
- The fuel pump electrical circuit.
- The fuel rail.
- The fuel injectors.
- The fuel pressure regulator.
- The throttle body.
- The Idle Air Control (IAC) valve.
- The Throttle Position (TP) sensor.

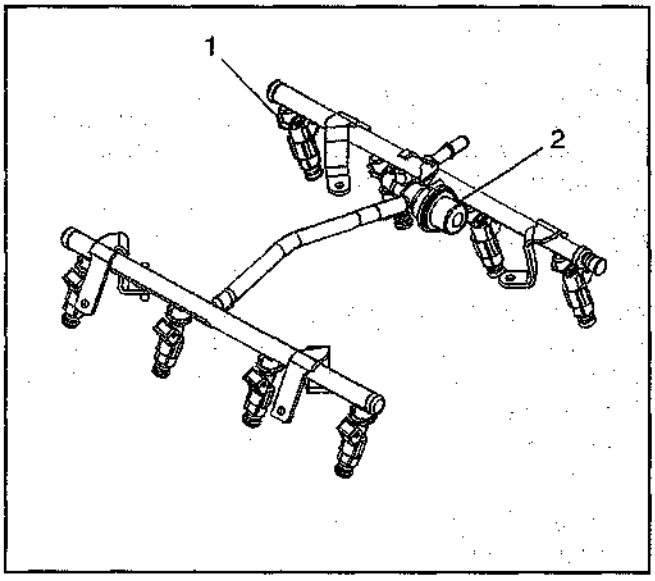
System Overview

The fuel tank stores the fuel supply. An electric fuel pump, located in the fuel tank with the fuel sender assembly, pumps fuel through an in-line fuel filter to the fuel rail assembly. The pump provides fuel at a pressure greater than is needed by the injectors. The fuel pressure regulator, part of the fuel sender assembly, keeps fuel available to the injectors at a regulated pressure. A separate pipe returns unused fuel to the fuel tank.

Fuel Pump Electrical Circuit

When the ignition switch is in the ON position (before engaging the starter), the PCM energizes the fuel pump relay for two seconds, causing the fuel pump to pressurize the fuel system. If the PCM does not receive ignition reference pulses (engine cranking or running) within two seconds, it shuts OFF the fuel pump relay, causing the fuel pump to stop.

Fuel Rail Assembly



217109

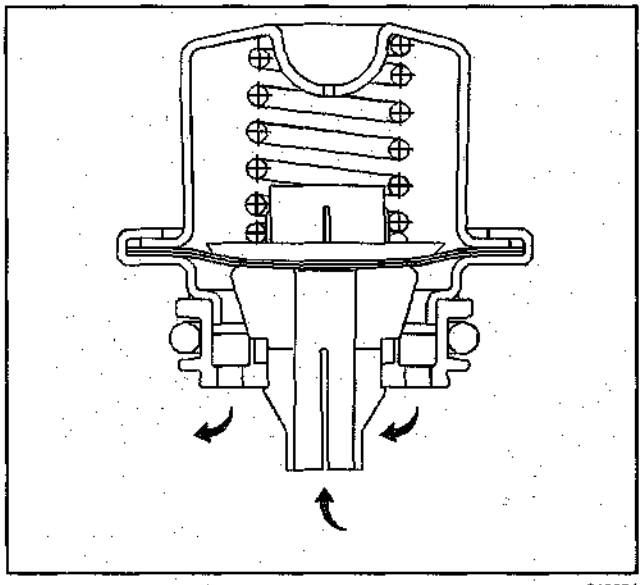
The fuel rail assembly attaches to the engine intake manifold. The fuel rail assembly performs the following functions:

- It positions the injectors (1) in the intake manifold.
- It distributes fuel evenly to the injectors.
- It integrates the fuel pulse dampener (2) into the fuel metering system.

Fuel Injectors

The top-feed fuel injector assembly is a solenoid operated device, controlled by the PCM, that meters pressurized fuel to a single engine cylinder. The PCM energizes the injector solenoid, which opens a ball valve, allowing fuel to flow past the ball valve, and through a recessed flow director plate. The director plate has multiple machined holes that control the fuel flow, generating a conical spray pattern of finely atomized fuel at the injector tip. Fuel is directed at the intake valve, causing it to become further atomized and vaporized before entering the combustion chamber. An injector stuck partly open can cause a loss of pressure after engine shutdown. Consequently, long cranking times would be noticed on some engines.

Fuel Pulse Dampener



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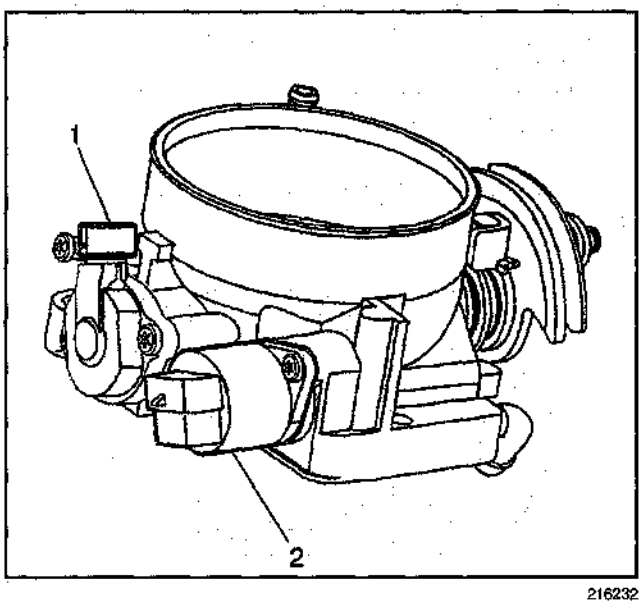
The fuel pulse dampener attaches inside a housing on the fuel rail assembly. The fuel pulse dampener is diaphragm operated, with fuel pump pressure on one side and spring pressure on the other side. The function of the dampener is to dampen fuel pulsation.

Accelerator Controls

The accelerator control system is cable operated. There are no linkage adjustments, therefore use the specific cable for each application.

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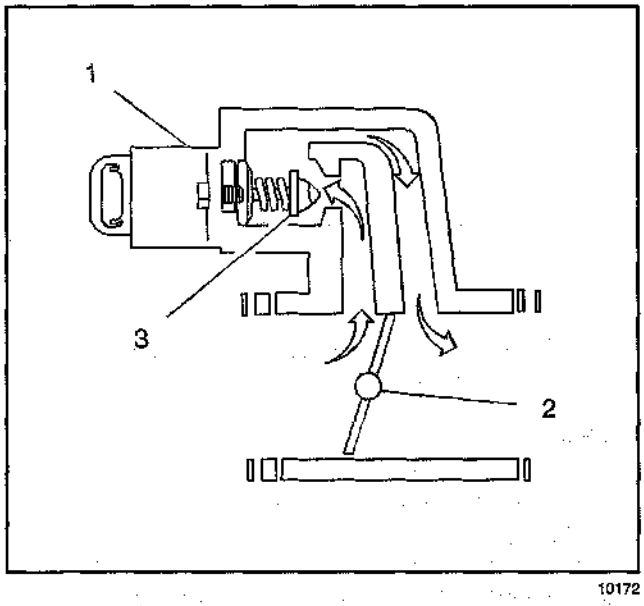
Throttle Body Assembly



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The throttle body assembly attaches to the intake manifold. The throttle body controls air flow into the engine, thereby controlling engine output. The vehicle operator opens the throttle valve within the throttle body through the accelerator controls. During engine idle, the throttle valves are almost closed. A fixed air bypass orifice and the Idle Air Control (IAC) valve (2) handle the air flow control. Engine coolant flows through the coolant cavity on the bottom of the throttle body in order to prevent throttle valve icing during cool weather operation. The throttle body also provides the location for mounting the Throttle Position (TP) sensor (1).

Idle Air Control (IAC) Valve



10172

The purpose of the IAC valve is to control engine idle speed, while preventing stalls due to changes in engine load. The IAC valve (1), mounted in the throttle body, controls the bypass air around the throttle valve (2). By moving a conical valve known as a pintle (3), in, towards the seat (to decrease air flow); or out, away from the seat (to increase air flow), a controlled amount of air can be bypassed. If engine speed is too low, more air is bypassed to increase RPM. If engine speed is too high, less air is bypassed to decrease RPM. The PCM moves the IAC valve in small steps, called counts. These can be measured and displayed by a scan tool, which plugs into the Data Link Connector (DLC). The PCM calculates the proper position of the IAC valve during idle based on battery voltage, coolant temperature, engine load, and engine RPM. If the RPM drops below specification and the throttle valve is closed, the PCM senses a near stall condition and calculates a new valve position in order to prevent stalling.

- Engine idle speed is a function of total air flow into the engine. Idle speed is based on IAC valve pintle position + crankcase ventilation valve flow + throttle valve opening + bypass orifice air flow + calibrated vacuum loss through accessories.
- Controlled idle speed is programmed into the PCM, which determines the correct IAC valve pintle position to maintain the desired idle speed for all engine operating conditions and loads.
- The minimum idle air rate is set at the factory with a stop screw. This setting allows enough air flow by the throttle valves to cause the IAC valve pintle to be positioned a calibrated number of steps (counts), from the seat, during controlled idle operation.
- If the IAC valve is disconnected and reconnected with the engine running, the idle speed may be wrong. If this occurs, reset the IAC valve by depressing the accelerator pedal slightly, start and run the engine for five seconds, then turn the ignition OFF for ten seconds.

Throttle Position (TP) Sensor

The TP sensor attaches to the side of the throttle body opposite the throttle lever. It senses the throttle valve angle and relays that information to the PCM. The PCM requires knowledge of throttle angle to generate the required injector control signals (pulses).

