SECTION 1F

ENGINE CONTROLS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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SPECIFICATIONS

SCAN TOOL DATA TABLE (2.0L SOHC/DOHC)

Parameter	Units Displayed	Typical Data Value
Engine Speed	rpm	± 50 rpm from desired rpm in drive (A/T) ± 50 rpm from desired rpm in neutral (M/T)
Desired Idle	rpm	ECM idle command (varies with temperature)
Engine Coolant Temperature	degrees Celsius	85-105°C
MAT/Internal Air Temperature	degrees Celsius	10-90°C
MAP	kPa/volts	29-48 kPa/1-2 volts (varies with manifold and barometric pressure)
Barometric Pressure	kPa/volts	varies with altitude
Fueling Mode	open/closed	“Closed Loop" (may enter “Open Loop" at extended idle)
Throttle Position	volts	0.3-1.0 V
Air/Fuel Ratio	-	-
Oxygen Sensor Signal	millivolts	1□1000 mv (varies continuously)
Injector Pulse Width	milliseconds	0.8-2.5 ms
Spark Advance	degrees	varies
Fuel Trim Integrator	counts	110 ~ 145
Block Lever	counts	115 ~ 138
Idle Air Control	counts	1-50
P/N Switch (A/T Only)	P-N and R-D-L	Park/Neutral (P/N)
Vehicle Speed	kph, mph	0
Air Conditioning Pressure	kPa	varies
Ignition/Battery Voltage	volts	13.5-14.8 V
Cooling Fan Relay	on/off	on/off
A/C Request	yes/no	no
A/C Clutch Relay	on/off	off
Low Fan Request	on/off	on/off
Prom ID	0-9999	PROM ID number varies
Canister Purge Solenoid	on/off	off
CO Adjust (Lead Fuel)	count	128
High-Speed Fan	on/off	off

SCAN TOOL DATA TABLE (2.2L DOHC)

Engine Data Display 01

Selected by 2: Data Display 1: Engine Data

2.2L Manual Transmission

Parameter	Units Displayed	Typtical Data Value
Engine Speed	rpm	±100 rpm from the Desired rpm
Desired Idle	rpm	ECM Idle Command
Engine Coolant Temperature	degrees Celsius	85°-115°C (185°-239°F)
Intake Air Temperature	degrees Celsius	10°-80°C (50°-176°F)
Throttle Position	%	0% (up to 100% at wide open throttle)
Throttle Position	Volts	0.200-0.900v (up to 5.0 at wide open throttle)
MAP	kPa	25-35 kPa
BARO	kPa	65-100 kPa (varies with altitude and with the BARO pressure)
EGR Actual Position	%	0%
EGR Desired Position	%	0-100%
EGR Feedback	Volt	
IAC Position	Counts	5-60
Cam Speed Activity	Counts	0-255
Ignition Voltage	Volts	12.0-15.0
Engine Run Time	Seconds	00:00:00-18:12:15 (hours:minutes:seconds)
BPW Bank 1	ms	0-999.9
Air Fuel Ratio	x:1	0:1-25.5:1
Spark	Degrees	64 to -64
Knock Retard	Degrees	0-90
Knock Active Counter	Counts	0-255
Knock Present	Yes / No	-
Calculated Load	%	0-100
Vehicle Speed	km/h	0-255
Air Condition Pressure	Volt	0-5
Oxygen Bank 1 Sensor 1	mV	0-1132
Oxygen Bank 1 Sensor 2	mV	0-1132
Decel Fuel Mode	Yes / No	-
Power Enrichment Mode	Yes / No	-
Closed Loop	Yes / No	-
Loop Status	See Table 3	
Hot Loop Open	Yes / No	-
Rich/Lean Bank 1	Rich / Lean	-
Short Term Fuel Trim	%	-100 to 100
Long Term Fuel Trim	%	-100 to 100

Engine Data Display 01 (Cont'd)

Parameter	Units Displayed	Typtical Data Value
EVAP Purge Solenoid	%	0-100
EVAP Vent Solenoid	On / Off	-
IAC Base Position	Counts	0-255
Fuel Trim Cell	Cell	
Calculated Air Flow	g/sec=n/128	0-512
Weak Cylinder	See Table 01	-
Rough Road Sensor	Volt	
5 Volt Reference	Volt	
Throttle at Idle	Yes / No	-
Power Steering Cramp	Yes / No	-
Air Conditioning Request	On / Off	-
Air Conditioning Clutch	On / Off	-
Fuel Pump	On / Off	-
Malfunction Indicator Lamp	On / Off	-
Upshift Lamp	On / Off	-
Low Fuel Lamp	On / Off	-
Hot Open Loop Lamp	On / Off	-
Variable Gate Intake	Long / Short	-
Fuel Trim Learned	On / Off	-
Fan 1	On / Off	-
Fan 2	On / Off	-

Engine Data Display 04
Selected by 2: Data Display 1: Engine Data
2.2L Automatic Transmission

Parameter	Units Displayed	Typtical Data Value
Engine Speed	rpm	±100 rpm from the Desired rpm
Desired Idle	rpm	ECM Idle Command
Engine Coolant Temperature	degrees Celsius	85°-115°C (185°-239°F)
Intake Air Temperature	degrees Celsius	10°-80°C (50°-176°F)
Throttle Position	%	0% (up to 100% at wide open throttle)
Throttle Position	Volts	0.200-0.900V (up to 5.0 at wide open throttle)
MAP	kPa	25-35 kPa
BARO	kPa	65-100 kPa (varies with altitude and with the BARO pressure)
EGR Actual Position	%	0%
EGR Desired Position	%	0-100%
EGR Feedback	Volt	

Engine Data Display 04 (Cont'd)

Parameter	Units Displayed	Typtical Data Value
IAC Position	Counts	5-
Cam Speed Activity	Counts	0-255
Ignition Voltage	Volts	12.0-15.0
Engine Run Time	Seconds	00:00:00-18:12:15 (hours:minutes:seconds)
BPW Bank 1	ms	0-999.9
Air Fuel Ratio	x:1	0:1-25.5:1
Spark	Degrees	64 to -64
Knock Retard	Degrees	0-90
Knock Active Counter	Counts	0-255
Knock Present	Yes / No	-
Calculated Load	%	0-100
Vehicle Speed	km/h	0-255
Air Condition Pressure	Volt	0-5
Oxygen Bank 1 Sensor 1	mV	0-1132
Oxygen Bank 1 Sensor 2	mV	0-1132
Decel Fuel Mode	Yes / No	-
Power Enrichment Mode	Yes / No	-
Closed Loop	Yes / No	-
Loop Status	See Table 3	-
Hot Loop Open	Yes / No	-
Rich/Lean Bank 1	Rich / Lean	-
Short Term Fuel Trim	%	-100 to 100
Long Term Fuel Trim	%	-100 to 100
EVAP Purge Solenoid	%	0-100
EVAP Vent Solenoid	On / Off	-
IAC Base Position	Counts	0-255
Fuel Trim Cell	Cell	
Calculated Air Flow	g/sec=n/128	0-512
Weak Cylinder	See Table 01	-
Rough Road Sensor	Volt	
5 Volt Reference	Volt	
Throttle at Idle	Yes / No	-
Power Steering Cramp	Yes / No	-
Air Conditioning Request	On / Off	-
Air Conditioning Clutch	On / Off	-
Fuel Pump	On / Off	-
Malfunction Indicator Lamp	On / Off	-
Upshift Lamp	On / Off	-
Low Fuel Lamp	On / Off	-

Engine Data Display 04 (Cont'd)

Parameter	Units Displayed	Typtical Data Value
Hot Open Loop Lamp	On / Off	-
Variable Gate Intake	Long / Short	-
Fuel Trim Learned	On / Off	-
Fan 1	On / Off	-
Fan 2	On / Off	-
Park/Neutral	Yes / No	-

EVAP Data Display 01

Selected by 2: Data Display 2: Specific Data 1: EVAP

Manual Transmission

Parameter	Units Displayed	Typtical Data Value
Engine Speed	rpm	±100 rpm from the Desired rpm
Ignition Voltage	Volts	12.0-15.0
Engine Coolant Temperature	degrees Celsius	85°-115°C (185°-239°F)
Start Up Coolant Temperature	degrees Celsius	4°-34°C (39°-93°F)
Intake Air Temperature	degrees Celsius	10°-80
Start Up Intake Air Temperature	degrees Celsius	12°-42°C (54°-108°F)
Engine Run Time	Seconds	00:00:00-18:12:15 (hours:minutes:seconds)
Fuel Level Sensor	Volt	0.4-4.5
Fuel Gauge	On / Off	-
EVAP Purge Solenoid	%	0-100
EVAP Vent Solenoid	On / Off	-
EVAP Tank Vacuum	in H_2O = n(25/65535)±7.5	
Throttle Position	%	0% (up to 100% at wide open throttle)
Throttle Position	Volts	0.200-0.900V (up to 5.0 at wide open throttle)
IAC Position	Counts	5-60
BPW Bank 1	ms	0-999.9
Air Fuel Ratio	x:1	0:1-25.5:1
Spark	Degrees	64 to -
MAP	kPa	25-35 kPa
BARO	kPa	65-100 kPa (varies with altitude and with the BARO pressure)
Calculated Load	%	0-100
Vehicle Speed	mph	0-255
Oxygen Sensor Bank 1 Sensor 1	mV	0-1132
Oxygen Sensor Bank 1 Sensor 2	mV	0-1132

EVAP Data Display 02
Selected by 2: Data Display 2: Specific Data 1: EVAP
Automatic Transmission

Parameter	Units Displayed	Typtical Data Value
Engine Speed	rpm	±100 rpm from the Desired rpm
Ignition Voltage	Volts	12.0-15.0
Engine Coolant Temperature	degrees Celsius	85°-115°C (185°-239°F)
Start Up Coolant Temperature	degrees Celsius	4°-34°C (39°-93°F)
Intake Air Temperature	degrees Celsius	10°-80°
Start Up Intake Air Temperature	degrees Celsius	12°-42°C (54°-108°F)
Engine Run Time	Seconds	Varies (since start up)
Fuel Level Sensor	Volt	0.4-4.5
Fuel Gauge	On / Off	-
Park/Neutral	Yes / No	-
EVAP Purge Solenoid	%	0-100
EVAP Vent Solenoid	On / Off	-
EVAP Tank Vacuum	in H_2O = n(25/65535)7.5	
Fuel Tank Vacuum Sensor	Volt	0.0-5.0
Throttle Position	%	0% (up to 100% at wide open throttle)
Throttle Position	Volts	0.200-0.900v (up to 5.0 at wide open throttle)
IAC Position	Counts	5-60
BPW Bank 1	ms	0-999.9
Air Fuel Ratio	x:1	0:1-25.5:1
Spark	Degrees	64 to -64
MAP	kPa	25-35 kPa
BARO	kPa	65-100 kPa (varies with altitude and with the BARO pressure)
Calculated Load	%	0-100
Vehicle Speed	km/h	0-255
Oxygen Sensor Bank 1 Sensor 1	mV	0-1132
Oxygen Sensor Bank 1 Sensor 2	mV	0-1132

EVAP Service Bay Test
F5: Functional Tests-F5: Outputs-F5: EVAP Service Bay Test
All

Parameter	Units Displayed	Typtical Data Value
EVAP Service Bay Test State	see PID table 4	-
EVAP Service Bay Test Min. TPS	%	0-100
Throttle Position	%	0-100
EVAP Service Bay Test Max. TPS	%	0-100
EVAP Service Bay Test Abort Reason	see PID table 5	-
EVAP Service Bay Test Results	see PID table 6	-
EVAP Purge Solenoid	%	0-100

EVAP Service Bay Test (Cont'd)

Parameter	Units Displayed	Typtical Data Value
EVAP Vent Solenoid	On / Off	-
EVAP Tank Vacuum	in H_2O=n(25/65535)7.5	
Fuel Tank Vacuum Sensor	Volt	0.0-5.0
Engine Speed	rpm	±100 rpm from the Desired rpm
Ignition Voltage	Volts	12.0-15.0
Engine Coolant Temperature	degrees Celsius	85°-115
Start Up Coolant Temperature	degrees Celsius	4°-34°C (39°-93°F)
Intake Air Temperature	degrees Celsius	10°-80°C (50°-176°F)
Start Up Intake Air Temperature	degrees Celsius	12°-42°C (54°-108°F)
Engine Run Time	Seconds	00:00:00-18:12:15 (hours:minutes:seconds)
Fuel Level Sensor	Volt	0.4-4.5
Fuel Gauge	On / Off	-

EGR Data Display

Selected by 2: Data Display 2: Specific Data 2: EGR

All Displays EGR01

Parameter	Units Displayed	Typtical Data Value
Engine Speed	rpm	±100 rpm from the Desired rpm
Ignition Voltage	Volts	12.0-15.0
IAC Position	Counts	0-255
Engine Coolant Temperature	degrees Celsius	85°-115°C (185°-239°F)
Throttle Position	%	0% (up to 100% at wide open throttle)
Throttle Position	Volts	0.200-0.900V (up to 5.0 at wide open throttle)
EGR Actual Position	%	0%
EGR Desired Position	%	0-100%
EGR Feedback	Volt	
EGR Closed Pintle Position	Counts	
EGR Trip Sample Count	Tests	
EGR EWMA Threshold	N	
EGR EWMA	Counts	
EGR Pintle Position Error	Counts	
Engine Run Time	Seconds	00:00:00-18:12:15 (hours:minutes:seconds)
BPW Bank 1	ms	0-999.9
Air Fuel Ratio	x:1	0:1-25.2:1
Spark	Degrees	64 to -64
MAP	kPa	25-35 kPa
BARO	kPa	65-100 kPa (varies with altitude and with the BARO pressure)
Calculated Load	%	0-100
Vehicle Speed	mph	0-255

Oxygen Sensor Data Display
Selected by F2: Data Display F2: Specific Data F4: Oxygen Sensors
All Displays O2SO1

Parameter	Units Displayed	Typtical Data Value
Engine Speed	rpm	±100 rpm from the Desired rpm
Engine Run Time	N	00:00:00-18:12:15 (hours:min-utes:seconds)
Loop Status	Open / Closed	-
O2S 1 Bank 1 Sensor 1	mv	0-1132
O2S 1 Bank 1 Sensor 1	0=Not Ready, 1=Ready	-
Rich/Lean Bank 1	0=Lean, 1=Rich	-
Injector Pulse Bank 1	msec	
Start Up Coolant Temperature	degrees Celsius	4°-34°C (39°-93°F)
Engine Coolant Temperature	degrees Celsius	85°-115°C (185°-239°F)
Start Up Intake Air Temperature	degrees Celsius	12°-42°C (54°-108°F)
Intake Air Temperature	degrees Celsius	10°-80°C (50°-176°F)
O2S 1 Time to Activity Bank 1 Sensor 1	Seconds	
Short Term FT Bank 1	%	-100 to 100
Long Term FT Bank 1	%	-100 to 100
TP Angle	%	0-100
Calculated Air Flow	g/sec=n/128	0-512
MAP	kPa	25-35 kPa
EVAP Purge PWM	%	0-100
Ignition 1	Volts	12.0-15.0
Air Fuel Ratio	x:1	0:1-25.5:1
Decel Fuel Mode	0=Inactive, 1=Active	-
Power Enrichment	0=Inactive, 1=Active	-
HO2S 2 Warm Up Time Bank 1 Senor 1	Seconds	
HO2S 2 Bank 1 Sensor 2	mV	0-1132

Misfire Data Display
Selected by F2: Data Display F2: Specific Data F5: Misfire
All 2.2L Displays MISF01

Parameter	Units Displayed	Typtical Data Value
Misfire Current #1	Count	0-255
Misfire History #1	Count	0-255
Misfire Current #2	Count	0-255
Misfire History #2	Count	0-255
Misfire Current #3	Count	0-255
Misfire History #3	Count	0-255
Misfire Current #4	Count	0-255
Misfire History #4	Count	0-255
Misfire Failures Since First Fail	N	
Misfire Passes Since First Fail	N	
Total Misfire Current Count	Count	0-255
Weak Cylinder	See Table 01	-
Engine Speed	rpm	±100 rpm from the Desired rpm
TP Angle	%	0-100
Calculated Load	%	0-100
Engine Coolant Temperature	degrees Celsius	85°-115°C (185°-239°F)
Intake Air Temperature	degrees Celsius	10°-80°C (50°-176°F)
Cam Activity Counter	Counts	0-255
Spark	Degrees	64 to -64
G Sensor	Volts	
EGR Desired Position	%	0-100%
EGR Actual Position	%	0%
MAP	kPa	25-35 kPa
Vehicle Speed	mph	0-255
Air Conditioning Request	On / Off	-
Air Conditioning Clutch	On / Off	-
Knock Active Counter	Counts	0-255
Knock Retard	Degrees	0-90
Decel Fuel Mode	Yes / No	-
Power Enrichment Mode	Yes / No	-
Injector Pulse Bank 1	msec	
O2S 1 Bank 1 Sensor 1	mV	0-1132
HO2S 2 Bank 2 Sensor 1	mV	0-1132
Short Term FT Bank 1	%	-100 to 100
Long Term FT Bank 1	%	-100 to 100

TEC Display Table
Selected by 5: Engine Outputs 5: Engine Outputs
TEC01

Parameter	Units Displayed	Typtical Data Value
Engine Speed	rpm	±100 rpm from the Desired rpm
TP Angle	%	0-100
Engine Coolant Temperature	degrees Celsius	85°-115°C (185°-239°F)
Intake Air Temperature	degrees Celsius	10°-80°C (50°-176°F)
Cam Activity Counter	N	0-255
Spark	Degrees	64 to -64
MAP	kPa	25-35 kPa
Vehicle Speed	mph	0-255
Decel Fuel Mode	Yes / No	-
Power Enrichment Mode	Yes / No	-
Injector Pulse Bank 1	msec	
Crank Error Latched	Yes / No	-
Sum Out Of Range	Yes / No	-
Opposing Factor Out Of Range	Yes / No	-
Factor Out Of Range	Yes / No	-
Enable Criteria Not Met	Yes / No	-
Cat Damaging Misfire	Yes / No	-
Test is Running	Yes / No	-
Learned This Key Cycle	Yes / No	-
Attempts to Learn	Counts	

ENGINE DATA DISPLAY TABLE DEFINITIONS

ECM Data Description

The following information will assist in diagnosing emission or driveability problems. A first technician can view the displays while the vehicle is being driven by second technician. Refer to Powertrain On-Board Diagnostic (OBD) System Check for addition information.