Short Term Fuel Trim Description

The short term fuel trim (FT) is a PCM erasable memory register. The neutral value for the short term FT is 0 percent. Any deviation from 0 percent indicates the short term FT 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 percent. The short term FT is rich when the scan tool indicates a negative number. The short FT is lean when the scan tool indicates a number greater than 0. The short term FT changes the injector pulse width by adding to or subtracting from the base pulse width equation. As the PCM monitors the oxygen sensors input, it is constantly varying the short term FT value. The value is updated very quickly, therefore the short term FT only corrects for short term mixture trends. The correction of long term mixture trends is the function of long term FT.

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When the PCM determines that the short term FT is out of the operating range, 1 of the following DTCs will set:

- DTC P0171 FT System Lean Bank 1
- DTC P0172 FT System Rich Bank 1
- DTC P0174 FT System Lean Bank 2
- DTC P0175 FT System Rich Bank 2

Long Term Fuel Trim Description

The long term fuel trim (FT) is a matrix of cells arranged by RPM and MAP. Each cell of the long term FT is a register like the short term FT. As the engine operating conditions change, the PCM will switch from cell to cell to determine what long term FT factor to use in the base pulse width equation.

While in any given cell, the PCM also monitors the short term FT. If the short term FT is far enough from 0 percent, the PCM will change the long term FT value. Once the long term FT value is changed, it should force the short term FT back toward 0 percent. If the mixture is still not correct (as judged by the PCM), the short term FT will continue to have a large deviation from the ideal 0 percent. In this case, the long term FT value will continue to change until the short term FT becomes balanced. Both the short term FT and long term FT have limits which vary by calibration. If the mixture is off enough so that long term FT reaches the limit of its control and still cannot correct the condition, the short term FT would also go to its limit of control in the same direction. If the mixture is still not corrected by both short term FT and long term FT at their extreme values, a FT DTC will likely result. When the PCM determines that the long term FT is out of the operating range, the following DTCs will set:

- DTC P0171 FT System Lean Bank 1
- DTC P0172 FT System Rich Bank 1
- DTC P0174 FT System Lean Bank 2
- DTC P0175 FT System Rich Bank 2

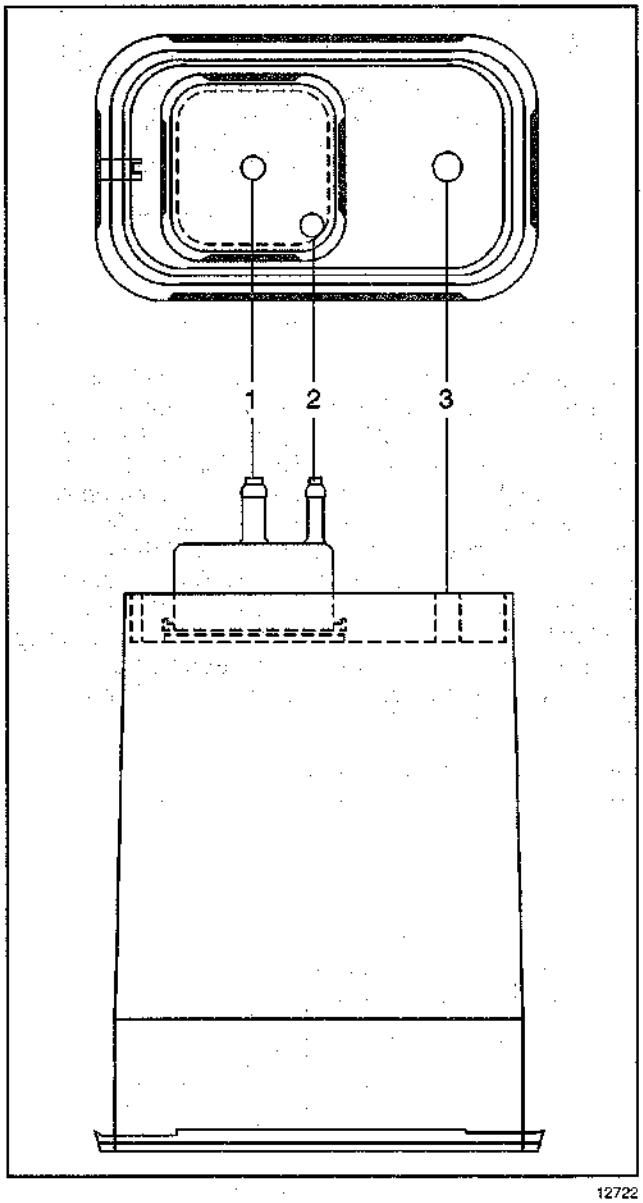
Under the conditions of power enrichment, the PCM sets the short term FT to 0 percent and freezes it there until power enrichment is no longer in effect. This is done so the Closed Loop factor and the long term FT will not try to correct for the commanded richness of power enrichment.

Speed Density System Description

The speed density system is only needed when there is a mass air flow (MAF) sensor malfunction. If the PCM detects a malfunction with the MAF sensor circuit, the PCM will default to speed density fuel management.

Three sensors provide the PCM with the basic information for the fuel management portion of its operation. That is, 3 specific signals to the PCM establish the engine speed and air density factors. The engine speed signal comes from the ignition system. Air density is derived from IAT and MAP sensor inputs. The IAT sensor measures the air temperature that is entering the engine. The IAT signal works in conjunction with the MAP sensor to determine air density. As the intake manifold pressure increases, the air density in the intake manifold also increases and additional fuel is required. This information from the IAT and MAP sensors is used by the PCM to control injector pulse width.

EVAP Control System Operation Description



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Legend

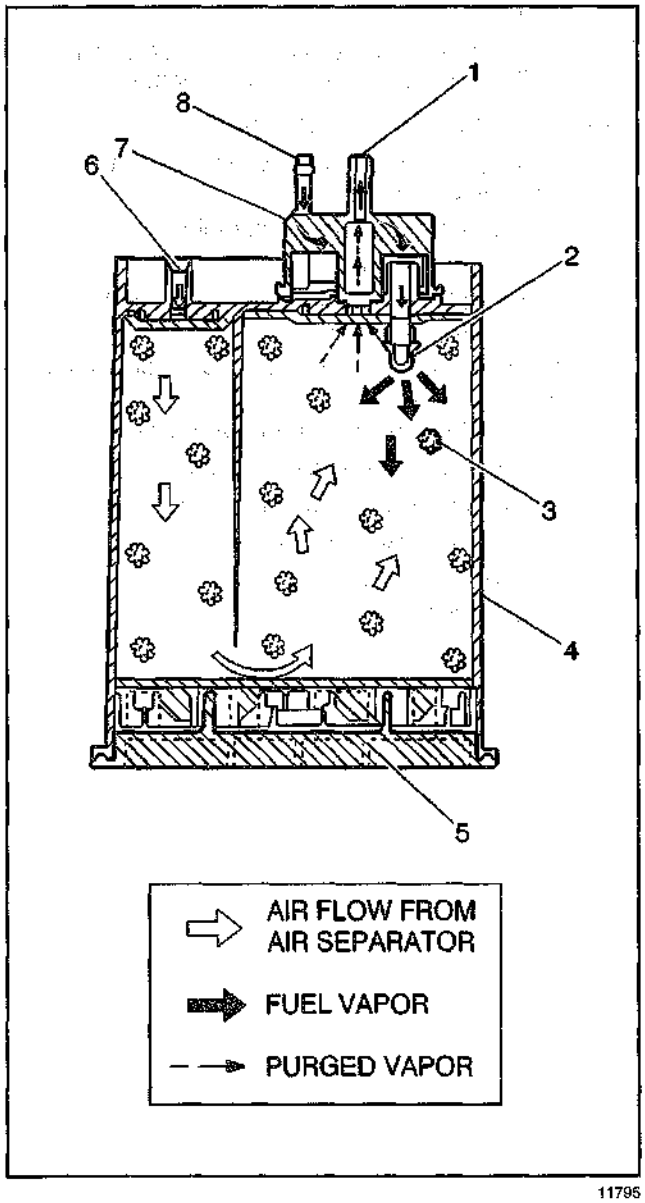
(1) Purge Line
(2) Vapor From Fuel Tank
(3) Air

The 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.

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When the engine is operating, the fuel vapor is purged from the carbon element by intake air flow and consumed in the normal combustion process.