A/C Clutch

The A/C Relay represents the commanded state of the A/C clutch control relay. The A/C clutch should be engaged when the scan tool displays ON.

A/C Pressure

The A/C High Side displays the pressure value of the A/C refrigerant pressure sensor. The A/C High Side helps to diagnose the diagnostic trouble code (DTC) P0533.

A/C Request

The A/C Request represents whether the air conditioning is being requested from the HVAC selector. The input is received by the instrument panel cluster and then sent over universal asynchronous receiver transmitter (UART) serial data to the ECM and finally to the scan tool over class 2 serial data.

Air Fuel Ratio

The Air Fuel Ration indicates the air to fuel ratio based on the Oxygen Sensor (O2S 1) inputs. The ECM uses the fuel trims to adjust fueling in order to attempt to maintain an air fuel ratio of 14.7:1.

BARO

The Barometric Pressure (BARO) sensor measures the change in the intake manifold pressure which results from altitude changes. This value is updated at ignition ON and also at Wide Open Throttle (WOT).

BPW Bank 1

Indicates the base Pulse Width Modulation (PWM) or ON time of the indicated cylinder injector in milliseconds. When the engine load is increased, the injector pulse width will increase.

Calculated Air Flow

The calculated air flow is a calculation based on manifold absolute pressure. The calculation is used in several diagnostics to determine when to run the diagnostics.

Camshaft Activity Counter

The Camshaft Position (CMP) activity counter displays the activity sent to the ECM from the CMP sensor. The counter will continually increment while the engine is running. The CMP activity counter is helpful in diagnosing DTC P0342.

Desired Idle

The ECM commands the idle speed. The ECM compensates for various engine loads in order to maintain the desired idle speed. The actual engine speed should remain close to the desired idle under the various engine loads with the engine idling.

Coolant Temperature

The Engine Coolant Temperature Sensor (CTS) sends engine temperature information to the ECM. The ECM supplies 5 volts to the engine coolant temperature sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (internal resistance high), the ECM monitors a high voltage which it interprets as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal will decrease and the ECM will interpret the lower voltage as a warm engine.

EGR Desired Position

The desired exhaust gas recirculation (EGR) position is the commanded EGR position. The ECM calculates the desired EGR position. The higher the percentage, the longer the ECM is commanding the EGR valve ON.

Engine Run Time

The engine run time is a measure of how long the engine has been running. When the engine stops running, the timer resets to zero.

Engine Speed

Engine Speed is computed by the ECM from the fuel control reference input. It should remain close to desired idle under the various engine loads with the engine idling.

EVAP Purge

The Evaporative Emission (EVAP) purge valve solenoid is a proportional signal used in order to control the EVAP canister purge function. At 0% the valve is commanded fully closed. 100% implies that the valve is fully open.

EVAP Purge Solenoid

When energized, the EVAP Solenoid allows the fuel vapor to flow from the EVAP canister to the engine. The EVAP Solenoid is normally closed. The EVAP Solenoid is pulse width modulated by the ECM. The EVAP Solenoid reads 0% when closed and 100% when fully opened.

EVAP Vent Solenoid

The EVAP Vent Solenoid allows fresh outside air to the EVAP canister during purge mode. The EVAP Vent Solenoid allows the diagnostic to pull a vacuum on the fuel tank by closing the vent solenoid.

Fan

The Fan Control Relay is commanded by the ECM. The FC Relay displays the command as ON or OFF.

Fuel Level Sensor

The Fuel Level Sensor monitors the fuel level in the tank. The Fuel Level Sensor monitors the rate of change of the air pressure in the EVAP system. Several of the Enhanced EVAP System diagnostics are dependent upon the correct fuel level.

Fuel Tank Pressure Sensor

The fuel tank pressure sensor measures the difference between the pressure or the vacuum in the fuel tank and the outside air pressure. When the air pressure in the fuel tank equals the outside air pressure, the output voltage of the sensor is 1.3 to 1.7 volts.

IAC Position

The scan tool displays the ECM command for the Idle Air Control (IAC) pintle position in counts. The higher the number of counts, the greater the commanded idle speed reads. The Idle Air Control responds to changes in the engine load in order to maintain the desired idle rpm.

Intake Air Temperature

The ECM converts the resistance of the Intake Manifold Air Temperature (MAT) sensor to degrees in the same manner as the Engine Coolant Temperature Sensor (CTS). Intake air temperature is used by the ECM to adjust fuel delivery and spark timing according to incoming air density.

Ignition 1 (Voltage)

The ignition volts represent the system voltage measured by the ECM at the ignition feed circuit.

Knock Retard

The Knock Sensor (KS) Retard indicates the amount of spark advance the ECM is decreasing in response to the KS signal.

Knock Present

The KS Noise Channel indicates when the ECM detects the KS signal. The ECM should display NO at idle.

Calculated Load

Indicates engine load based on manifold absolute pressure. The higher the percentage, the more load the engine is under.

Long Term FT

The Long Term Fuel Trim (FT) is derived from the short term fuel trim value. The Long Term FT is used for the long term correction of the fuel delivery. A value of 128 counts (0%) indicates that the fuel delivery requires no compensation in order to maintain a 14.7:1 air to fuel ratio. A value below 128 counts means that the fuel system is too rich and the fuel delivery is being reduced. The ECM is decreasing the injector pulse width. A value above 128 counts indicates that a lean condition exists for which the ECM is compensating.

Long Term FT Average

Long Term FT Average is derived from the long term fuel trim from all of the cells. The ECM then takes all of the values and then creates one average value.

Loop Status

The Closed Loop is displayed indicating that the ECM is controlling the fuel delivery according to the Oxygen Sensor (O2S 1) voltage as close to an air/fuel ratio of 14.7 to 1 as possible.

MAP

The Manifold Absolute Pressure (MAP) sensor measures the change in the intake manifold pressure which results from engine load and speed changes. As the intake manifold pressure increases, the air density in the intake also increases and the additional fuel is required.

Misfire Current #14

Indicates the number of current misfires that are present in the indicated cylinder. Increments only when misfire is current.

Misfire History #14

Indicates the number of misfires that have occurred after 195 current misfires have been counted. The current misfire counter will add its misfires to the history misfire counter after 195 total misfires have taken place. If 1 cylinder is misfiring, the misfiring current counter will have 195 misfires counted before adding to its history counter. If 2 cylinders are misfiring, the misfiring current counter will add to their history counters after 97 misfires. The counter increments only after a misfire diagnostic trouble code (DTC) has been set.

Oxygen Sensor Bank 1 Sensor 1

The pre-converter Oxygen Sensor (O2S 1) reading represents the exhaust oxygen sensor output voltage. This voltage will fluctuate constantly between 100 mv (lean exhaust) and 900 mv (rich exhaust) when the system is operating in a Closed Loop.

Oxygen Sensor Bank 1 Sensor 2

The post-converter Heated Oxygen Sensor (HO2S 2) represents the exhaust oxygen output voltage past the catalytic converter. This voltage remains inactive, or the voltage will appear lazy within a range of 100 mv (lean exhaust) and 900 mv (rich exhaust) when operating in a Closed Loop.

Short Term FT

The Short Term FT represents a short term correction to fuel delivery by the ECM in response to the amount of time the oxygen sensor voltage spends above or below the 450 mv threshold. If the oxygen sensor has mainly been below 450 mv, indicating a lean air/fuel mixture, short term fuel trim will increase to tell the ECM to add fuel. If the oxygen sensor voltage stays mainly above the threshold, the ECM will reduce fuel delivery to compensate for the indicated rich condition.

Short Term FT Average

The Short Term FT Average is derived from the short term fuel trim from all of the cells. The ECM takes all of the values and then creates one average value.

Spark

This is a display of the spark advance Ignition Coil calculation which the ECM is programming in the ignition system. It computes the desired spark advance using data such as engine temperature, rpm, engine load, vehicle speed and operating mode.

Total Misfire Current Counter

Indicates the total number of misfires that have been detected in all the cylinders after 100 engine cycles. One cycle equals one complete 4 stroke cycle. The total misfire only increments during the steady state cruise conditions.

TP Angle

From the Throttle Position Sensor (TPS) voltage input, the ECM computes the TPS. The TPS Angle will auto zero to 0% at idle (TPS voltage below 0.90 volt). The TPS Angle will read 100% at WOT.

TPS

The ECM uses the TPS in order to determine the amount of the throttle demanded by the vehicle's operator. The TPS reads between 0.360.96 volts at idle to above 4 volts at WOT.

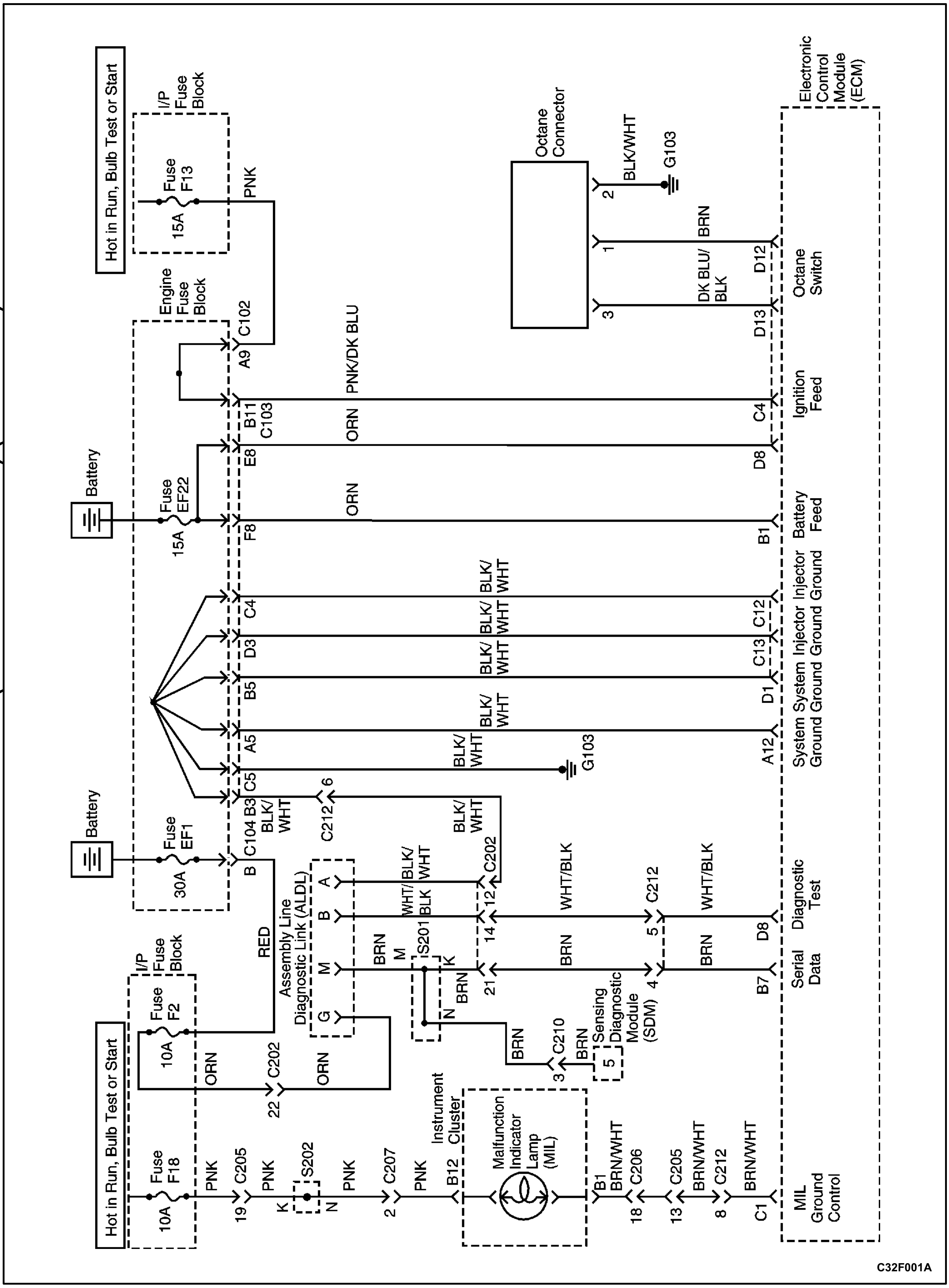
Vehicle Speed

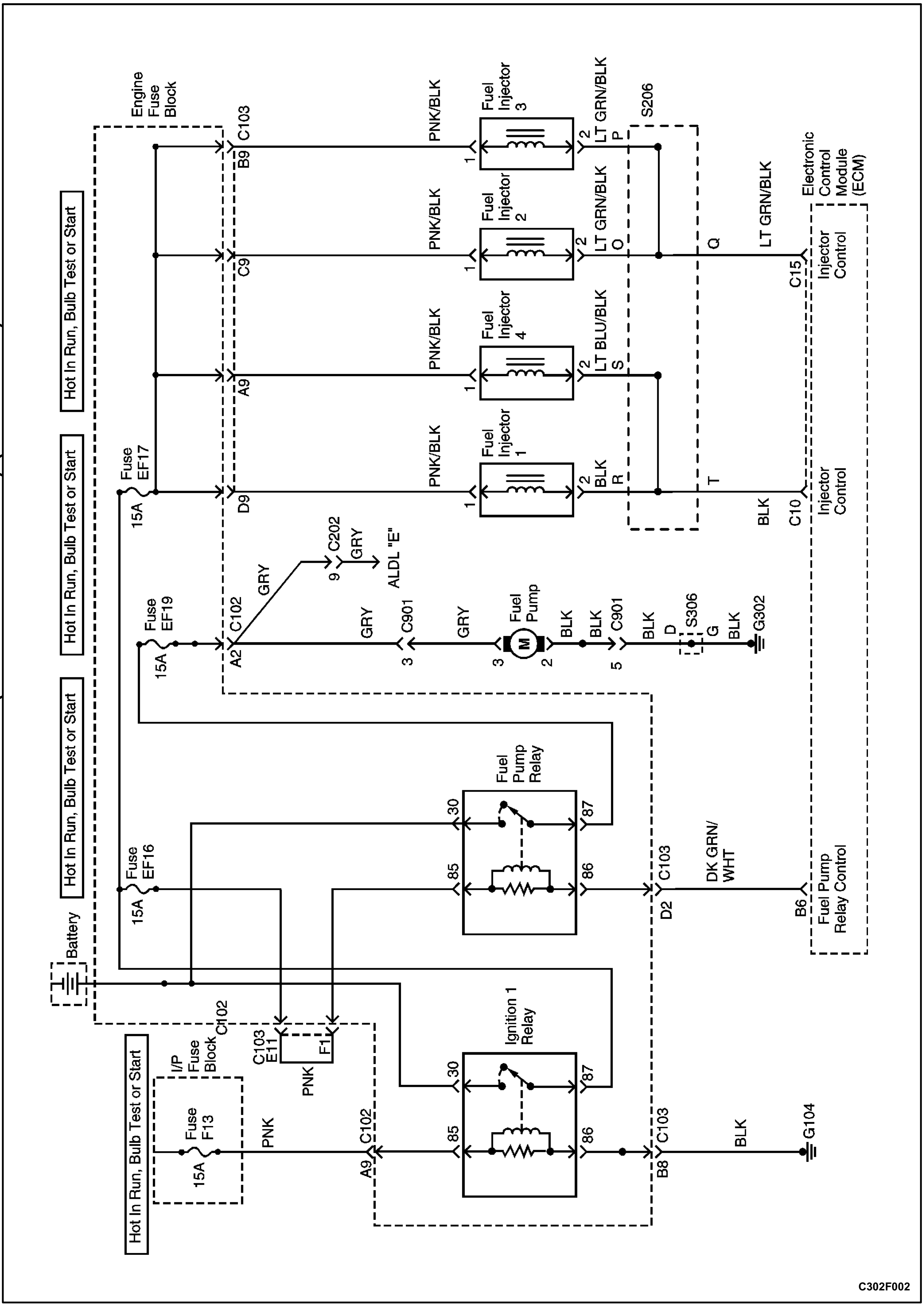
The vehicle speed sensor signal is converted into mph or km/h for display. The vehicle speed output from the ECM is 4000 pulses per mile. The scan tool uses the class 2 serial data from the ECM to obtain vehicle speed, while the Instrument Panel Cluster, cruise control module and the chime alarm module use the 4000 ppm output.