EVAP Canister



11795

Legend

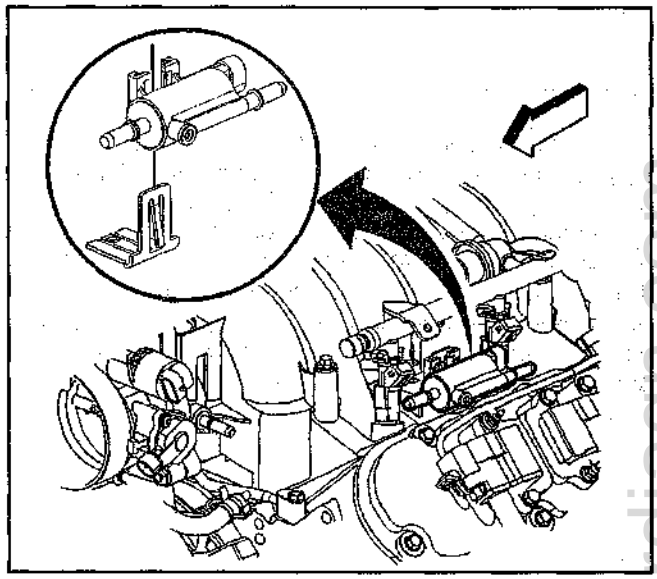
(1) Purge Tube to Solenoid
(2) Buffer Tube
(3) Charcoal Bed
(4) EVAP Charcoal Canister
(5) Volume Compensator
(6) Fresh Air Inlet from Air Separator
(7) Liquid Fuel Trap
(8) Vapor Tube from Fuel Tank

EVAP System

The evaporative system includes the following components:

- Fuel tank
- Evaporative emission canister vent solenoid
- Fuel tank pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emission canister
- Purge lines
- Purge valve solenoid

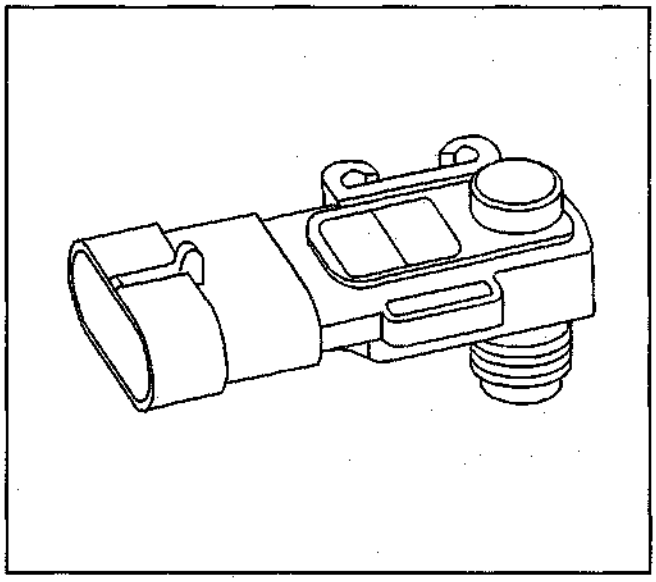
EVAP System Operation



218763

The EVAP purge solenoid valve allows manifold vacuum to purge the canister. The Powertrain Control Module (PCM) supplies a ground to energize the EVAP purge solenoid valve (purge on). The EVAP purge solenoid control is Pulse Width Modulated (PWM) or turned on and off several times a second.

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18839

The EVAP canister purge PWM duty cycle varies according to the operating conditions determined by the mass air flow, the fuel trim, the engine coolant temperature, and the intake air temperature. For certain EVAP tests, the diagnostic will be disabled if the TP angle increases to above 75 percent.

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring for 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 percent.

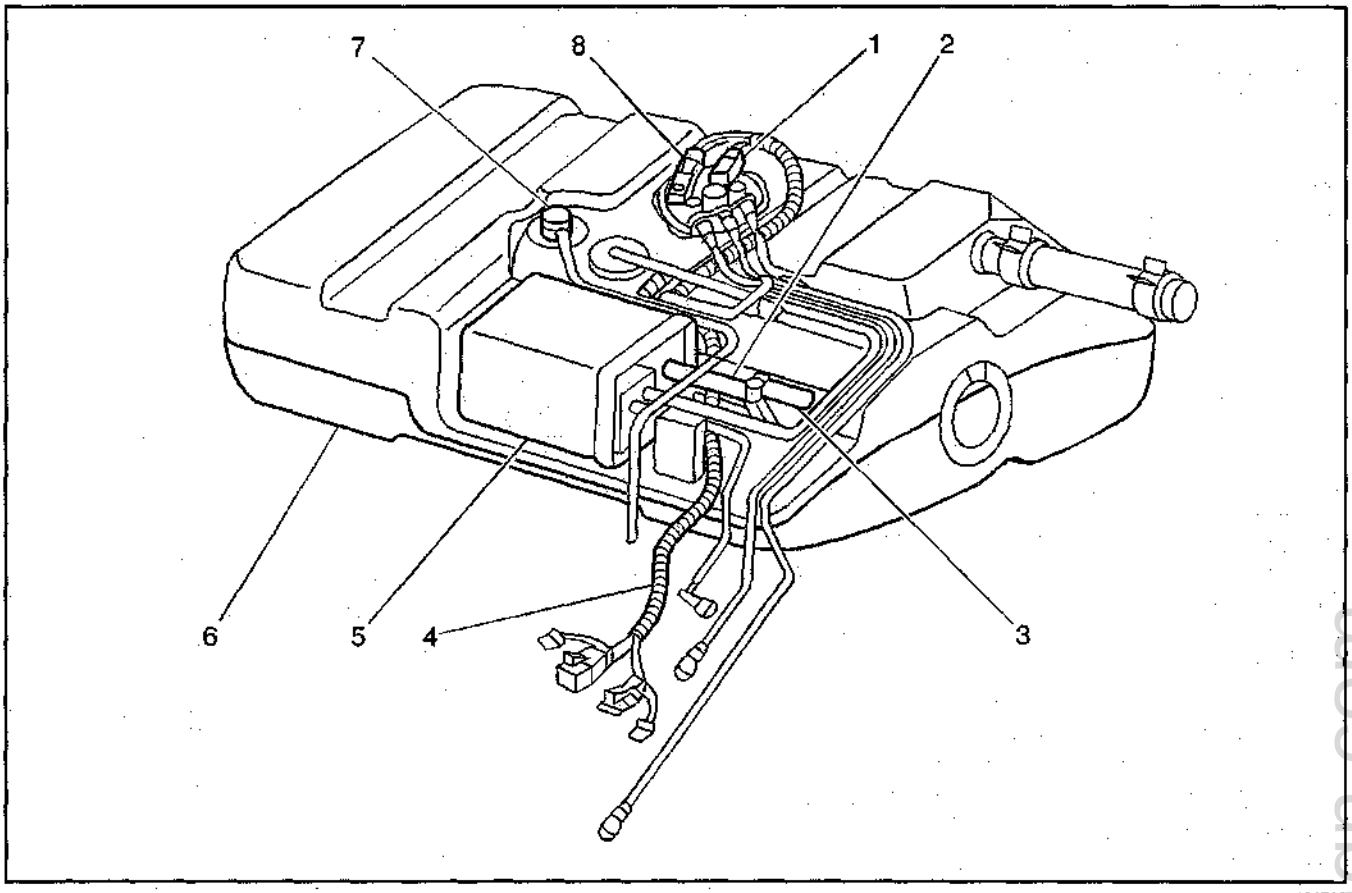
The PCM monitors the fuel tank pressure/vacuum level via the fuel tank pressure sensor input.

Results of Incorrect Operation

- Poor idle, stalling and poor driveability can be caused by the following:
  - Malfunctioning purge solenoid.
  - Damaged canister.
  - Hoses/lines split, cracked and/or not connected properly.
- Evidence of fuel loss or fuel vapor odor can be caused by the following:
  - Liquid fuel leaking from the fuel lines
  - Cracked or damaged canister
  - Inoperative canister control valve
  - Vacuum hoses that are:
  - Disconnected
  - Mis-routed
  - Kinked
  - Deteriorated
  - Damaged

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Fuel Tank Assembly with EVAP Canister



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Legend

(1) Fuel Sender Assembly
(2) Hose (EVAP Canister to Vent Solenoid)
(3) EVAP Vent Valve
(4) Fuel Tank Harness
(5) EVAP Canister
(6) Fuel Tank
(7) Overpressure Relief Valve
(8) Fuel Tank Pressure Sensor

The evaporative leak detection diagnostic strategy 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 purge solenoid and the EVAP vent solenoid 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 solenoid 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 causes DTC P0442 to be set.

If the desired vacuum level cannot be achieved in the test described above, a large leak or a faulty EVAP purge solenoid is indicated. This can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor.
- Missing or faulty 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 faulty EVAP canister solenoid.
- Disconnected or faulty EVAP vent solenoid.
- Open ignition feed circuit to the EVAP vent or purge solenoid.
- Damaged EVAP canister.

Any of the above conditions sets DTC P0440.

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A restricted or blocked EVAP canister vent path is detected by drawing vacuum into the EVAP system. The PCM turns off the EVAP vent solenoid and the EVAP purge solenoid (EVAP vent solenoid Open, EVAP purge PWM 0 percent). The PCM monitors the fuel tank pressure sensor input. With the EVAP vent solenoid open, any vacuum in the system should decrease quickly unless the vent is blocked. A blockage is caused by the following conditions:

- Faulty EVAP vent solenoid (stuck closed).
- Plugged, kinked, or pinched vent hose.
- Shorted EVAP vent solenoid driver circuit.
- Plugged evaporative canister.

If any of the above conditions are present, DTC P0446 sets.

The PCM checks for conditions that cause the EVAP system to purge continuously by commanding the EVAP vent solenoid on and the EVAP purge solenoid off (EVAP vent solenoid CLOSED, EVAP purge PWM 0 percent). If fuel tank pressure level increases during the test, a continuous purge flow condition is indicated. This can be caused by the following conditions:

- EVAP purge solenoid leaking.
- EVAP purge and engine vacuum source lines switched at the EVAP purge solenoid.
- EVAP purge solenoid driver circuit grounded.

If any of the above conditions are present, DTC P1441 sets.

Refer to the appropriate DTCs for further diagnostic procedures regarding the EVAP system.

Visual Check of Evaporative Emission Canister

- Cracked or damaged, replace the canister.
- Fuel leaking from the canister, replace canister and check lines and line routing.

Electronic Ignition (EI) System Description

Ignition System Overview

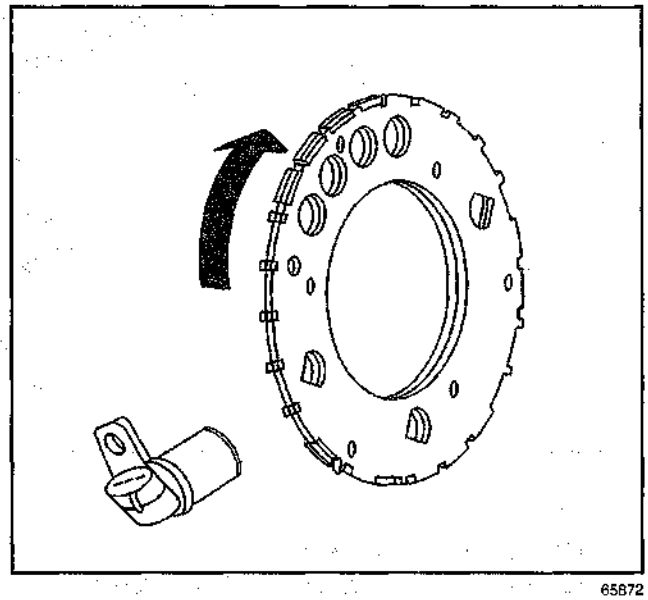
The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. The Electronic ignition system 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.

The electronic ignition system does not use the conventional distributor and coil. The ignition system consists of the following components/circuits:

- Eight ignition coils/modules
- Eight Ignition Control (IC) circuits
- Camshaft Position (CMP) sensor
- 1X Camshaft reluctor wheel
- Crankshaft Position (CKP) sensor
- 24X Crankshaft reluctor wheel
- Related connecting wires
- Powertrain Control Module (PCM)

Crankshaft Position Sensor and Reluctor Wheel



65872

The Crankshaft Position (CKP) sensor is located in the right rear of the engine, behind the starter. The CKP sensor is a dual magneto resistive type sensor. This sensor is not speed dependent. The dual micro switches monitor both notches of the reluctor wheel for greater accuracy. The CKP sensor works in conjunction with a 24X reluctor wheel. The reluctor wheel is mounted on the rear of the crankshaft. The 24X reluctor wheel uses two different width notches that are 15 degrees apart. This Pulse Width Encoded pattern allows cylinder position identification within 90 degrees of crankshaft rotation. In some cases, cylinder identification can be located in 45 degrees of crankshaft rotation. This reluctor wheel also has dual track notches that are 180 degrees out of phase. The dual track design allows for quicker starts and accuracy.

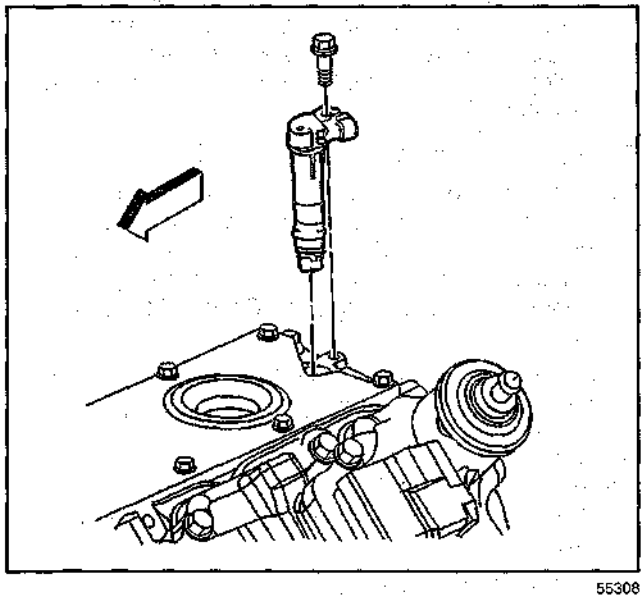
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The PCM also receives a 4X signal from the Crankshaft Position sensor. The PCM utilizes the 4X signal for the following:

- Misfire
- Tachometer output
- Spark control
- Fuel control
- Certain diagnostics

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

Camshaft Position Sensor

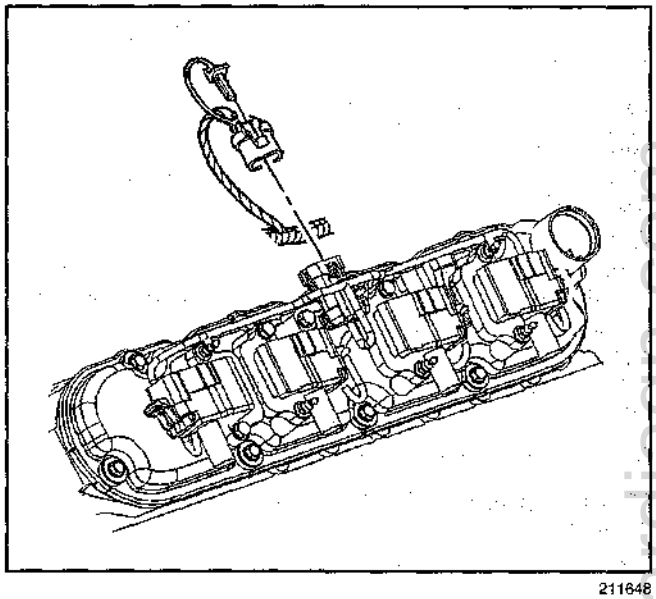


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The Camshaft Position (CMP) sensor is mounted through the top of the engine block at the rear of the valley cover. The CMP sensor works in conjunction with a 1X reluctor wheel on the camshaft. The CMP sensor is used to determine whether a cylinder is on the firing or the exhaust stroke. As the camshaft rotates, the reluctor wheel interrupts a magnetic field produced by a magnet within the sensor. The CMP sensor internal circuitry detects this and produces a signal which is used by the PCM. The PCM uses this signal in combination with the CKP 24X signal to determine crankshaft position and stroke.

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

Ignition Coils/Module

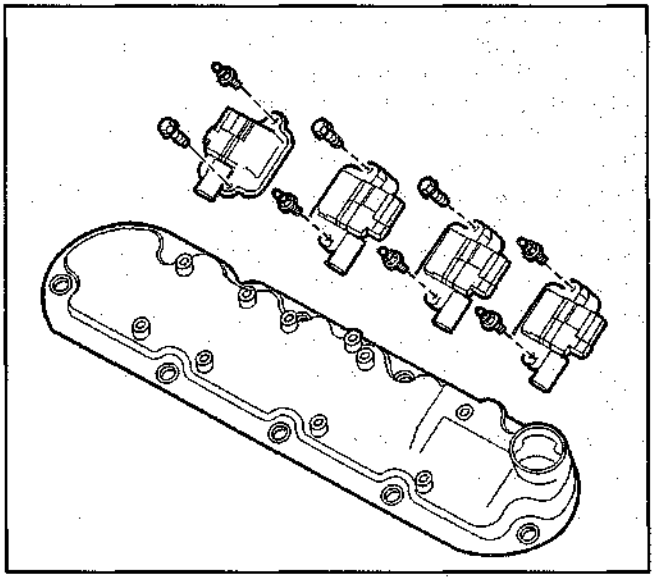


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The ignition system on this vehicle features a multiple coil ignition and is known as coil near plug. The secondary ignition wires are short compared with a distributor ignition system wire. Eight ignition coils/modules are individually mounted above each cylinder on the rocker covers. The coils/modules are fired sequentially. There is an Ignition Control (IC) circuit for each ignition coil/module. The eight ignition control circuits are connected to the PCM. All ignition timing decisions are made by the PCM, which triggers each coil/module individually. The ignition coil/modules are supplied with the following circuits:

- Ignition feed circuit
- Ignition control circuit
- Ground circuit
- Reference low circuit

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65292

The ignition feed circuits are fused separately for each bank of the engine. The two fuses also supply power to the injectors for that bank of the engine. Each coil/module is serviced separately.

This system puts out very high ignition energy for plug firing. The ignition wires are shorter so less energy is lost to ignition wire resistance. Also, since the firing is sequential, each coil has seven ignition events to saturate as opposed to the three in a waste spark arrangement. Futhermore, no energy is lost to the resistance of a waste spark system.

Circuits Affecting Ignition Control

To properly control ignition timing, the PCM relies on the following information:

- Engine load (manifold pressure or vacuum)
- Atmospheric (barometric) pressure
- Engine temperature
- Intake air temperature
- Crankshaft position
- Engine speed (RPM)

The Ignition Control (IC) system consists of the following components:

- Ignition coil/modules
- 24X crankshaft position sensor
- Powertrain Control Module (PCM)
- All connecting wires

The Ignition Control utilizes the following to control spark timing functions:

- 24X signal - The 24X crankshaft position sensor sends a signal to the PCM. The PCM uses this signal to determine crankshaft position. The PCM also utilizes this signal to trigger the fuel injectors.
- Ignition Control (IC) circuits - The PCM uses these circuits to trigger the ignition coil/modules. The PCM uses the crankshaft reference signal to calculate the amount of spark advance needed.

Ignition Information

There are important considerations to point out when servicing the ignition system. The following Noteworthy Information will list some of these to help the technician in servicing the ignition system.

- The ignition coils secondary voltage output capabilities are very high - more than 40,000 volts. Avoid body contact with secondary high voltage ignition components when the engine is running, or personal injury may result!
- The 24X crankshaft position sensor is the most critical part of the ignition system. If the sensor is damaged so that pulses are not generated, the engine will not start!
- Crankshaft position sensor clearance is very important! The sensor must not contact the rotating interrupter ring at any time, or sensor damage will result. If the interrupter ring is bent, the interrupter ring blades will destroy the sensor.
- Ignition timing is not adjustable. There are no timing marks on the crankshaft balancer or timing chain cover.
- Be careful not to damage the secondary ignition wires or boots when servicing the ignition system. Rotate each boot to dislodge it from the plug or coil tower before pulling it from either a spark plug or the ignition coil. Never pierce a secondary ignition wire or boot for any testing purposes! Future problems are guaranteed if pinpoints or test lights are pushed through the insulation for testing.