FASTENER TIGHTENING SPECIFICATIONS

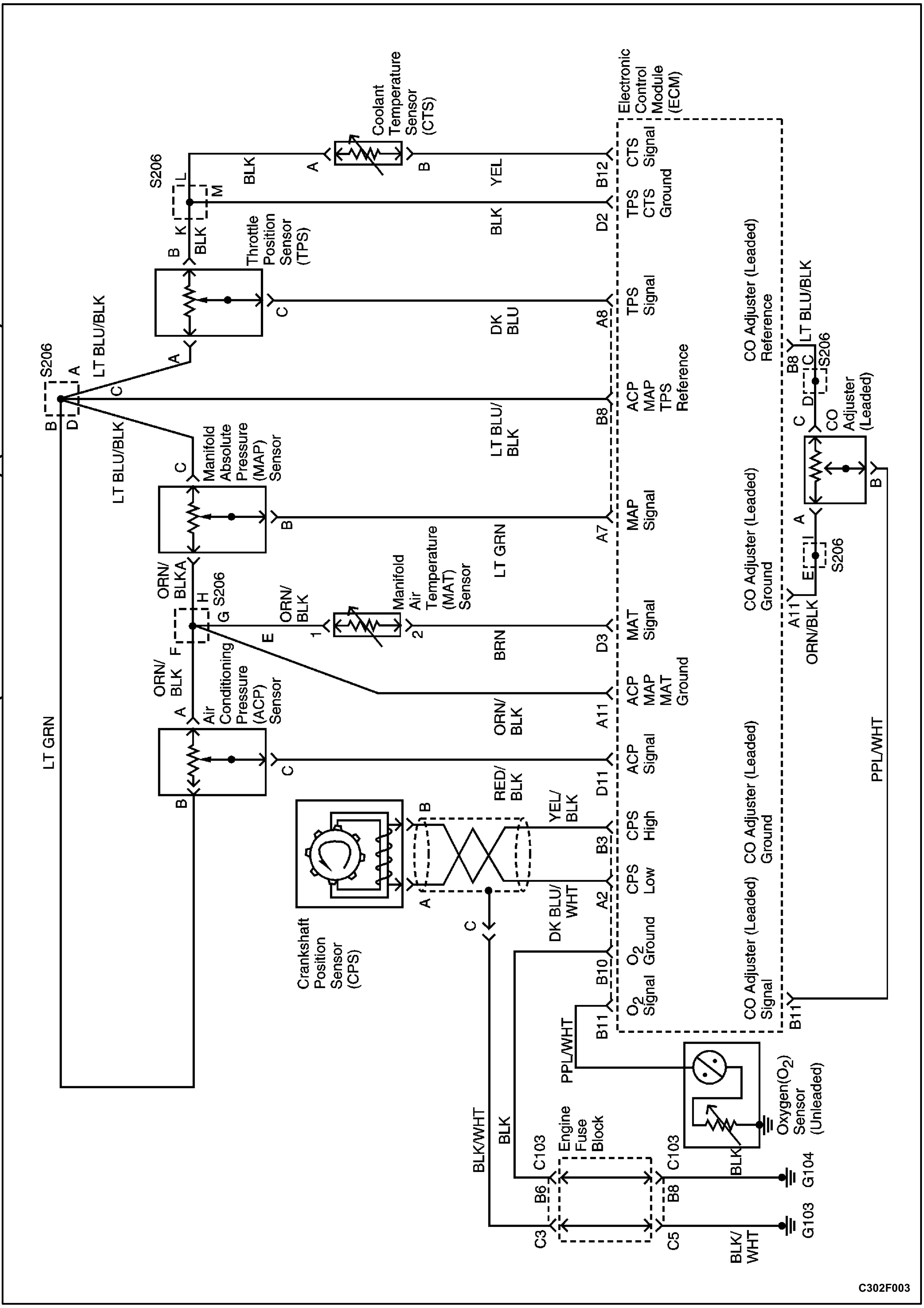
Application	N•m	Lb•Ft	Lb•In
Accessory Mounting Bracket Bolts	35	26	-
Camshaft Position Sensor Bolts	12	-	106
Controlled Canister Purge Solenoid Bracket Bolts	5	-	44
Coolant Temperature Sensor	25	18	-
Crankshaft Position Sensor (CPS) Retaining Bolt	10	-	89
Direct Ignition System (DIS) Ignition Coil Retaining Bolts	10	-	89
Evaporative Emission Canister Flange Bolt	20	15	-
Evaporative Emission Canister Protective Cover	8	-	71
Evaporative Emission Canister Purge Solenoid Bracket Bolts	5	-	44
Exhaust Gas Recirculation (EGR) Valve Retaining Bolts	20	15	-
Fuel Cutoff Switch Bolt	3	-	27
Fuel Injector Cover Bolts	10	-	89
Fuel Pressure Regulator Retaining Bolt	10	-	89
Fuel Pressure Regulator Retaining Clamp	12	-	106
Fuel Rail Retaining Bolts	25	18	-
Fuel Tank Strap Retaining Nuts	13	-	115
Heated Oxygen Sensor	41	30	-
Idle Air Control (IAC) Valve Retaining Bolts	3	-	27
Knock Sensor Bolt	20	15	-
Manifold Air Temperature (MAT) Sensor	20	15	-
Manifold Absolute Pressure (MAP) Sensor Retaining Bolt	10	-	89
Oxygen Sensor	41	30	-
Rear A/C Compressor Mounting Bracket Bolts	35	26	-
Throttle Body Retaining Nuts (DOHC)	9	-	80
Throttle Body Retaining Nuts (SOHC)	15	11	-
Throttle Cable Bracket Bolts	10	-	89
Throttle Position Sensor Retaining Bolts	2	-	18

SCHEMATIC AND ROUTING DIAGRAMS (2.0L SOHC/DOHC)

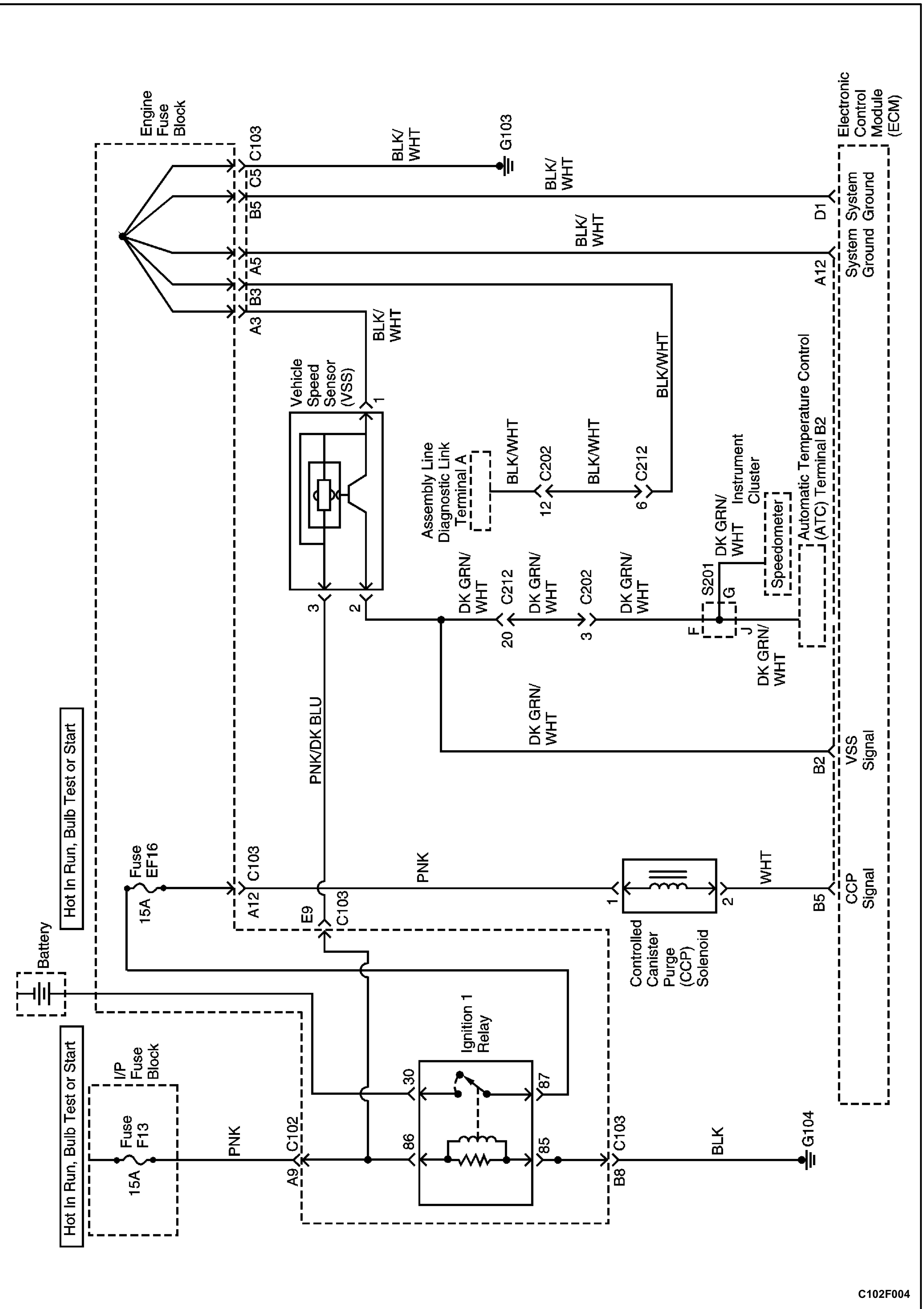



ECM WIRING DIAGRAM (2.0 SOHC - 2 OF 5) (IEFI6 ECM)
Hot In Run, Bulb Test or Start
Hot In Run, Bulb Test or Start
Hot In Run, Bulb Test or Start
Hot In Run, Bulb Test or Start
Hot In Run, Bulb Test or Start
Engine Fuse Block
Battery
Fuse EF17
15A
Fuse EF19
15A
Fuse EF16
15A
I/P Fuse Block
Fuse F13
15A
C103
B9
C9
A9
D9
C102
A2
C202
9
GRY
ALDL "E"
PNK/BLK
Fuel Injector 3
Fuel Injector 2
Fuel Injector 4
Fuel Injector 1
LT GRN/BLK
LT BLU/BLK
BLK
P
O
S
R
S206
Q
T
LT GRN/BLK
Electronic Control Module (ECM)
C15
Injector Control
C10
Injector Control
GRY
C901
Fuel Pump
BLK
C901
S306
D
G
G302
Fuel Pump Relay
30
85
87
86
C103
D2
DK GRN/WHT
B6
Fuel Pump Relay Control
C103
E11
F1
C102
PNK
Ignition 1 Relay
A9
B8
G104
C302F002

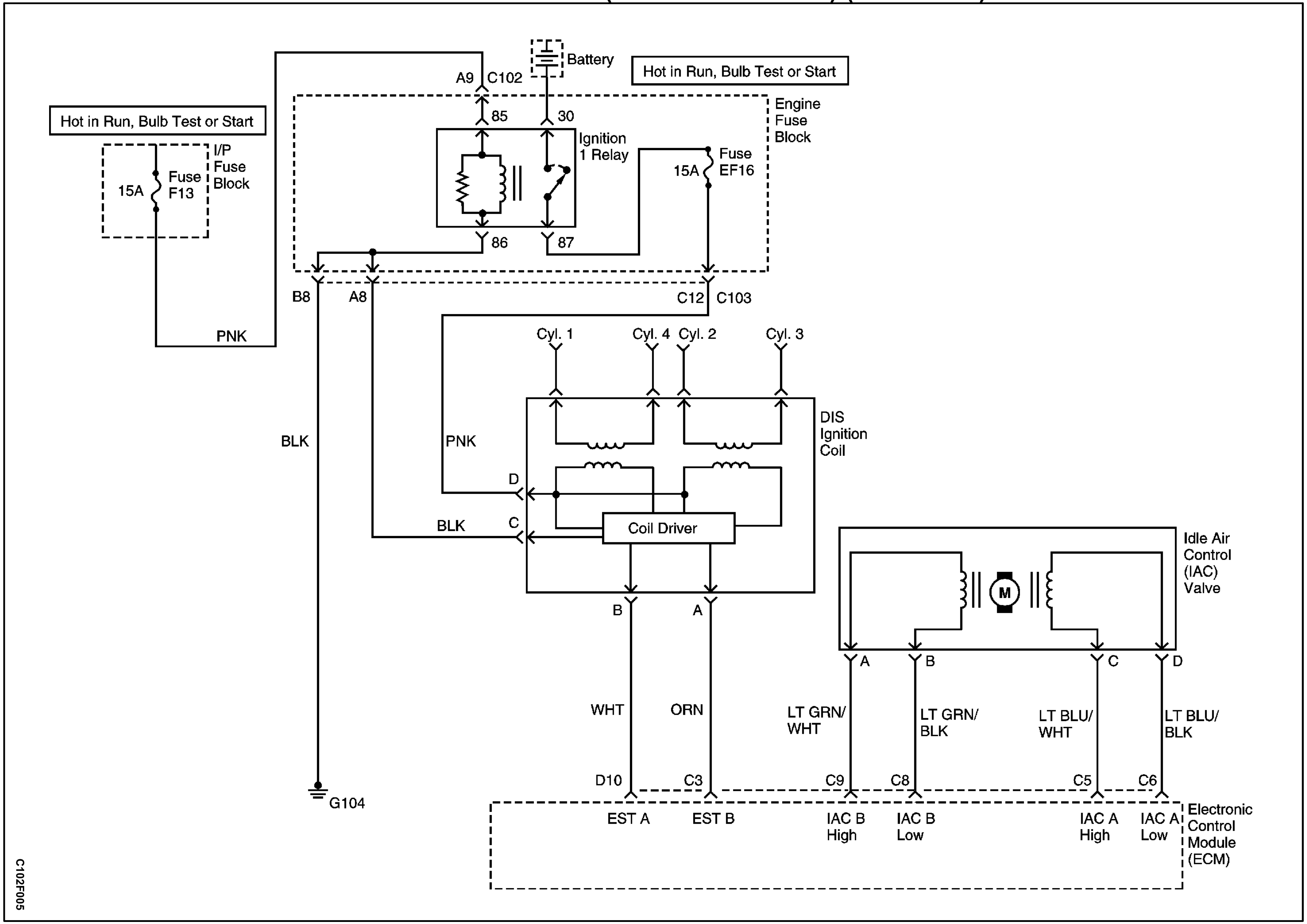
ECM WIRING DIAGRAM (2.0 SOHC - 3 OF 5) (IEFI6 ECM)