Powertrain Control Module (PCM)

The PCM is responsible for maintaining proper spark and fuel injection timing for all driving conditions. To provide optimum driveability and emissions, the PCM monitors input signals from the following components to calculate Ignition Control (IC) spark timing:

- The Engine Coolant Temperature (ECT) sensor
- The Intake Air Temperature (IAT) sensor
- The Mass Air Flow (MAF) sensor
- The Knock Sensor
- The Trans Range inputs from Transaxle Range switch
- The Throttle Position (TP) sensor
- The Vehicle Speed Sensor (VSS)

Results of Incorrect Operation

An Ignition control circuit that is open, grounded, or shorted to voltage will set an ignition control circuit DTC. If a fault occurs in the IC output circuit when the engine is running, the engine will experience a misfire. DTCs P0351–P0358 will set when a malfunction is detected with an Ignition Control circuit. When an Ignition control DTC sets, the PCM disables the injector for the appropriate cylinder.

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The PCM uses information from the engine coolant temperature sensor in addition to RPM to calculate spark advance values as follows:

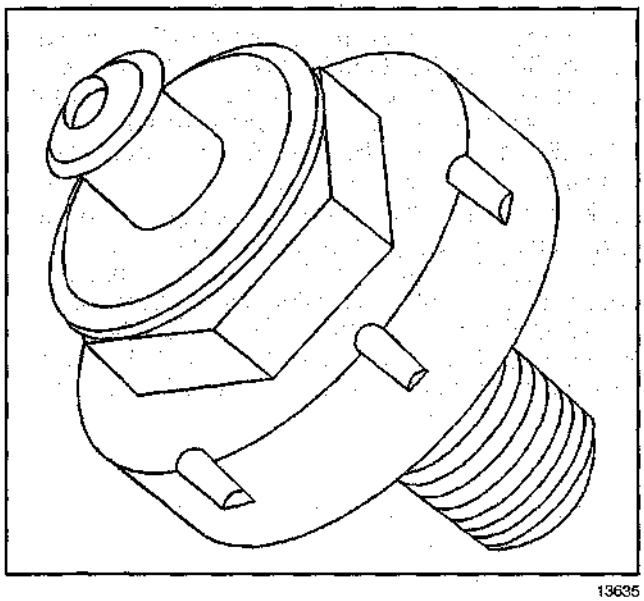
- High RPM = more advance
- Cold engine = more advance
- Low RPM = less advance
- Hot engine = less advance

Therefore, detonation could be caused by high resistance in the engine coolant temperature sensor circuit. Poor performance could be caused by low resistance in the engine coolant temperature sensor circuit.

If the engine cranks but will not run or immediately stalls, the Engine Cranks But Will Not Run diagnostic table must be used to determine if the failure is in the ignition system or the fuel system. If DTC P0300, P0341, P0342, P0343, P0335, P0336 is set, the appropriate diagnostic trouble code table must be used for diagnosis.

Knock Sensor (KS) System Description

Knock Sensor



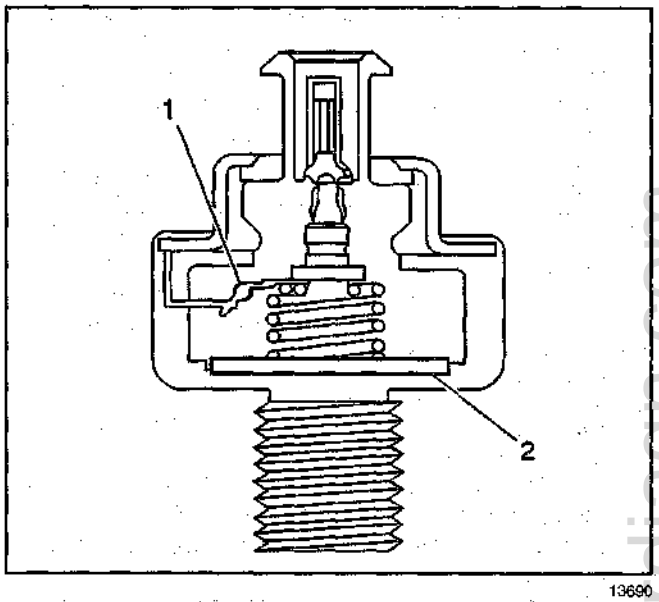
13635

Varying octane levels in gasoline can cause detonation in some engines. Detonation is sometimes called spark knock. 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 up to 20 degrees to reduce spark knock in the engine. This allows the engine to use maximum spark advance to improve driveability and fuel economy.

The knock sensor system is used to detect engine detonation. The knock sensor(s) produce an AC voltage which is sent to the PCM. The PCM will retard the spark timing based on signals from the KS sensors. The amount of AC voltage produced by the sensors is determined by the amount of knock. The PCM then adjusts the Ignition Control (IC) to reduce the spark knock.

Knock Sensor Cutaway



13690

Legend

(1) Shunt Resistor
(2) Piezo Crystal

The scan tool has several positions for diagnosing the KS circuit.

- Knock Retard indicates the amount of spark the PCM is removing from the IC spark advance in response to the signal from the knock sensors.
- Spark indicates the amount of spark advance being commanded by the PCM on the IC circuit.

DTC P0325 indicates an internal PCM malfunction related to the KS system. DTCs P0327 and P0332 indicates that a Knock sensor or Knock sensor circuit is malfunctioning. If these DTCs are set, Refer to applicable DTC table.

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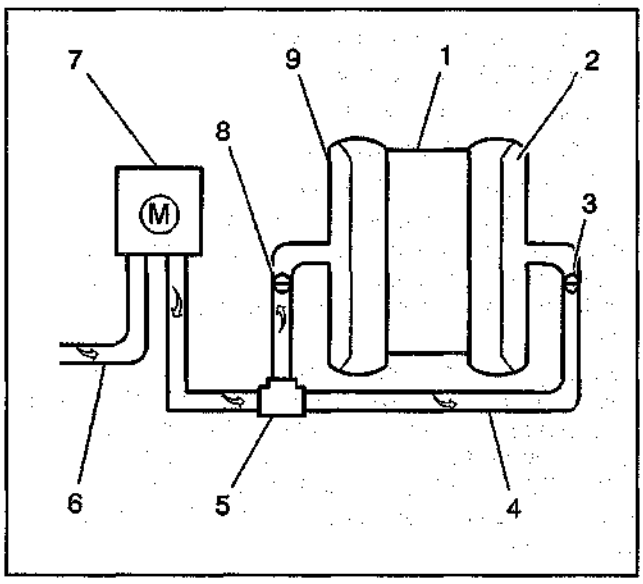
Secondary AIR Injection System Description

The Secondary Air Injection (AIR) system helps reduce Hydrocarbon (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx) exhaust emissions. It also heats up the 3–way catalytic converters quickly on engine start–up so conversion of exhaust gases can occur sooner.

The system includes the following:

- AIR pump – The AIR pump is mounted to the lower left front of the engine Compartment and supplies the air to the AIR system. The electric air pump pressurizes fresh air and pumps it to the AIR Shut Off Valve. The AIR pump is controlled by the PCM. Battery voltage to the AIR pump is controlled by the AIR pump relay. When the PCM provides a ground circuit for the secondary AIR pump relay, battery voltage is allowed to power up the AIR pump.
- AIR Solenoid Valve – The AIR Solenoid Valve is located at the left rear of the intake manifold. The AIR Solenoid Valve is controlled by the PCM. The AIR Solenoid Valve controls the engine vacuum to the AIR Shut Off Valve. The PCM provides a ground circuit for the AIR Solenoid Valve, which allows engine vacuum to be applied to the AIR Shut Off Valve.
- AIR Shut Off Valve – The AIR Shut Off Valve is mounted to the rear of the left cylinder head. The AIR Shut Off Valve controls the air flow from the AIR pump to the check valves. The PCM enables the AIR Solenoid Valve, which applies engine vacuum to the AIR Shut Off Valve. The applied engine vacuum opens the AIR Shut Off Valve and allows air supplied by the AIR Pump to flow to the check valves.
- Check valves – The check valves prevent back flow of exhaust gases into the AIR system in the event of an exhaust backfire.
- Necessary plumbing.
  - Hoses
  - Pipes
  - Clamps

AIR System (Typical)



605865

Legend

(1)

The AIR pump (7) is controlled by the PCM. The PCM will turn ON the AIR pump by providing the ground to complete the circuit which energizes the AIR pump relay. When air to the exhaust ports is desired, the PCM will turn ON the AIR Solenoid valve and then the AIR pump.

The PCM turns ON the AIR pump during startup any time engine coolant temperature is above –10°C (14°F). The AIR pump operates for a maximum of 240 seconds, or until the system enters Closed Loop operation. At the same time the PCM turns the AIR pump OFF, it also de-energizes the AIR Solenoid Valve so no vacuum is applied to the AIR Shut Off Valve (5).

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The AIR system will be disabled under the following conditions:

- When the PCM recognizes a condition and sets a diagnostic trouble code.
- When the fuel system is operating in Closed Loop.
- The AIR pump has been ON for 240 seconds.
- Engine Speed is greater than 2825 RPM.
- MAP is greater than 96 kPa with VSS over 60 mph.
- MAP is less than 20 kPa.
- ECT less than –10°C (14°F).
- 3-way catalytic converters over temperature detected.
- Short and long term fuel trim are not in the normal range.
- Power enrichment is detected.

Results of Incorrect Operation

If no air (oxygen) flow enters the exhaust stream at the exhaust ports, HC and CO emission levels will be too high.

Air flowing to the exhaust ports at all times could increase temperature of the 3–way catalytic converter.

Diagnostic Trouble Codes P0410, P0412, P1415, and P1416 will set if there is a malfunction in the following components:

- The AIR pump.
- The AIR pump relay.
- The AIR shut off valve.
- Hoses or pipes that are leaking.
- The Check valves that are leaking.
- Circuits going to the AIR pump and the AIR pump relay.
- The AIR Solenoid Valve.
- Circuits going to the AIR solenoid Vvalve.

AIR Pump

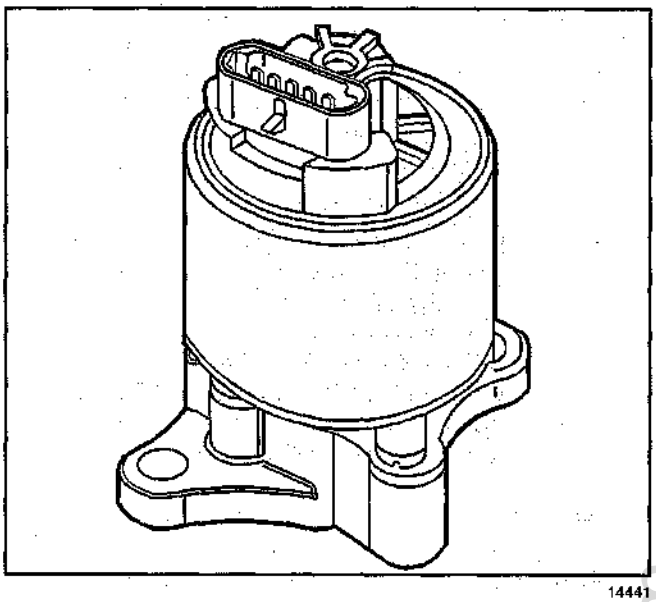
The AIR pump is a regenerative turbine type which is permanently lubricated and requires no periodic maintenance.

The engine should be at normal operating temperature in neutral at idle. Using the scan tool enable the AIR pump system. Select HO2S voltages for both Bank 1 and Bank 2 HO2S. The HO2S voltages for both sensors should remain under 350 mV because air is being directed to the exhaust ports. If the HO2S voltages remain low during the Output Test, the AIR pump and integral stop valve are operating satisfactorily. If the HO2S voltage does not remain low when the AIR pump is enabled, inspect for the following:

- For voltage at the Air Pump when it is energized.
- For a seized AIR pump.
- Hoses, pipes and all connections for leaks and proper routing.
- For air flow going to the exhaust ports.
- AIR pump for proper mounting.
- Hoses and Pipes for deterioration or holes.

EGR System Description

EGR Valve



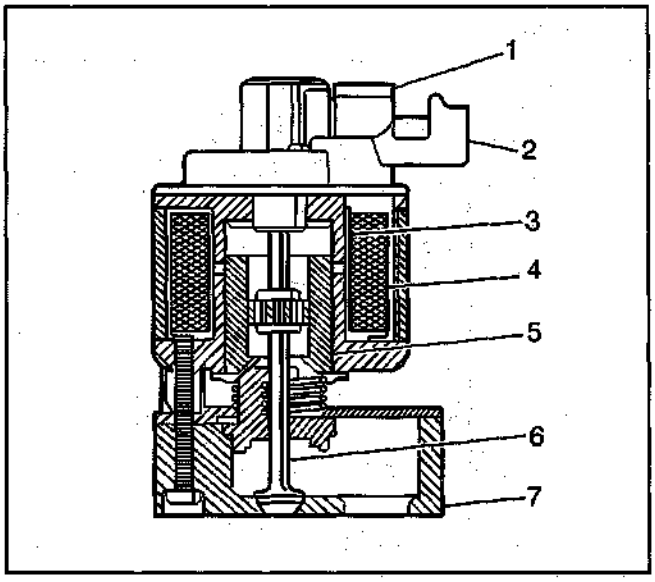
14441

Purpose

An Exhaust Gas Recirculation (EGR) system is used in order to lower Oxides of Nitrogen (NOx) emission levels. The EGR system accomplishes this by feeding small amounts of exhaust gas back into the combustion chamber. High combustion temperatures cause NOx. Combustion temperatures are reduced when the air/fuel mixture is diluted with the exhaust gases.

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Operation



11696

Legend

(1) Cap-Sensor
(2) Sensor-EGR Pintle Position
(3) Pole Piece-Primary
(4) Bobbin and Coil Assembly
(5) Sleeve-Armature
(6) Valve-Pintle
(7) Armature and Base Assembly

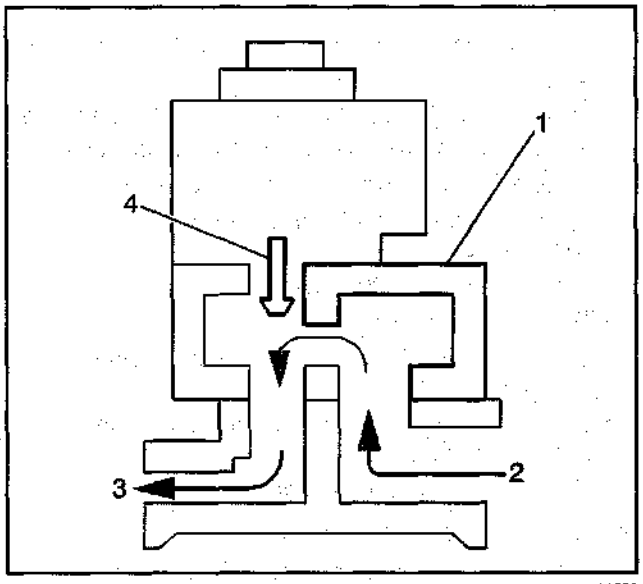
The EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The EGR valve controls the exhaust flow into the intake manifold from the exhaust manifold through an orifice with a PCM controlled pintle. The PCM controls the pintle position using inputs from the Engine Coolant Temperature (ECT) sensor, the Throttle Position (TP) sensor, and the Manifold Absolute Pressure (MAP) sensor. The PCM commands the EGR valve in order to supply the correct amount of exhaust gas recirculation for the current engine operating conditions. This can be monitored on a scan tool as the Desired EGR Position.

The PCM monitors the position of the EGR valve through a feedback signal. The PCM supplies a 5.0 volt reference and a ground to the EGR valve. A voltage signal representing the EGR valve pintle position is sent to the PCM from the EGR valve. This feedback signal can also be monitored on a scan tool and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

The EGR valve is usually activated under the following conditions:

- The engine is warm.
- The engine is above the idle speed.

Diagnosis



11699

Legend

(1) Linear EGR Valve
(2) Exhaust Gas
(3) To Cylinders
(4) Pintle

Too much EGR flow causes any of the following conditions to occur:

- The engine stalls after a cold start.
- The engine stalls during closed throttle conditions.
- The vehicle surges during a cruise condition.
- A rough idle.
- A DTC P0300 (misfire detected).

Too little or no EGR flow allows the combustion temperatures to increase. This causes the following symptoms:

- Spark knock (detonation)
- Engine overheating
- Emission test failure
- DTC P0401
- Poor fuel economy

The EGR flow diagnosis is included in the DTC P0401 diagnostic table. The EGR pintle position and the EGR valve control circuit diagnosis are covered in DTCs P0404, P0405, and P1404. Go to the appropriate DTC table for diagnosis if an EGR diagnostic trouble code is stored.

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Crankcase Ventilation System Description

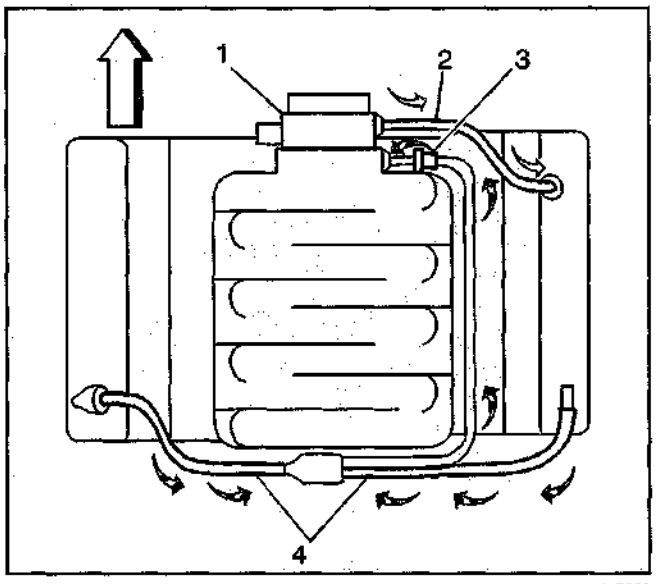
A closed crankcase ventilation system is used to provide a more complete scavenging of crankcase vapors. Fresh air from the throttle body is supplied to the crankcase, mixed with blow–by gases and then passed through a crankcase ventilation valve into the intake manifold.

The primary control is through the crankcase ventilation valve which meters the flow at a rate depending on manifold vacuum. To maintain idle quality, the crankcase ventilation valve restricts the flow when intake manifold vacuum is high. If abnormal operating conditions arise, the system is designed to allow excessive amounts of blow–by gases to back flow through the crankcase vent tube into the engine air inlet to be consumed by normal combustion.

The engine ventilation system was developed to minimize oil consumption and ensure that oil ingestion could not occur during vehicle limit handling maneuverers. Filtered fresh air is routed from up stream of the throttle blade to the front of the right rocker cover via a formed rubber hose. To reduce the potential of oil pullover into the throttle bore area due to back flow of the ventilation system, the fitting in the right side rocker cover is located between a shield from the rocker arms. Blowby gases are routed from the rear of both rocker covers, through molded nylon lines to a tee fitting located on the centerline of the engine at the rear of the intake manifold. From there, a single nylon line carries the foul air gases through an externally mounted, horizontal PCV valve and enters the intake manifold behind the throttle body.