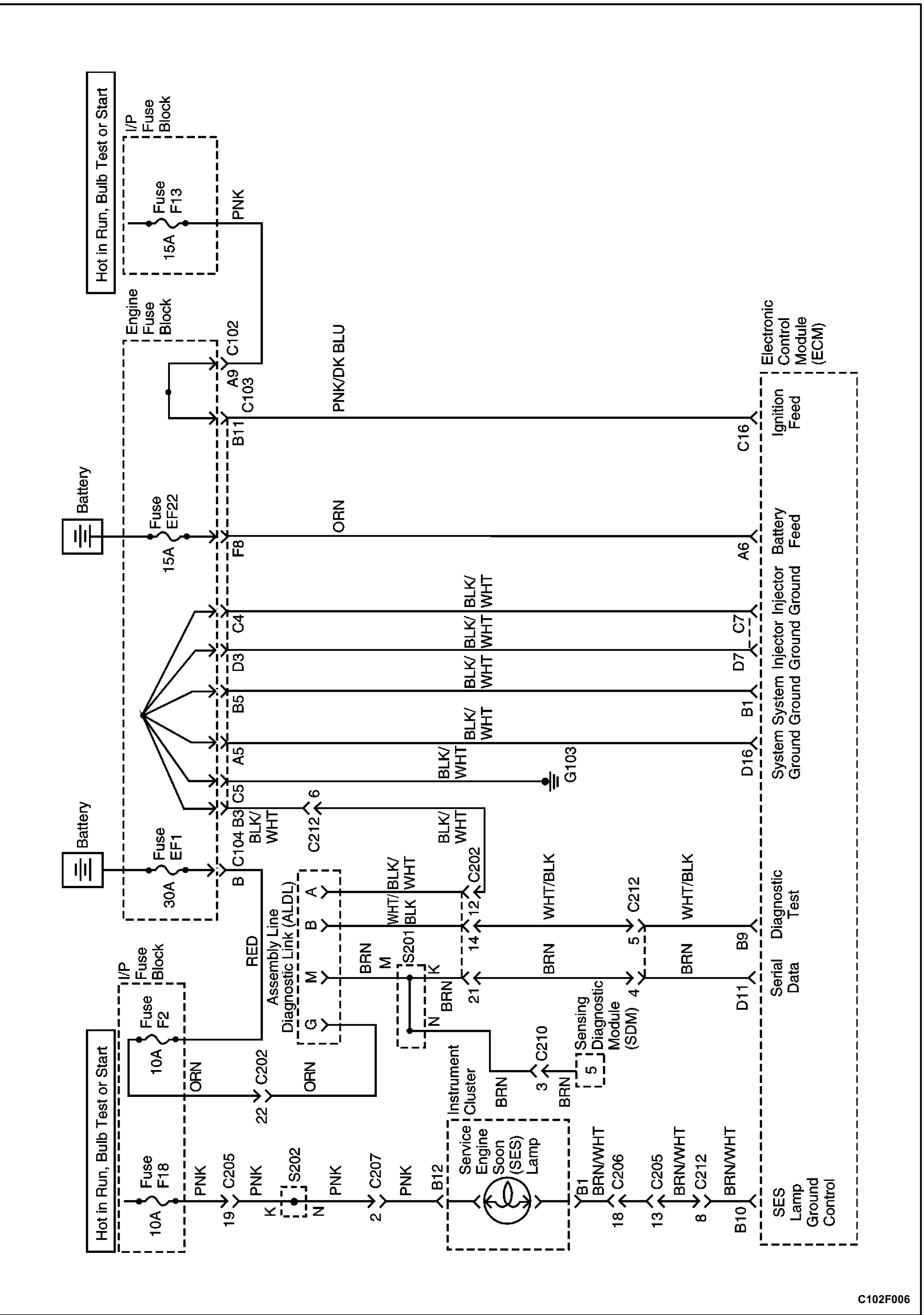
ECM WIRING DIAGRAM (2.0 SOHC - 4 OF 5) (IEFI6 ECM)



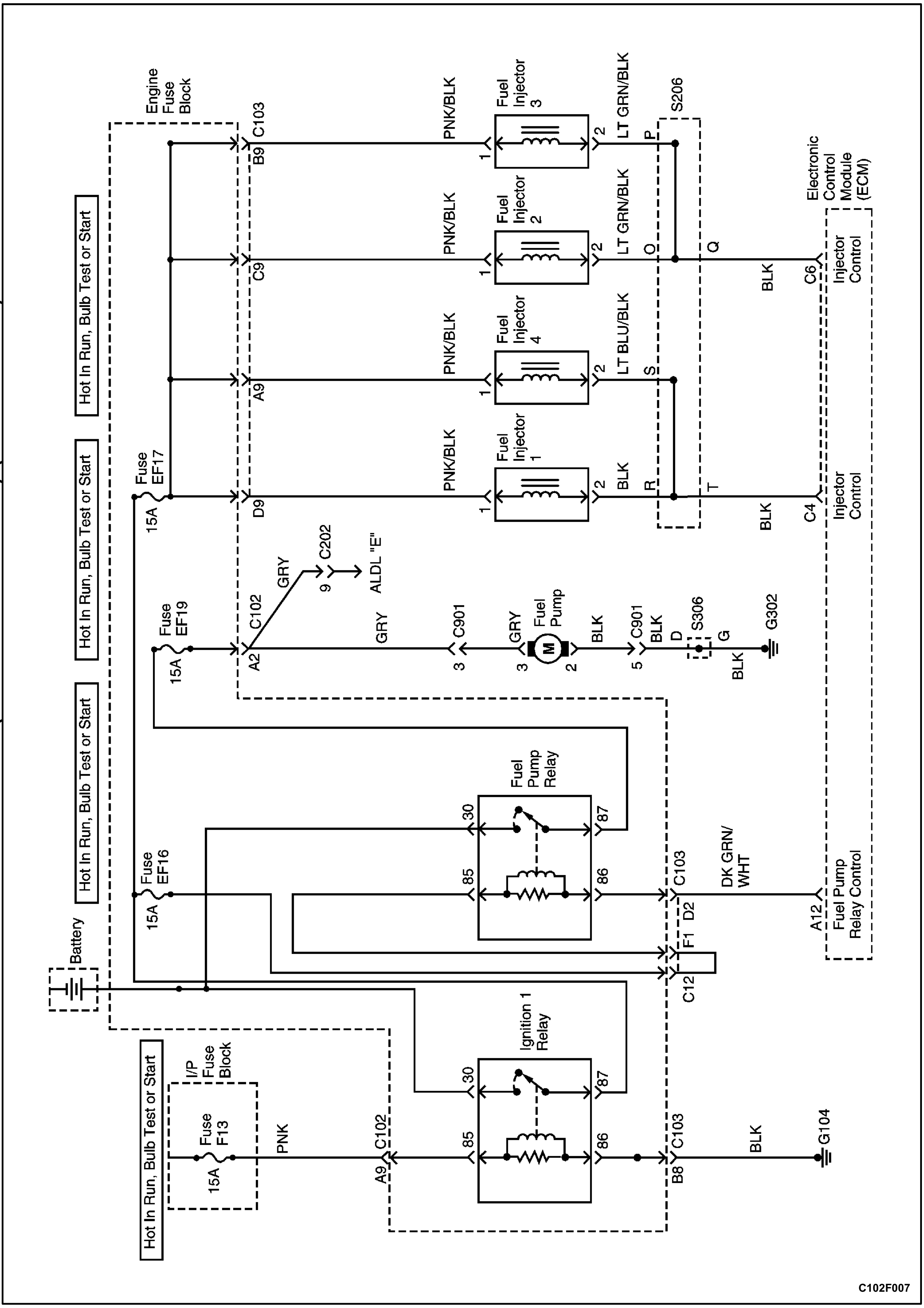
ECM WIRING DIAGRAM (2.0 SOHC - 5 OF 5) (IEFI6 ECM)

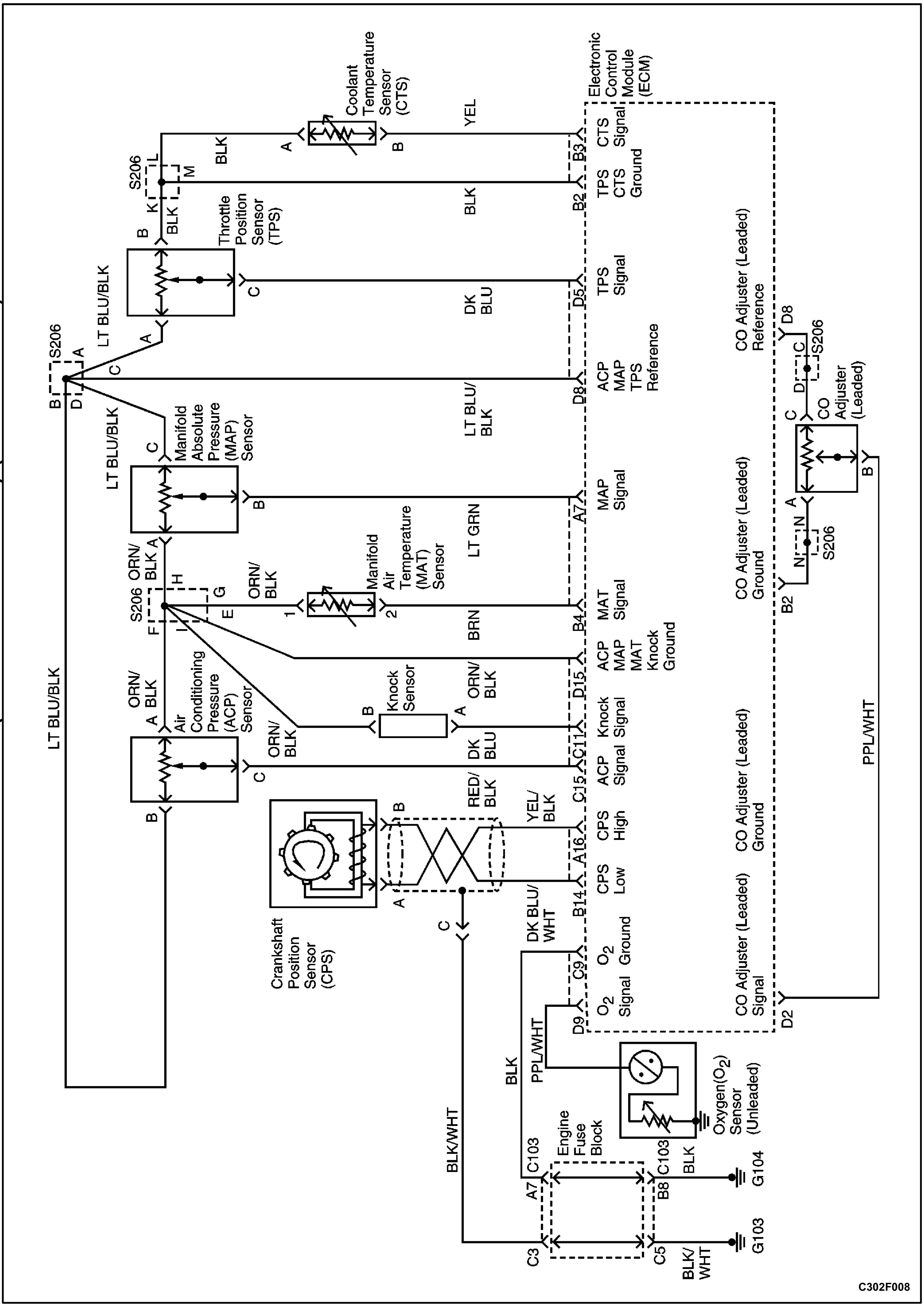


ECM WIRING DIAGRAM (2.0L DOHC - 1 OF 5) (ITMS6F ECM)

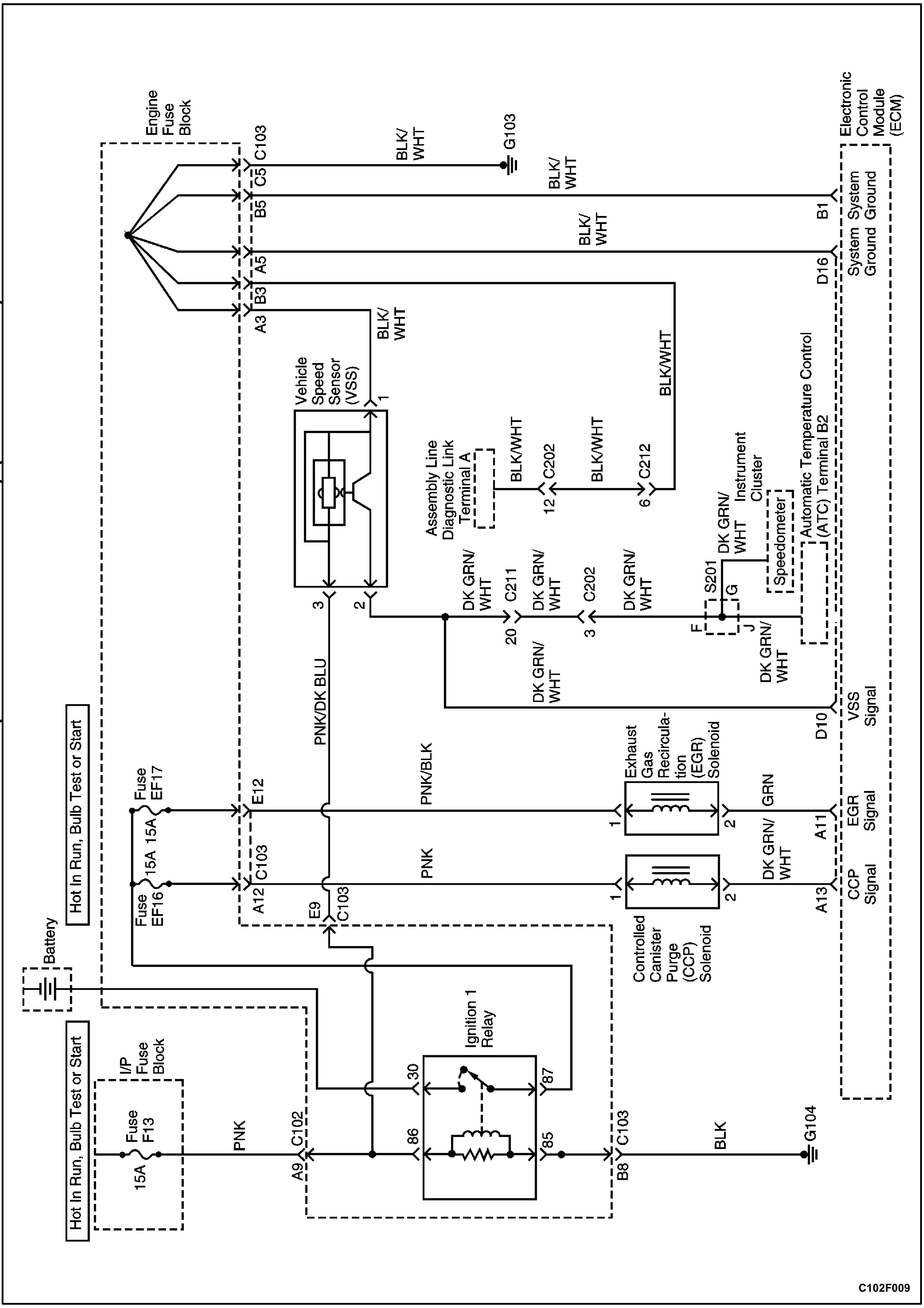


ECM WIRING DIAGRAM (2.0L DOHC - 2 OF 5) (ITMS6F ECM)

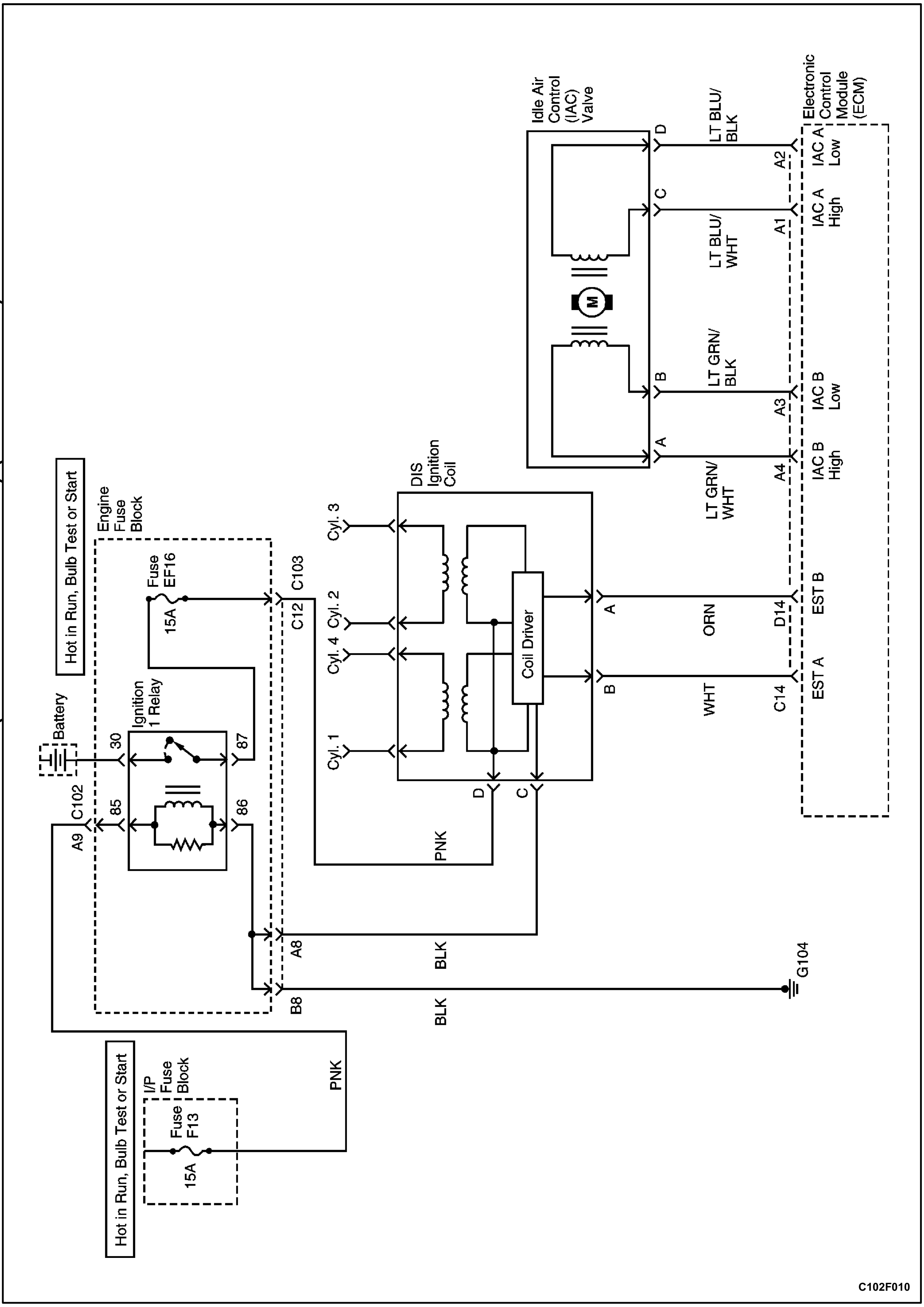



ECM WIRING DIAGRAM (2.0L DOHC - 3 OF 5) (ITMS6F ECM)
Coolant Temperature Sensor (CTS)
Electronic Control Module (ECM)
Throttle Position Sensor (TPS)
Manifold Absolute Pressure (MAP) Sensor
Manifold Air Temperature (MAT) Sensor
Air Conditioning Pressure (ACP) Sensor
Knock Sensor
Crankshaft Position Sensor (CPS)
Oxygen(O_2) Sensor (Unleaded)
CO Adjuster (Leaded)
Engine Fuse Block
S206
C103
G104
G103
CTS Signal
TPS CTS Ground
TPS Signal
ACP MAP TPS Reference
MAP Signal
MAT Signal
ACP MAP MAT Knock Ground
Knock Signal
ACP Signal
CPS High
CPS Low
O_2 Ground
O_2 Signal
CO Adjuster (Leaded) Reference
CO Adjuster (Leaded) Ground
CO Adjuster (Leaded) Signal
YEL
BLK
DK BLU
LT BLU/BLK
LT GRN
BRN
ORN/BLK
RED/BLK
YEL/BLK
DK BLU/WHT
PPL/WHT
BLK/WHT
C302F008

ECM WIRING DIAGRAM (2.0L DOHC - 4 OF 5) (ITMS6F ECM)

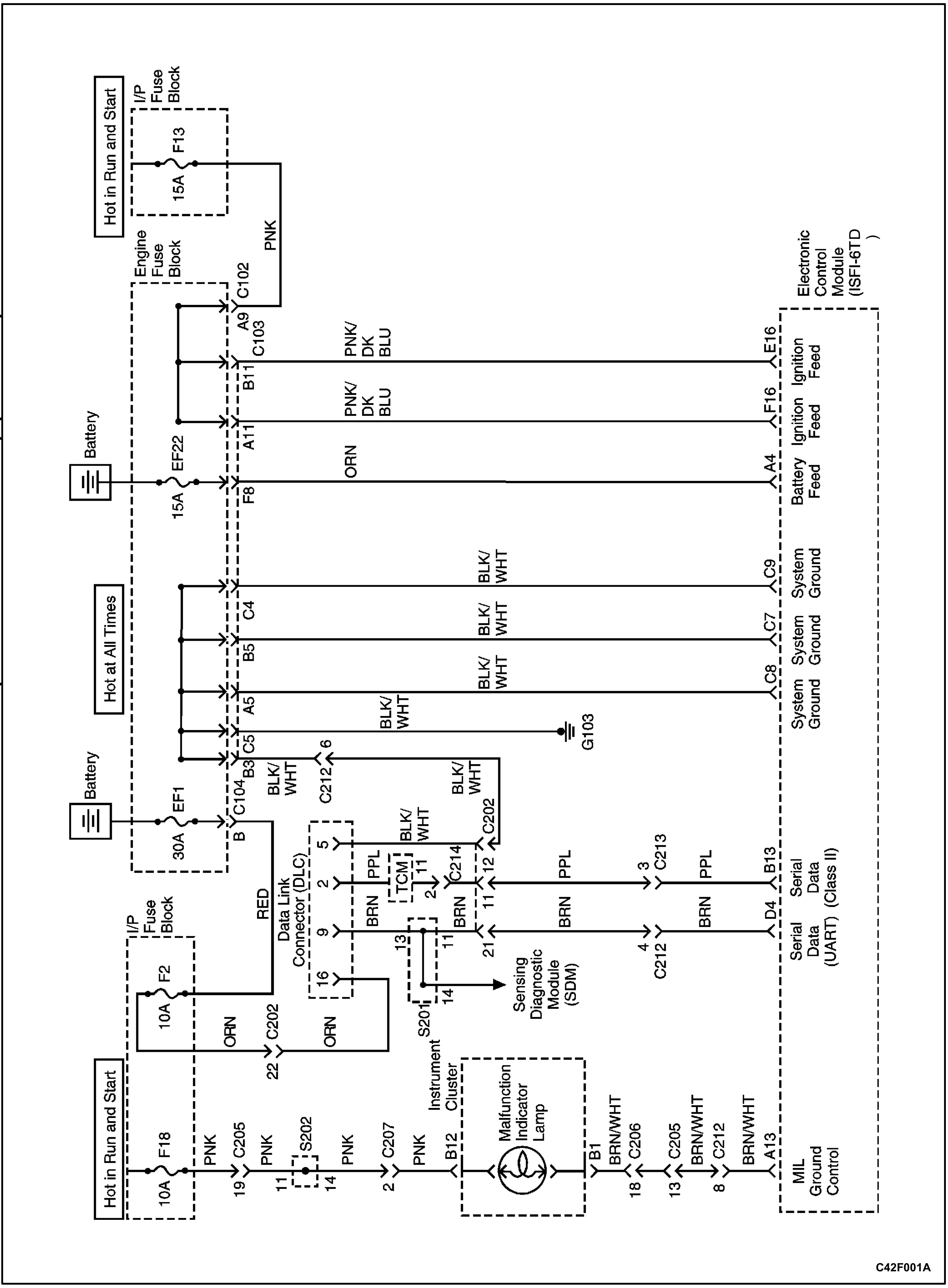


ECM WIRING DIAGRAM (2.0L DOHC - 5 OF 5) (ITMS6F ECM)

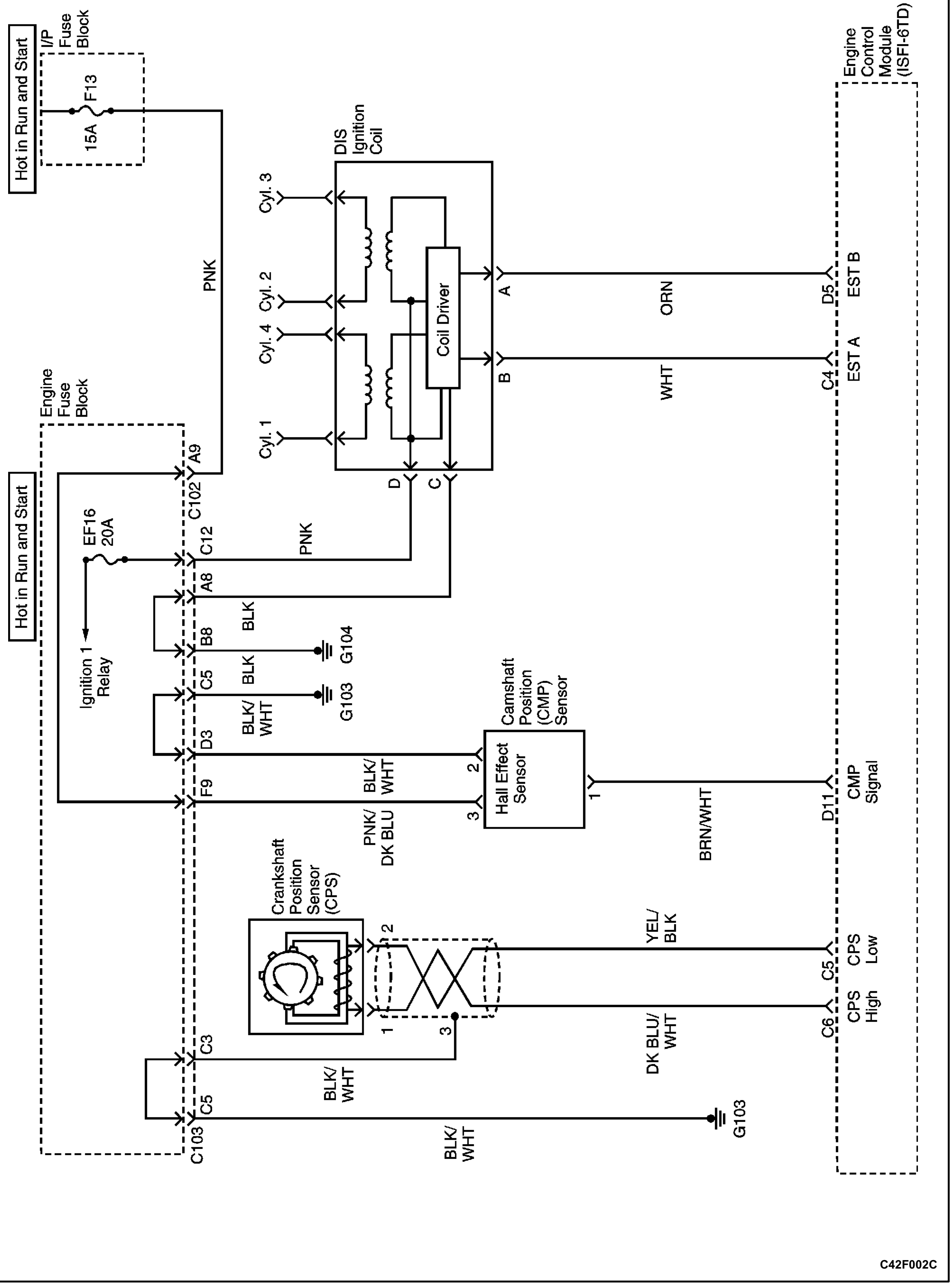


SCHEMATIC AND ROUTING DIAGRAMS (2.2L DOHC)

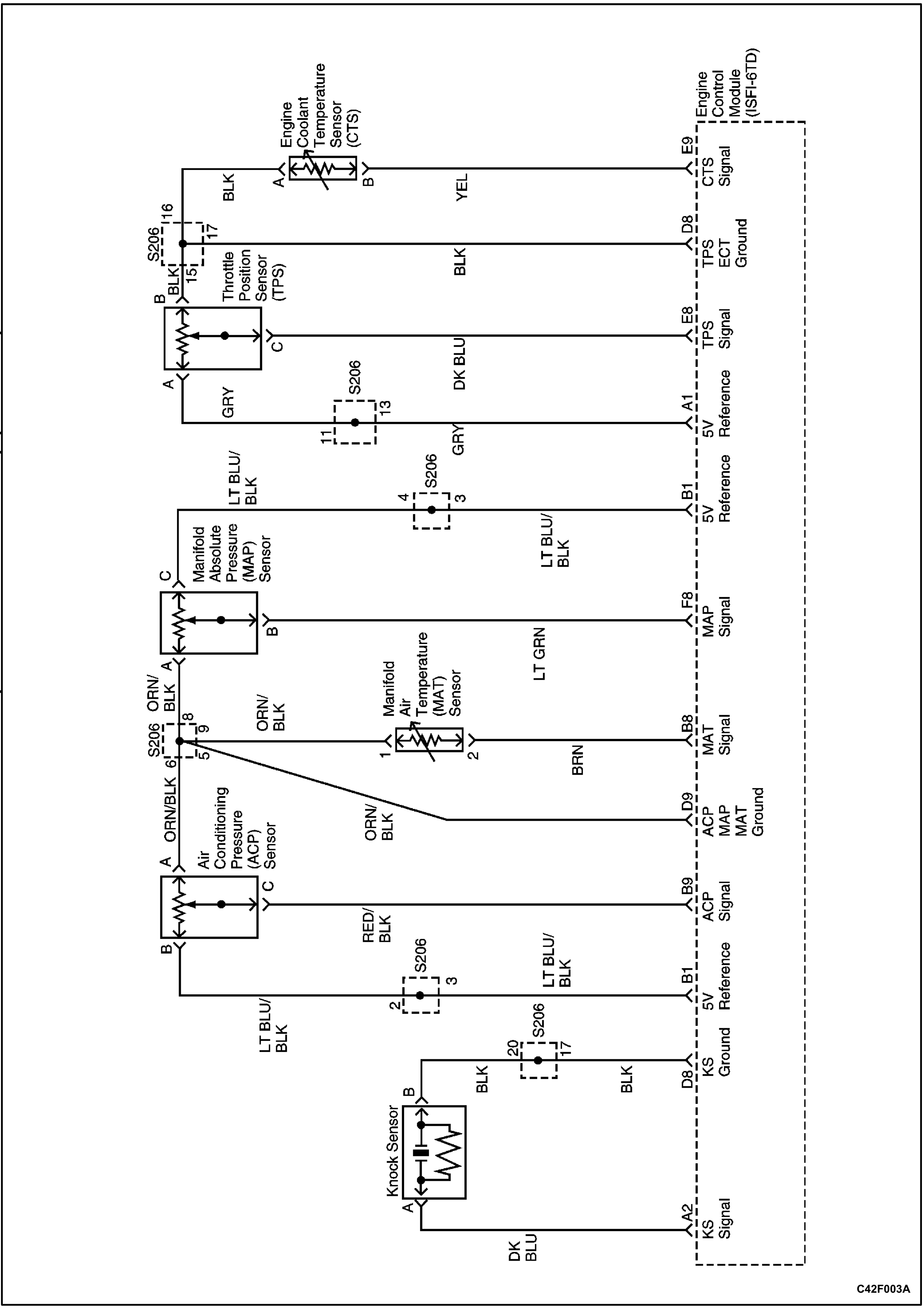
ECM WIRING DIAGRAM (2.2L DOHC - 1 OF 6) (ISFI6TD)



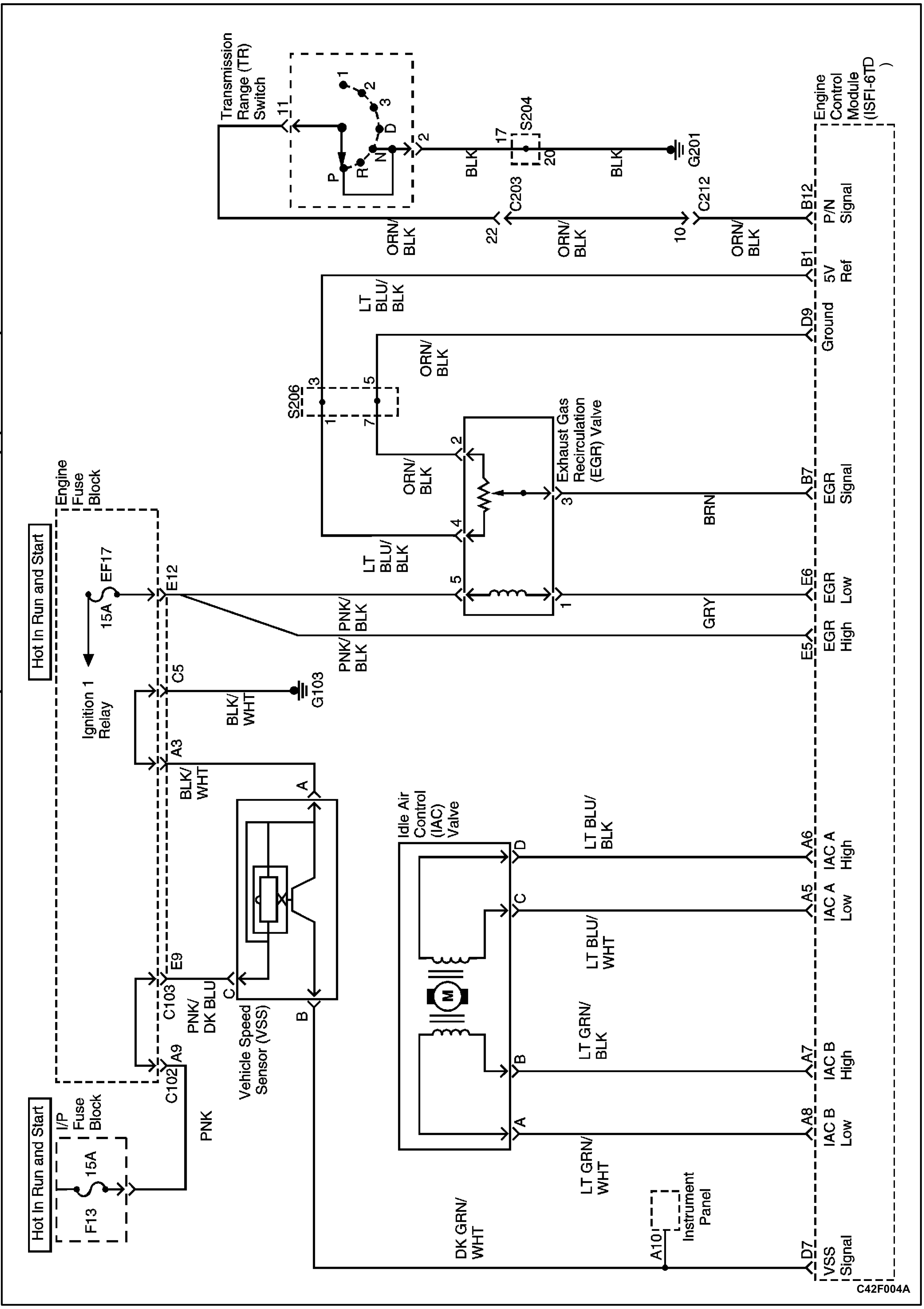
ECM WIRING DIAGRAM (2.2L DOHC - 2 OF 6) (ISFI6TD)