The dual draw system was develop to meet the limited handling maneuver requirements. During sustained maximum lateral accelerations, the outboard rocker cover may fill with oil. The dual draw system passively switches, allowing the PCV valve to draw on the rocker cover with the least resistance. This results in the system drawing on the air filled, or inboard rocker cover and eliminates oil pullover due to drawing on the oil-filled outboard rocker cover.

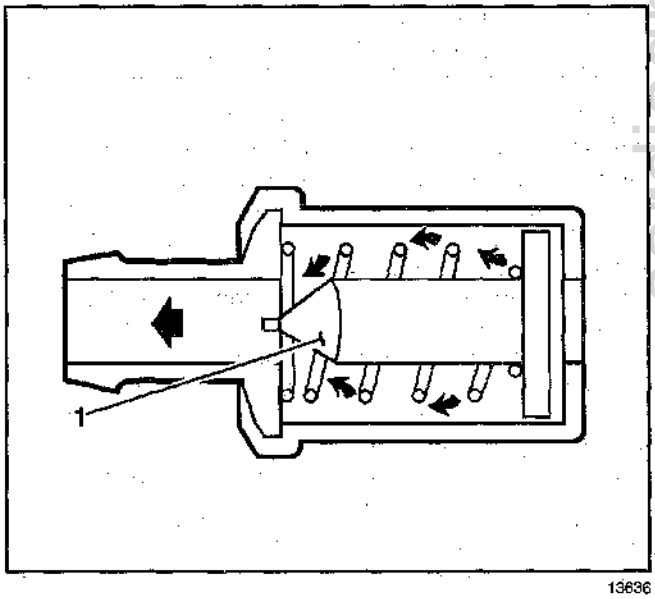
Crankcase Ventilation System Routing



417539

Legend

(1) Throttle Body
(2) Fresh Air
(3) PCV Valve
(4) Crankcase Gases



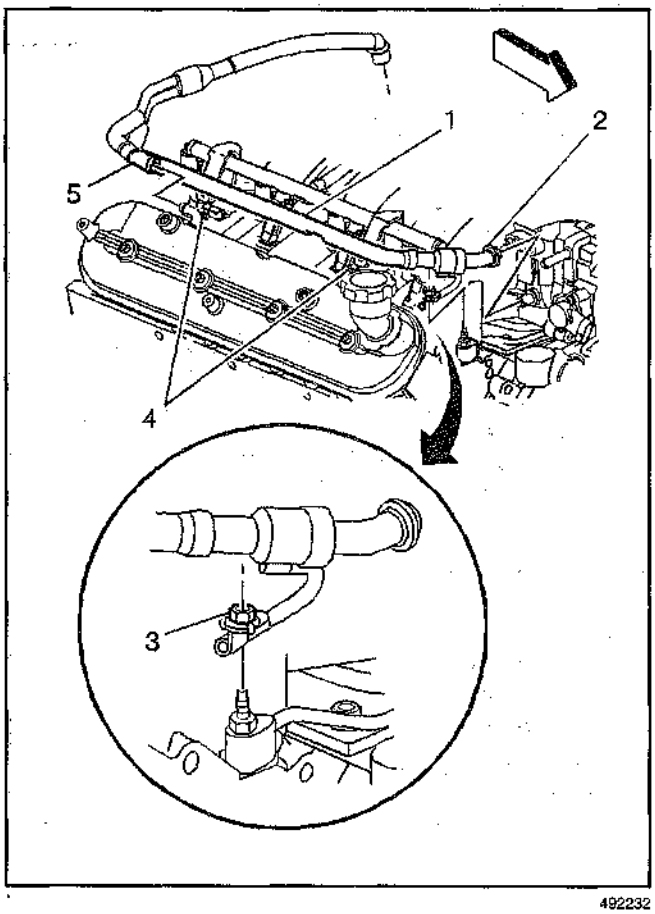
13636

Legend

(1) Check Valve

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PCV System



492232

The PCV valve is connected to the PCV Heat Exchange cable. The PCV Heat Exchange cable is mounted to the coolant crossover with a integral fastener (3). This cable transfers heat to the PCV valve to eliminate condensation build-up in the PCV system. This also aids in eliminating throttle body icing.

Results of Incorrect Operation

A plugged PCV valve or hose may cause:

- Rough idle
- Stalling or slow idle speed
- Oil leaks
- Sludge in engine

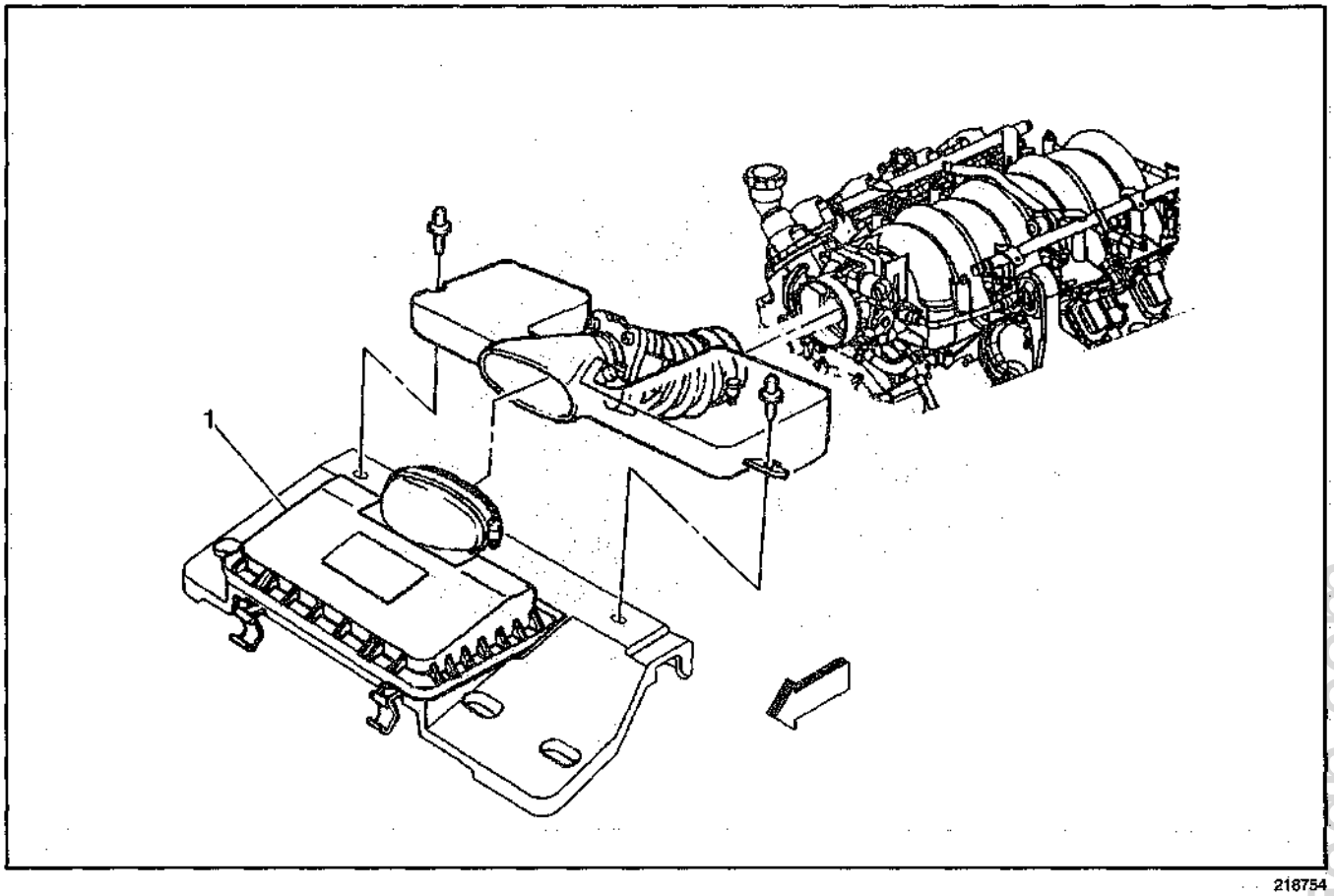
A leaking valve or hose would cause:

- Rough idle
- Stalling
- High idle speed

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Air Intake System Description