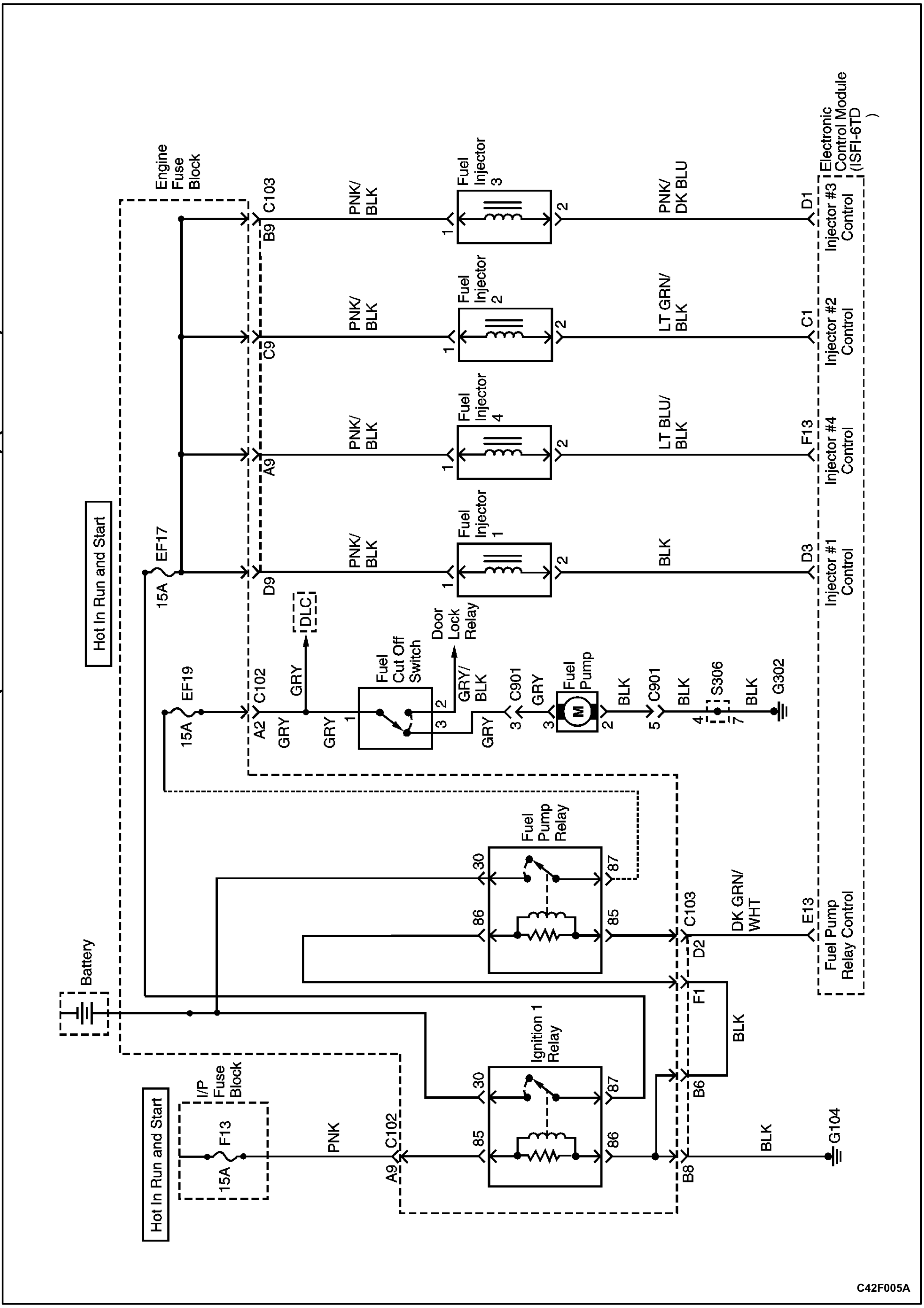
ECM WIRING DIAGRAM (2.2L DOHC - 3 OF 6) (ISFI6TD)



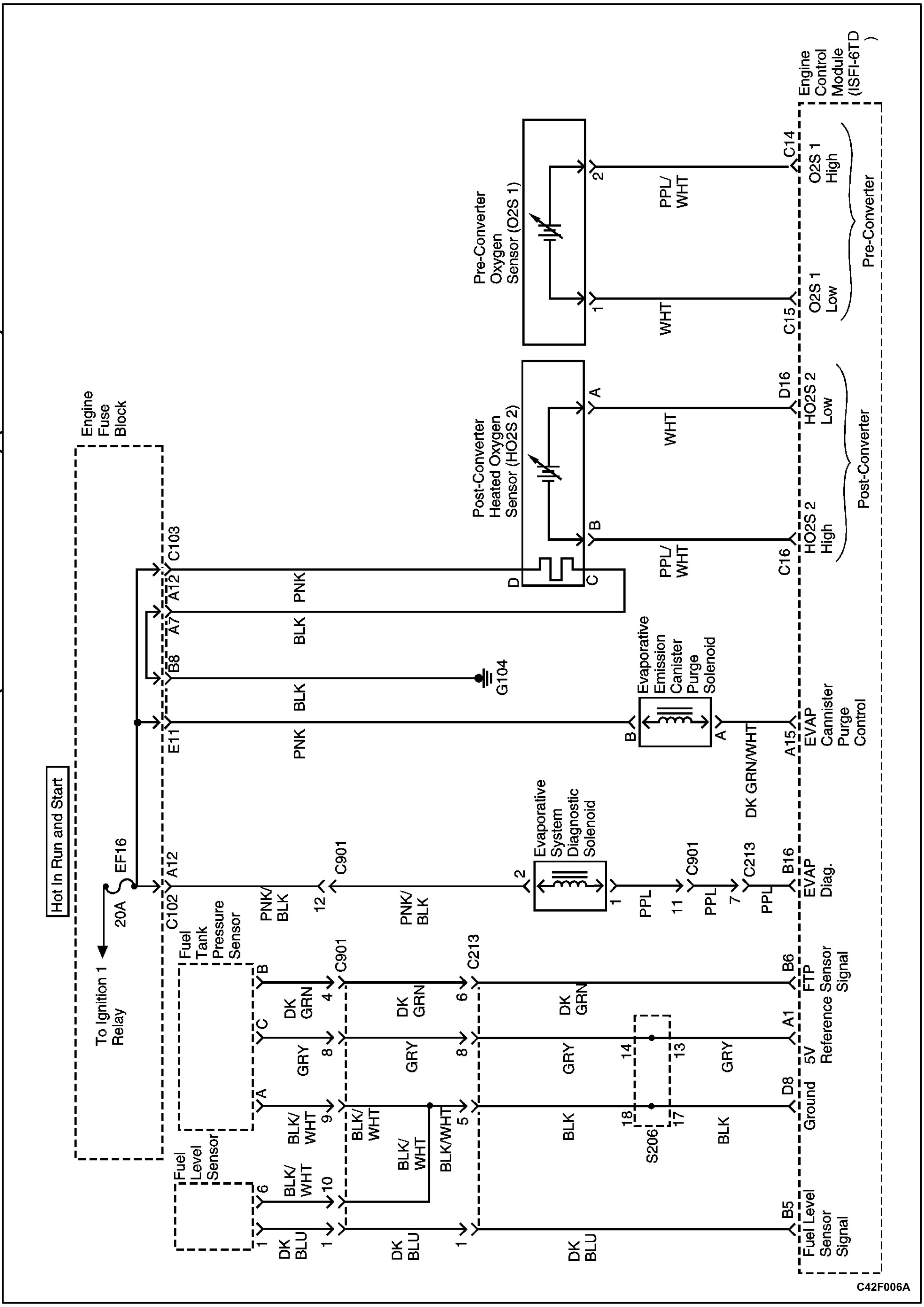
ECM WIRING DIAGRAM (2.2L DOHC - 4 OF 6) (ISFI6TD)



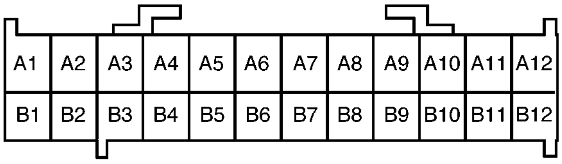
ECM WIRING DIAGRAM (2.2L DOHC - 5 OF 6) (ISFI6TD)



ECM WIRING DIAGRAM (2.2L DOHC - 6 OF 6) (ISFI6TD)

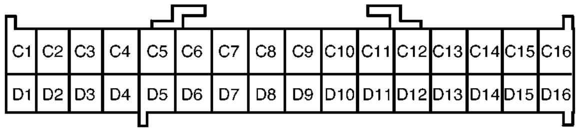


CONNECTOR END VIEW



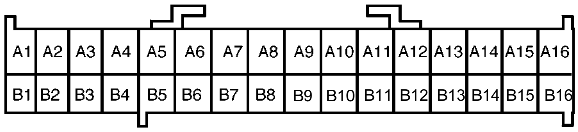
Electronic Control
Module (ECM) 24 Pin
Connector
(2.0L SOHC)

C302F086



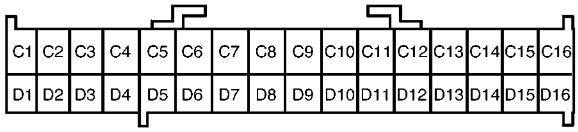
Electronic Control
Module (ECM) 32 Pin
Connector
(2.0L SOHC)

C302F085



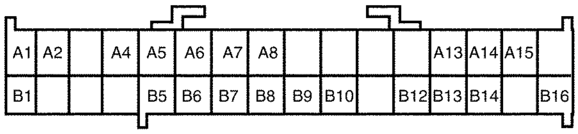
Electronic Control
Module (ECM) J2 (Red)
Connector
(2.0L DOHC)

C302F083



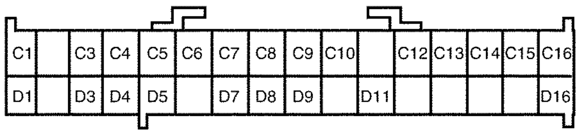
Electronic Control
Module (ECM) J1 (White)
Connector
(2.0 L DOHC)

C302F084



Engine Control
Module (ECM) J1 (Red)
Connector
(2.2L DOHC)

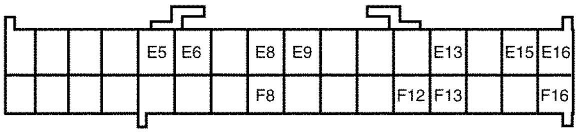
C402F008



Engine Control
Module (ECM) J2 (White)
Connector
(2.2L DOHC)

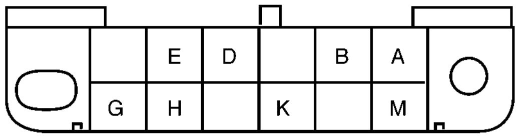
C402F009

CONNECTOR END VIEW (Cont'd)



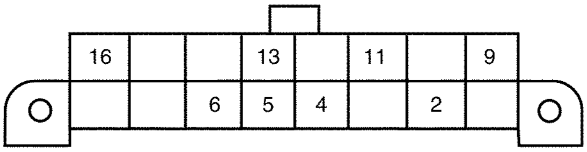
Engine Control
Module (ECM)
(Blue) Connector
(2.2L DOHC)

C402F010



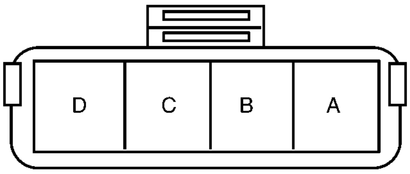
Assembly Line
Diagnostic Link
(ALDL)
(2.0L SOHC/DOHC)

C32F091A



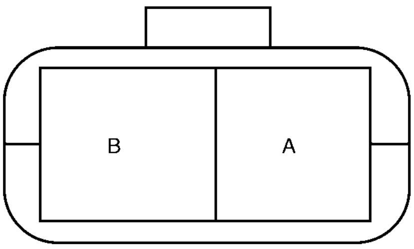
Data Link
Connector (DLC)
(2.2L DOHC)

A402F050



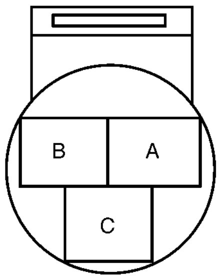
Direct Ignition System (DIS)
Ignition Coil
Connector

A102F080



Coolant Temperature
Sensor (CTS) Connector

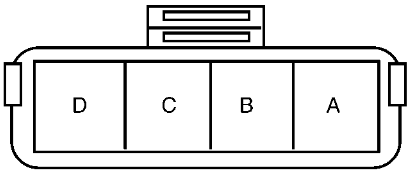
A102F085



Air Conditioning
Pressure (ACP) Sensor
Connector

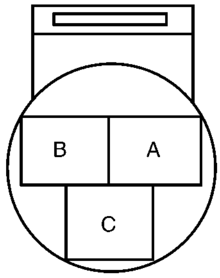
A102F088

CONNECTOR END VIEW (Cont'd)



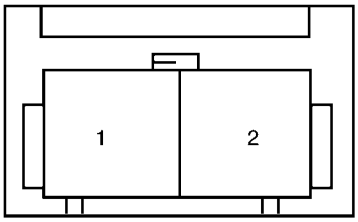
Idle Air Control (IAC) Valve
Connector

A102F076



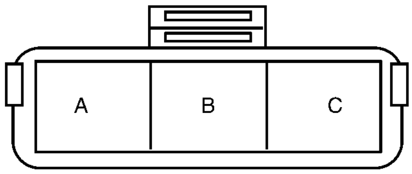
Throttle Position
Sensor (TPS) Connector

A102F074



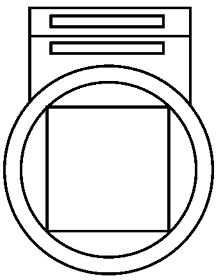
Manifold Air
Temperature (MAT) Sensor
Connector

A102F077



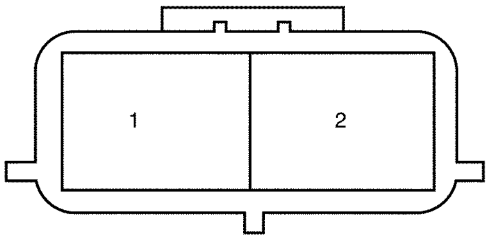
Vehicle Speed
Sensor (VSS) (M/T)
Connector

A102F086



Oxygen (O2) Sensor
Connector
(2.0L SOHC/DOHC)

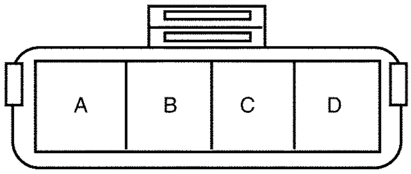
A102F081



Evaporative Emission (EVAP) Canister
Purge Solenoid
Connector

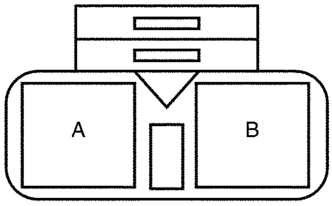
C402F048

CONNECTOR END VIEW (Cont'd)



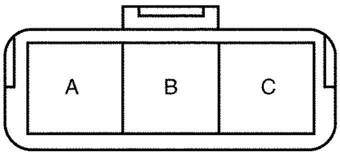
Post- Converter Heated
Oxygen Sensor (HO2S 2)
Connector

A402F022



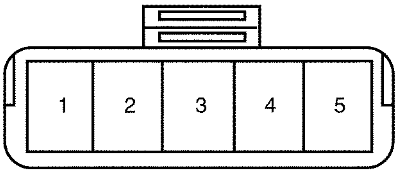
Evaporative System
Diagnostic Solenoid (ESDS)
Connector

A402F023



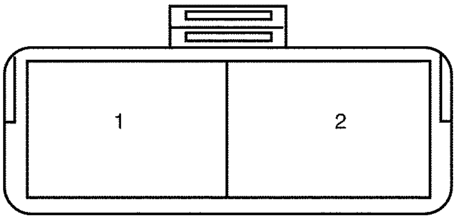
Fuel Tank Pressure
Sensor Connector

A402F025



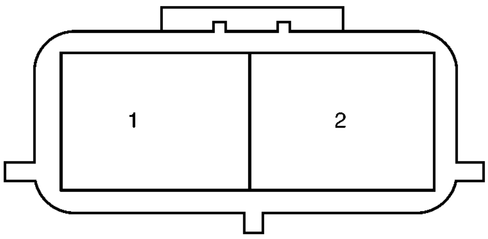
Exhaust Gas Recirculation
(EGR) Value
Connector