Air Cleaner Location



218754

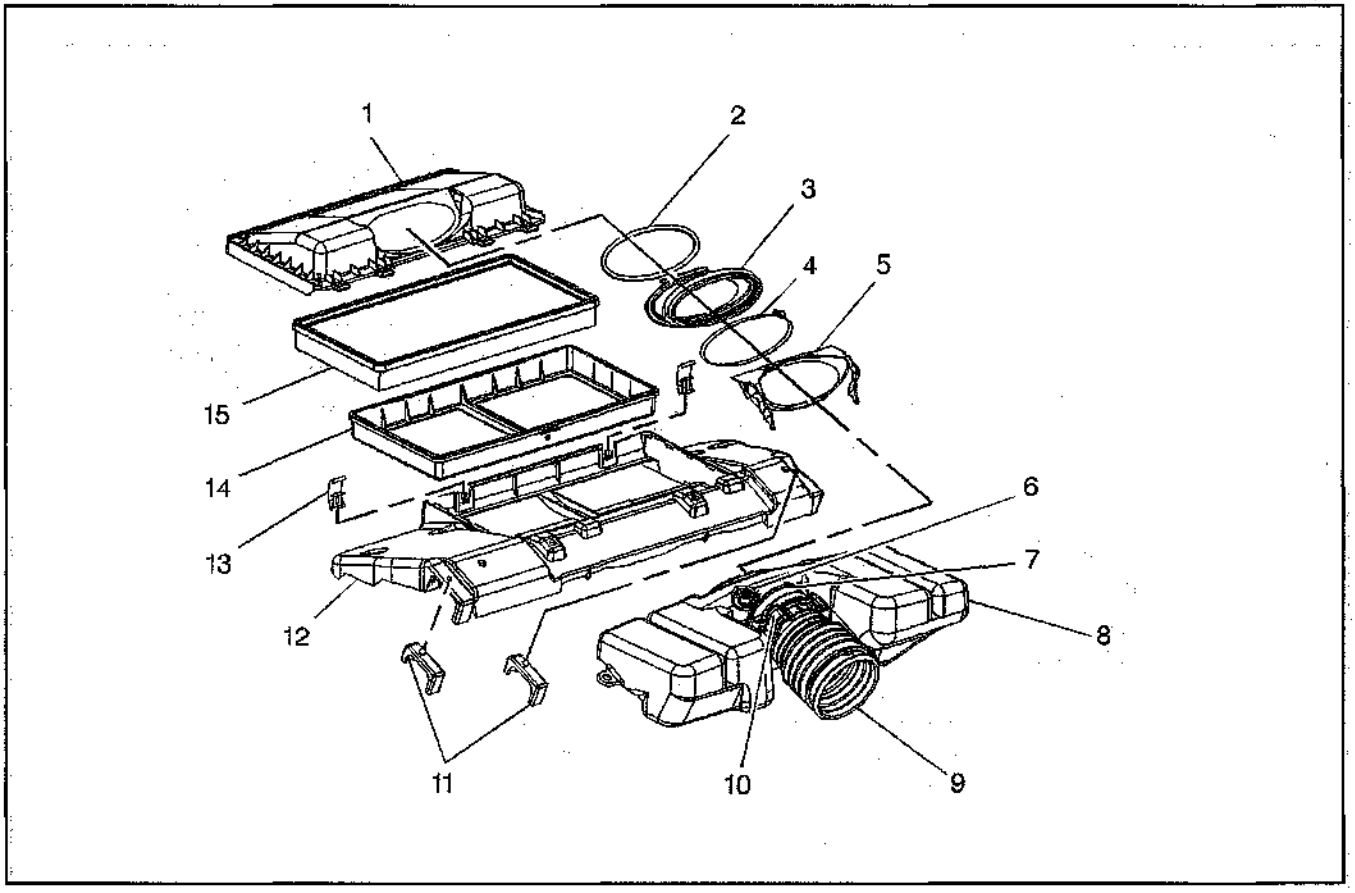
Legend

(1) Air Cleaner Housing

The air intake system draws outside air through the front of the remotely mounted air cleaner assembly (1) and filter element. The air is then routed through the MAF sensor and then into the throttle body to the intake manifold. The air is then directed into the intake manifold runners, through cylinder heads and into the cylinders.

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Air Cleaner Housing and Resonator



247788

Legend

(1) Air cleaner housing top cover
(2) Seal
(3) Air intake duct to resonator
(4) Clamp
(5) Air intake duct to top cover retainer
(6) Intake Air Temperature (IAT) sensor
(7) Clamp
(8) Air intake resonator
(9) Air intake duct to throttle body
(10) Mass Airflow (MAF) sensor
(11) Isolator
(12) Air cleaner housing lower assembly
(13) Front retaining clips
(14) Air filter element frame
(15) Air filter element

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.

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Special Tools and Equipment

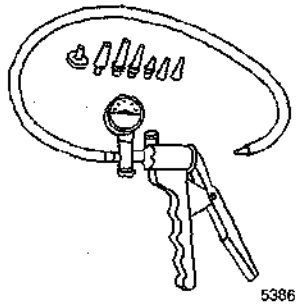
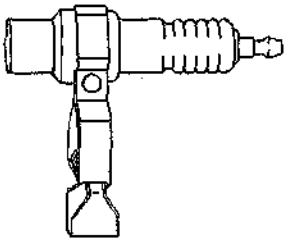
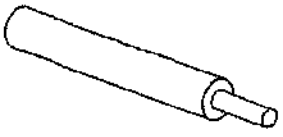
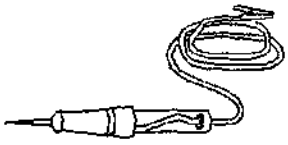
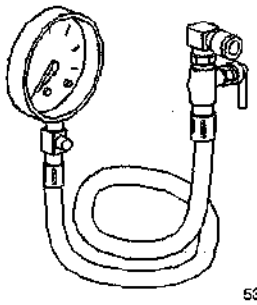
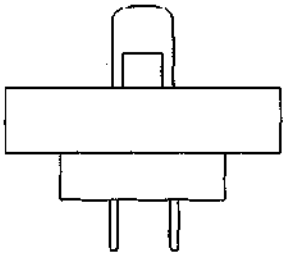
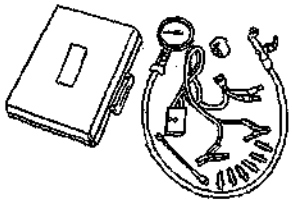
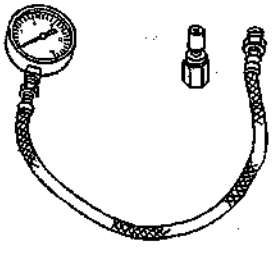
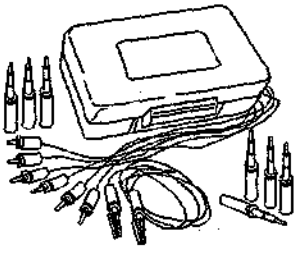
Illustration	Tool Number/Description
 5386	J 23738-A Vacuum Pump
 5381	J 26792 Spark Tester
 5396	J 28742-A Weather Pack Terminal Remover
 9194	J 33431-B Signal Generator and Instrument Panel Tester
 5382	J 34142-B Test Light

Illustration	Tool Number/Description
 5389	J 34730-1A Fuel Pressure Gauge
 5390	J 34730-2C Injector Test Light
 5377	J 34730-E Fuel Pressure Gauge Kit
 13544	J 35314-A Exhaust Back Pressure Tester
 8917	J 35616-A Connector Test Adapter Kit

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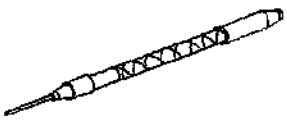
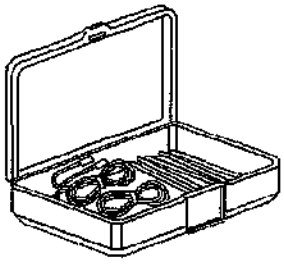
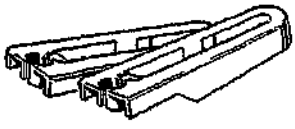
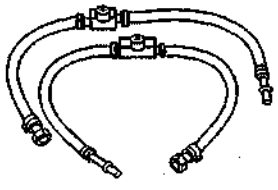
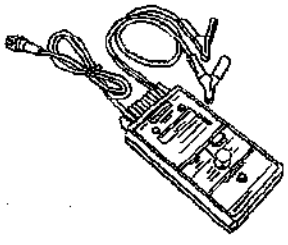
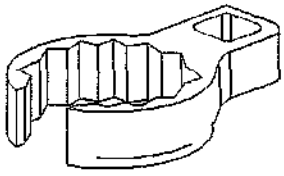
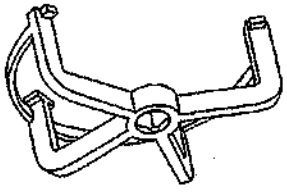
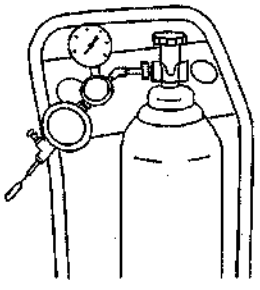
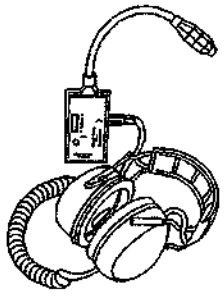
Illustration	Tool Number/Description
 5395	J 35689-A Metri-Pack Terminal Kit
 5399	J 37027-A IAC Motor Analyzer
 12366	J 37088-A Fuel Line Quick Connect Separator
 13541	J 37287 Inlet and Return Fuel Line Shut-off Adapters
 5380	J 39021 Fuel Injector Coil/Balance Tester

Illustration	Tool Number/Description
 5388	J 39194-B Oxygen Sensor Wrench
 3430	J 39200 Digital Multimeter
 16891	J 39765 Fuel Sender Lock Nut Wrench
 227620	J 41413 Pressure/Purge Diagnostic Station
 69758	J 41416 Ultrasonic Leak Detector

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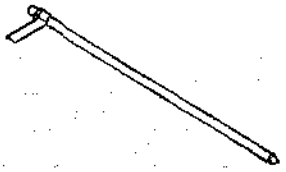
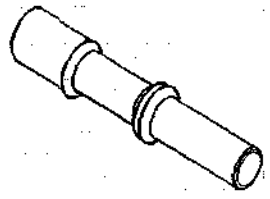
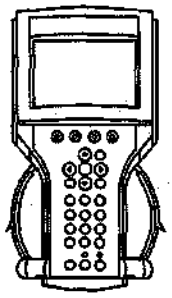
Illustration	Tool Number/Description
 382673	J 42960-1 Fuel Tank Drain Hose
 382677	J 42960-2 Fuel Flapper Door Holder

Illustration	Tool Number/Description
 50062	P/N 7000081 Tech 2 Kit

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