A402F027



Pre-Converter Oxygen
Sensor (O2S 1)
Connector
(2.2L DOHC)

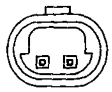
C402F012



Controlled Canister
Purge (CCP) Solenoid
Connector

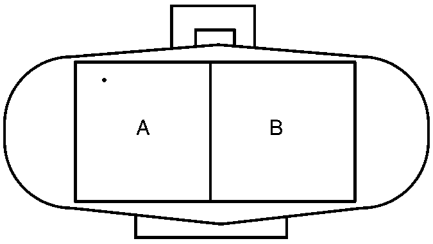
A102F078

CONNECTOR END VIEW (Cont'd)



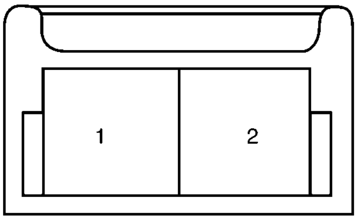
Knock Sensor Connector
(2.0L DOHC)

C302F092



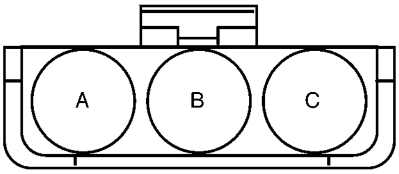
Cooling Fan
Connector

A102F089



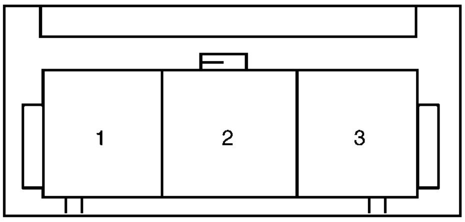
Fuel Injector
Connector
(2.0L SOHC)

C302F089



Manifold Absolute
Pressure (MAP) Sensor
Connector
(2.0L SOHC)

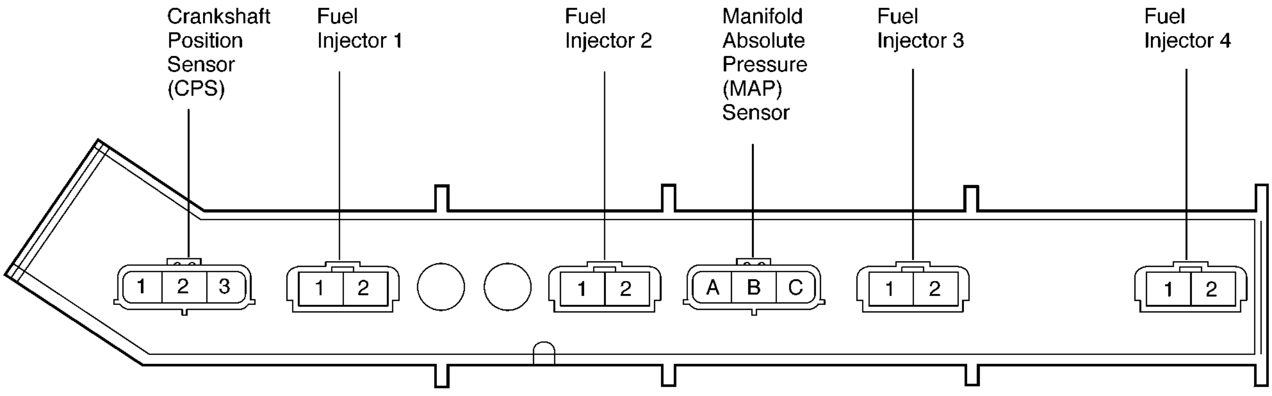
C302F087



Crankshaft Position
Sensor (CPS)
Connector
(2.0L SOHC)

C302F088

CONNECTOR END VIEW (Cont'd)

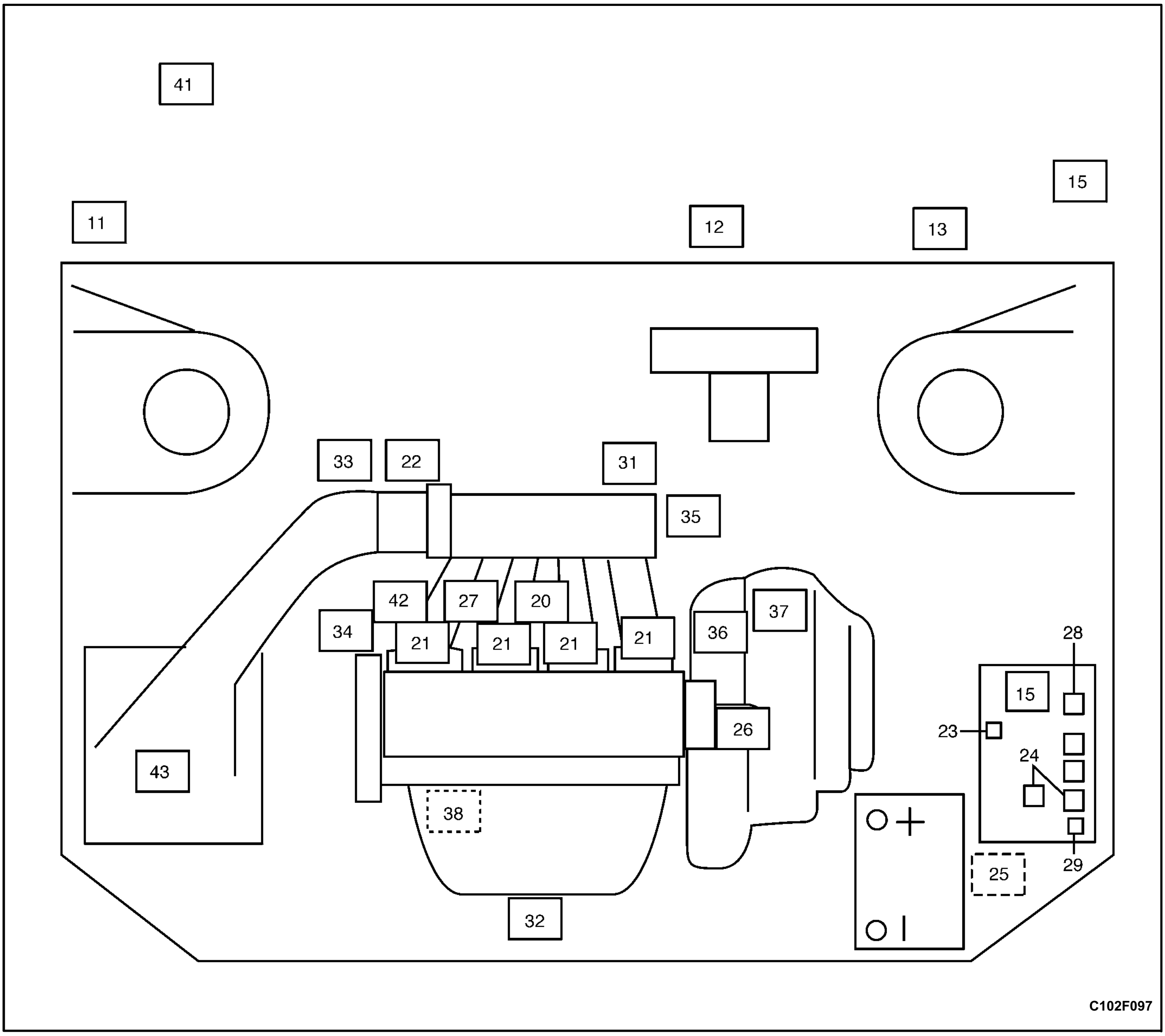


Fuel Injector Channel Cover (2.0L DOHC)

COMPONENT LOCATOR

COMPONENT LOCATOR (2.0L SOHC)

(Left-Hand Drive Shown, Right-Hand Drive Similar)



Components on ECM Harness
- 11 Electronic Control Module (ECM)
- 12 ALDL Diagnostic Connector
- 13 Malfunction Indicator Lamp (MIL)
- 15 Fuse Panel (2)

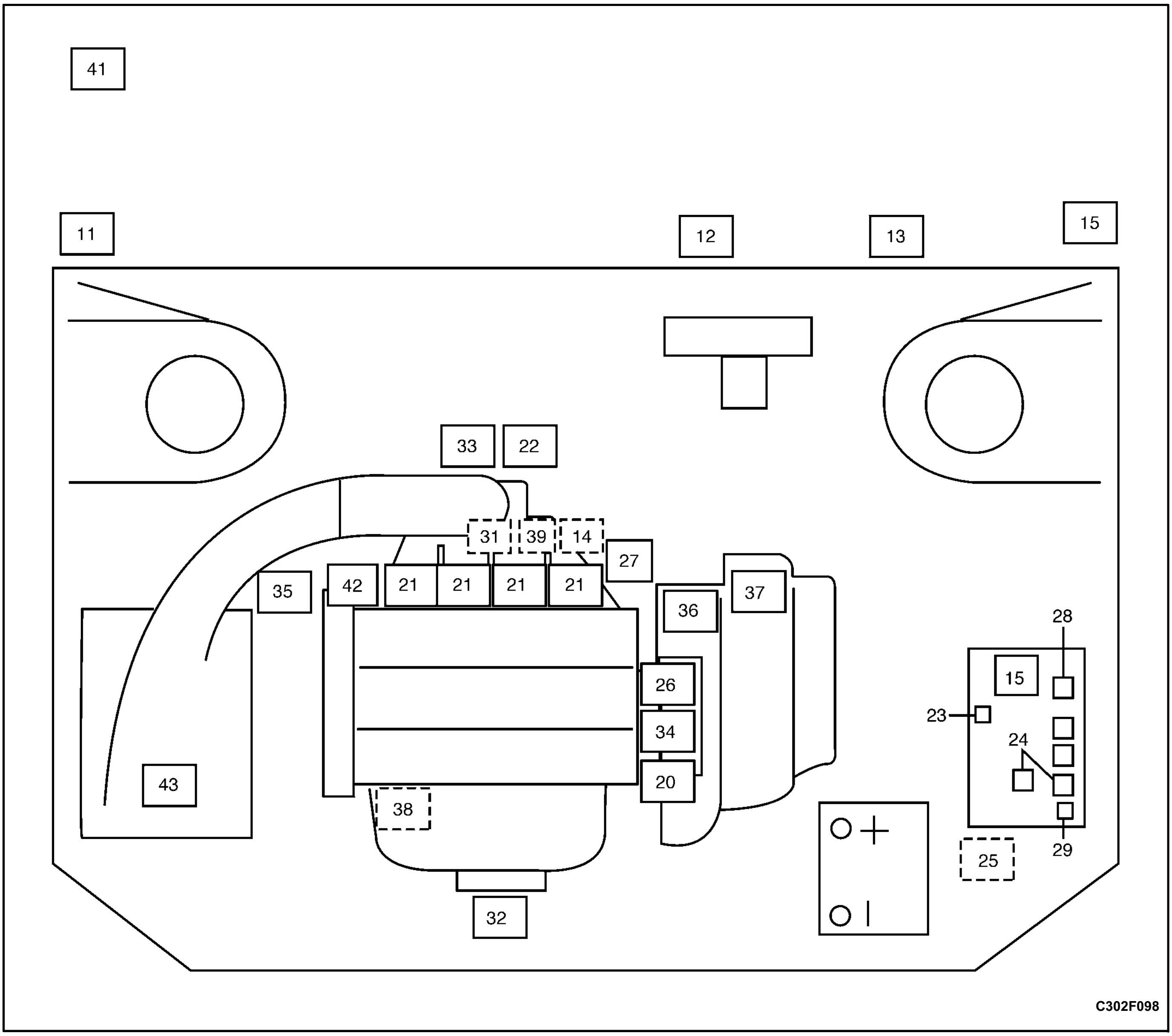
ECM Controlled Devices
- 20 Exhaust Gas Recirculation (EGR) Valve
- 21 Fuel Injector (4)
- 22 Idle Air Control (IAC) Valve
- 23 Fuel Pump Relay
- 24 Cooling Fan Relays
- 25 Series/Parallel Cooling Fan Relay
- 26 Direct Ignition System Ignition Coil
- 27 Controlled Canister Purge Solenoid
- 28 Ignition 1 Relay
- 29 A/C Compressor Relay

Information Sensors
- 31 Manifold Absolute Pressure (MAP) Sensor
- 32 Oxygen (O_2) Sensor
- 33 Throttle Position Sensor (TPS)
- 34 Coolant Temperature Sensor (CTS)
- 35 Manifold Air Temperature (MAT) Sensor
- 36 Vehicle Speed Sensor (VSS)
- 37 P/N Switch (Automatic Transaxle only)
- 38 Crankshaft Position Sensor (CPS)

Not ECM Connected
- 41 Evaporative Emission Canister (under vehicle, behind right rear wheel)
- 42 Oil Pressure Switch
- 43 Air Cleaner

COMPONENT LOCATOR (2.0L DOHC)

(Left-Hand Drive Shown, Right-Hand Drive Similar)



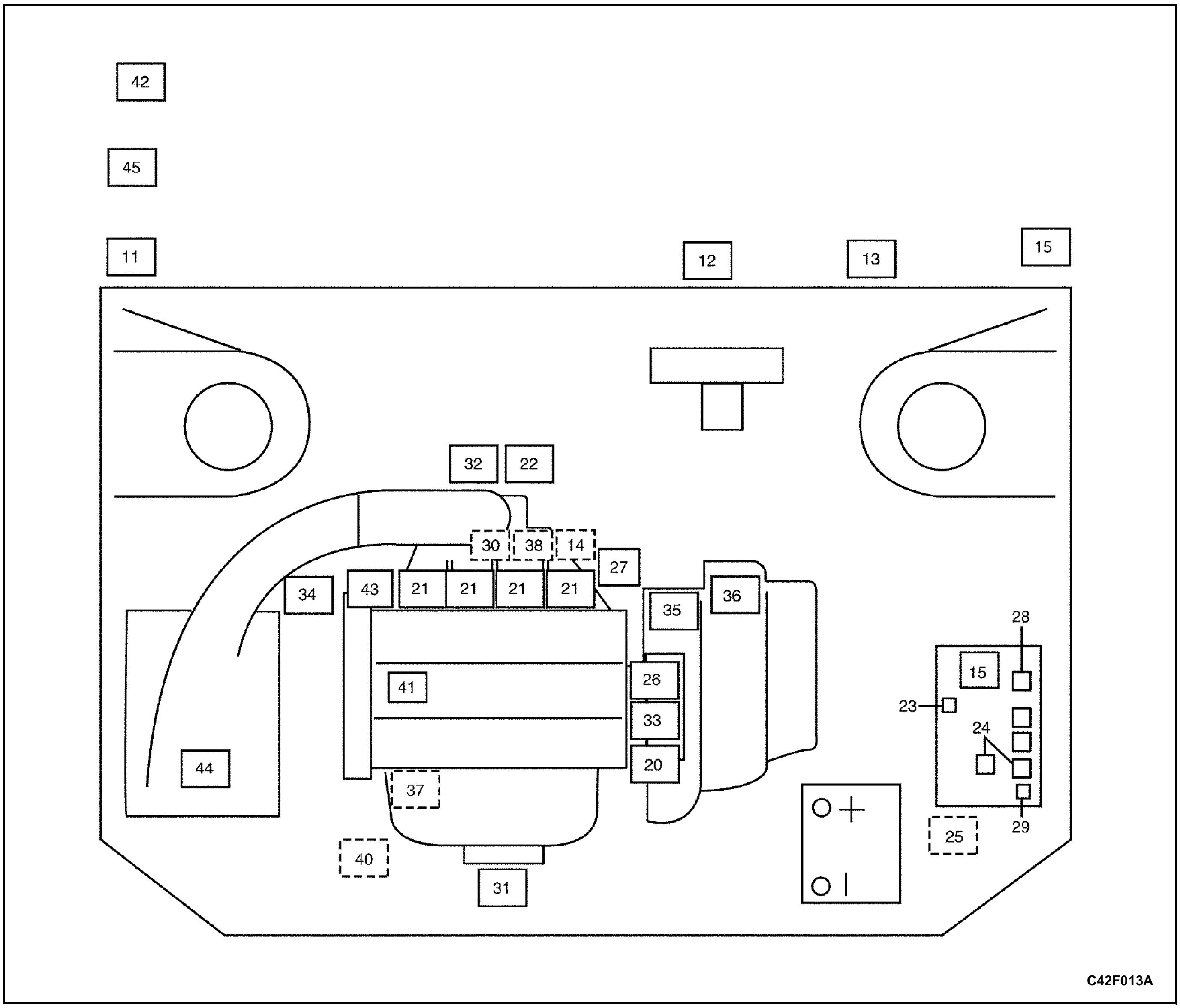
Components on ECM Harness
11 Electronic Control Module (ECM)
12 ALDL Diagnostic Connector
13 Malfunction Indicator Lamp (MIL)
14 ECM/ABS Harness Ground
15 Fuse Panel (2)

ECM Controlled Devices
20 Exhaust Gas Recirculation (EGR) Valve
21 Fuel Injector (4)
22 Idle Air Control (IAC) Valve
23 Fuel Pump Relay
24 Engine Fan Relays
25 Series/Parallel Cooling Fan Relay
26 Direct Ignition System Ignition Coil
27 Controlled Canister Purge Solenoid
28 Ignition 1 Relay
29 A/C Compressor Relay

Information Sensors
31 Manifold Absolute Pressure (MAP) Sensor
32 Oxygen (O_2) Sensor
33 Throttle Position Sensor (TPS)
34 Coolant Temperature Sensor (CTS)
35 Manifold Air Temperature (MAT) sensor
36 Vehicle Speed Sensor (VSS)
37 P/N Switch (Automatic Transaxle only)
38 Crankshaft Position Sensor (CPS)
39 Knock Sensor

Not ECM Connected
41 Evaporative Emission Canister (under vehicle, behind right rear wheel)
42 Oil Pressure Switch
43 Air Cleaner

COMPONENT LOCATOR (2.2L DOHC)



Components on ECM Harness
- 11 Engine Control Module (ECM)
- 12 Data Link Connector (DLC)
- 13 Malfunction Indicator Lamp (MIL)
- 14 ECM/ABS Harness Ground
- 15 Fuse Panel (2)

ECM Controlled Devices
- 20 Exhaust Gas Recirculation (EGR) Valve
- 21 Fuel Injector (4)
- 22 Idle Air Control (IAC) Valve
- 23 Fuel Pump Relay
- 24 Engine Fan Relays
- 25 Series/Parallel Cooling Fan Relay
- 26 Direct Ignition System Ignition Coil
- 27 Evaporative Emission Canister Purge Solenoid
- 28 Ignition 1 Relay
- 29 A/C Compressor Relay

Information Sensors
- 30 Manifold Absolute Pressure (MAP) Sensor
- 31 Pre-Converter (O2S 1) Oxygen Sensor
- 32 Throttle Position Sensor (TPS)
- 33 Engine Coolant Temperature Sensor (CTS)
- 34 Manifold Air Temperature Sensor (MAT)
- 35 Vehicle Speed Sensor (VSS)
- 36 P/N Position Switch (Automatic Transaxle only)
- 37 Crankshaft Position Sensor (CPS)
- 38 Knock Sensor
- 40 Post-Converter Oxygen (HO2S 2) Sensor
- 41 Camshaft Position (CMP) Sensor

Not ECM Connected
- 42 Evaporative Emission Canister (under vehicle, behind right rear wheel)
- 43 Oil Pressure Switch
- 44 Air Cleaner
- 45 Fuel Cutoff Switch

DIAGNOSIS (2.0L SOHC/DOHC)

TROUBLE CODE DIAGNOSIS

CLEARING TROUBLE CODES

Notice: To prevent electronic control module damage, the key must be OFF when disconnecting or recon-necting the power to the electronic control module (for example battery cable, electronic control module pigtail connector, electronic control module fuse, jumper cables, etc.).

When the electronic control module sets a diagnostic trouble code, the malfunction indicator lamp (MIL) will be turned on and a diagnostic trouble code will be stored in the electronic control module's memory. If the problem is intermittent, the light will go out after 10 seconds if the fault is no longer present. The diagnostic trouble code will stay in the electronic control module's memory until the battery voltage to the electronic control module is removed. Removing battery voltage for 10 seconds will clear all stored diagnostic trouble codes.

Diagnostic trouble codes should be cleared after repairs have been completed. Some diagnostic tables will tell you to clear the codes before using the chart. This al-lows the electronic control module to set the diagnostic trouble code while going through the chart, which will help to find the cause of the problem more quickly.

IDLE LEARN PROCEDURE

Whenever the battery cables, the electronic control module (ECM), or the ECM fuse is disconnected more than 10 seconds or replaced, the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.
4. Start the engine in park/neutral.
5. Allow the engine run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.
7. Turn the A/C OFF for 10 seconds, if equipped.
8. If the vehicle is equipped with an automatic trans-axle, apply the parking brake. While depressing the brake pedal, place the transaxle in D (drive).
9. Turn the A/C ON for 10 seconds, if equipped.
10. Turn the A/C OFF for 10 seconds, if equipped.
11. Turn the ignition OFF. The idle learn procedure is complete.

DIAGNOSTIC SYSTEM CHECK (2.0L SOHC)

Circuit Description

The diagnostic system check is an organized approach to identifying a problem created by an electronic engine control system malfunction. It must be the starting point for any driveability complaint diagnosis because it di-rects the technician to the next logical step in diagnosing the complaint. Understanding the table and using it cor-rectly will reduce diagnostic time and prevent the un-necessary replacement of parts.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. Check for proper operation of the malfunction indica-tor lamp (MIL). When the ignition is ON and the en-gine is OFF, the MIL should come on and remain on steadily.
2. No MIL at this point indicates that there is a problem with the MIL circuit or the electronic control module (ECM) control of that circuit.
3. This step checks the ability of the ECM to control the MIL. With the assembly line diagnostic link (ALDL) terminal grounded, the MIL should flash a Code 12 three times, followed by any diagnostic trouble code stored in memory. Depending upon the type of ECM, an ECM error may result in the inability to flash Code 12.
4. Most procedures use a scan tool to aid diagnosis; therefore, serial data must be available. If an ECM error is present, the ECM may be able to illuminate the MIL, but not enable serial data.
5. Although the ECM is powered up, an "Engine Cranks But Will Not Start" symptom could exist because of an ECM or system problem.
6. This step will isolate if the customer complaint is an MIL or a driveability problem with no MIL. Refer to the diagnostic trouble code (DTC) in this section for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool or a faulty ECM.
7. Comparison of actual control system data with the typical values is a quick check to determine if any parameter is not within limits. Keep in mind that a ba-sic engine problem (such as incorrect valve timing or a vacuum leak) may substantially alter sensor values.

8. Installation of a scan tool will provide a good ground path for the ECM and may hide a driveability com-plaint due to poor ECM grounds.
9. If the actual data is not within the typical values es-tablished, refer to the tables in Symptom Diagnosis" to provide a functional check of the suspect compo-nent or system.

Diagnostic System Check (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Verify the customer complaint(s). Are the customer's complaint(s) verified?	-	Go to *Step 2*	-
2	Turn the ignition ON. Is the malfunction indicator lamp (MIL) on steadily?	-	Go to *Step 4*	Go to *Step 3*
3	Jumper the assembly line diagnostic link (ALDL) terminals A and B. Does the MIL flash Code 12?	-	Go to *Step 4*	Go to Will Not Flash MIL"
4	1. Connect the scan tool to the ALDL. 2. Turn the ignition ON. Does the scan tool display serial data?	-	Go to *Step 5*	Go to *Step 12*
5	Start the engine. Does the engine start?	-	Go to *Step 6*	Go to Engine Cranks But Will Not Start
6	1. Turn the ignition OFF. 2. Connect the scan tool to the ALDL. 3. Turn the ignition ON. Are any diagnostic trouble codes (DTCs) displayed?	-	Go to *Step 8*	Go to *Step 7*
7	1. Start the engine. 2. Compare the scan tool data with typical values. Are the values normal or within the normal range?	-	Go to *Step 9*	Go to *Step 10*
8	Refer to the applicable DTC table. Start with the DTC with the lowest numerical value and move up. Are the DTC(s) identified as valid trouble code(s)?	-	Go to the applicable DTC table	Go to *Step 6*
9	Are there any symptoms that have been identified?	-	Go to the applicable symptom table	Go to *Step 11*
10	Identify the component that has a serial data value outside the normal range. Has the component been identified?	-	Go to Diagnostic Aids"	-
11	1. Clear any DTC(s) from the ECM memory. 2. Verify that the DTC(s) have been cleared. 3. Road test the vehicle. 4. Recheck for the presence of any DTC(s). Is the repair complete?	-	System OK	Go to *Step 1*
12	1. Attach the scan tool to another vehicle. 2. Turn the ignition ON. Does the scan tool read serial data?	-	Go to *Step 13*	Go to *Step 16*
13	Check for an open or short in the wire between ECM terminal B7 and ALDL connector M. Is the problem found?	-	Go to *Step 14*	Go to *Step 15*

Diagnostic System Check (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Repair the open or short as necessary. 2. Connect the scan tool to the ALDL. 3. Start the engine. Does the scan tool display serial data?	-	System OK	Go to *Step 15*
15	1. Replace the electronic control module. 2. Connect the scan tool to the ALDL. 3. Start the engine. Does the scan tool display serial data?	-	Go to *Step 6*	-
16	1. Replace the scan tool. 2. Connect the scan tool to the ALDL. 3. Ignition ON. Does the scan tool read serial data?	-	Go to *Step 5*	-

DIAGNOSTIC SYSTEM CHECK (2.0L DOHC)

Circuit Description

The diagnostic system check is an organized approach to identifying a problem created by an electronic engine control system malfunction. It must be the starting point for any driveability complaint diagnosis because it directs the technician to the next logical step in diagnosing the complaint. Understanding the table and using it correctly will reduce diagnostic time and prevent the unnecessary replacement of parts.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. Check for proper operation of the malfunction indicator lamp (MIL). When the ignition is ON and the engine is OFF, the MIL should come on and remain on steadily.
2. No MIL at this point indicates that there is a problem with the MIL circuit or the electronic control module (ECM) control of that circuit.
3. This step checks the ability of the ECM to control the MIL lamp. With the assembly line diagnostic link (ALDL) terminal grounded, the MIL should flash a Code 12 three times, followed by any diagnostic trouble code stored in memory. Depending upon the type of ECM, an ECM error may result in the inability to flash Code 12.
4. Most procedures use a scan tool to aid diagnosis; therefore, serial data must be available. If an ECM error is present, the ECM may be able to illuminate the MIL, but not enable serial data.
5. Although the ECM is powered up, an "Engine Cranks But Will Not Start" symptom could exist because of an ECM or system problem.
6. This step will isolate if the customer complaint is an MIL or a driveability problem with no MIL. Refer to the diagnostic trouble code (DTC) in this section for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool or a faulty ECM.
7. Comparison of actual control system data with the typical values is a quick check to determine if any parameter is not within limits. Keep in mind that a basic engine problem (such as incorrect valve timing or a vacuum leak) may substantially alter sensor values.
8. Installation of a scan tool will provide a good ground path for the ECM and may hide a driveability complaint due to poor ECM grounds.
9. If the actual data is not within the typical values established, refer to the tables in "Symptom Diagnosis" to provide a functional check of the suspect component or system.

Diagnostic System Check (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Verify the customer complaint(s). Are the customer's complaint(s) verified?	-	Go to *Step 2*	-
2	Turn the ignition ON. Is the malfunction indicator lamp (MIL) on steadily?	-	Go to *Step 4*	Go to *Step 3*
3	Jumper the assembly line diagnostic link (ALDL) terminals A and B. Does the MIL flash Code 12?	-	Go to *Step 4*	Go to "Will Not Flash MIL"
4	1. Connect the scan tool to the ALDL. 2. Turn the ignition ON. Does the scan tool display serial data?	-	Go to *Step 5*	Go to *Step 12*
5	Start the engine. Does the engine start?	-	Go to *Step 6*	Go to "Engine Cranks But Will Not Start"
6	1. Turn the ignition OFF. 2. Connect the scan tool to the ALDL. 3. Turn the ignition ON. Are any diagnostic trouble codes (DTCs) displayed?	-	Go to *Step 8*	Go to *Step 7*
7	1. Start the engine. 2. Compare the scan tool data with typical values. Are the values normal or within the normal range?	-	Go to *Step 9*	Go to *Step 10*
8	Refer to the applicable DTC table. Start with the DTC with the lowest numerical value and move up. Are the DTC(s) identified as valid trouble code(s)?	-	Go to the applicable DTC table	Go to *Step 6*
9	Are there any symptoms that have been identified?	-	Go to the applicable symptom table	Go to *Step 11*
10	Identify the component that has a serial data value outside the normal range. Has the component been identified?	-	Go to "Diagnostic Aids"	-
11	1. Clear any DTC(s) from the ECM memory. 2. Verify that the DTC(s) have been cleared. 3. Road test the vehicle. 4. Recheck for the presence of any DTC(s). Is the repair complete?	-	System OK	Go to *Step 1*
12	1. Attach the scan tool to another vehicle. 2. Turn the ignition ON. Does the scan tool read serial data?	-	Go to *Step 13*	Go to *Step 16*
13	Check for an open or short in the wire between ECM terminal D11 and ALDL connector M. Is the problem found?	-	Go to *Step 14*	Go to *Step 15*
14	1. Repair the open or short as necessary. 2. Connect the scan tool to the ALDL. 3. Start the engine. Does the scan tool display serial data?	-	System OK	Go to *Step 15*

Diagnostic System Check (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
15	1. Replace the electronic control module. 2. Connect the scan tool to the ALDL. 3. Start the engine. Does the scan tool display serial data?	-	Go to *Step 6*	-
16	1. Replace the scan tool. 2. Connect the scan tool to the ALDL. 3. Ignition ON. Does the scan tool read serial data?	-	Go to *Step 5*	-

DIAGNOSTIC AIDS

If an intermittent problem is evident, follow the guidelines below.

Preliminary Checks

Before using this section you should have already performed the "Diagnostic System Check."

Perform a thorough visual inspection. This inspection can often lead to correcting a problem without further checks and can save valuable time. Inspect for the following conditions:

- Electronic control module (ECM) grounds for being clean, tight, and in their proper location.
- Vacuum hoses for splits, kinks, collapsing and proper connections as shown on the Vehicle Emission Control Information label. Inspect thoroughly for any type of leak or restriction.
- Air leaks at the throttle body mounting area and the intake manifold sealing surfaces.
- Ignition wires for cracks, hardness, proper routing, and carbon tracking.
- Wiring for proper connections.
- Wiring for pinches or cuts.

Diagnostic Trouble Code Tables

Do not use the diagnostic trouble code (DTC) tables to try and correct an intermittent fault. The fault must be present to locate the problem.

Incorrect use of the DTC tables may result in the unnecessary replacement of parts.

Faulty Electrical Connections or Wiring

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful inspection of suspect circuits for the following:

- Poor mating of the connector halves.
- Terminals not fully seated in the connector body.
- Improperly formed or damaged terminals. All connector terminals in a problem circuit should be carefully inspected, reformed, or replaced to insure contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body.

Road Test

If a visual inspection does not find the cause of the problem, the vehicle can be driven with a voltmeter or a scan tool connected to a suspected circuit. An abnormal voltage or scan tool reading will indicate that the problem is in that circuit.

If there are no wiring or connector problems found and a diagnostic trouble code (DTC) was stored for a circuit having a sensor, except for DTC 44 and DTC 45, replace the sensor.

Intermittent Malfunction Indicator Lamp (MIL)

An intermittent malfunction indicator lamp (MIL) with no diagnostic trouble code (DTC) present may be caused by the following:

- Electrical system interference caused by a defective relay, electronic control module (ECM) driven solenoid, or switch.
- Improper installation of electrical options such as lights, two-way radios, sound systems, or security systems.
- Ignition control wires should be routed away from ignition wires, ignition system components, and the generator.
- Ignition secondary wires shorted to ground.
- MIL driver wire or diagnostic test terminal intermittently shorted to ground.
- Intermittent loss of ECM ground connections.

Fuel System

Some intermittent driveability problems can be attributed to poor fuel quality. If a vehicle is occasionally running rough, stalling, or otherwise performing badly, ask the customer about the following fuel buying habits:

- Do they always buy from the same source? If so, fuel quality problems can usually be discounted.
- Do they buy their fuel from whichever fuel station that is advertising the lowest price? If so, check the fuel tank for signs of debris, water, or other contamination.

ENGINE CRANKS BUT WILL NOT START (2.0L SOHC)

Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. By performing a compression test, it can be determined if the engine has the mechanical ability to run.
9. It is important to check for the presence of spark from all of the ignition wires. If spark is present from one to three of the ignition coil terminals, the crankshaft position sensor (CPS) is OK.
19. In checking the electronic control module (ECM) outputs for the electronic spark timing signal, it recommended to use an oscilloscope to view the varying voltage signals. In measuring these outputs with a voltmeter, intermittent errors may occur that cannot be seen by a voltmeter.
35. This step checks for proper operation of the ECM's control of the fuel pump circuit.
59. This step checks for a ground signal being supplied by the ECM to operate the fuel injectors. If there is no ground present during the cranking of the engine, and the fuel injector wiring is OK, the ECM is at fault.

Engine Cranks But Will Not Start (2.0L SOHC)

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	Crank the engine. Does the engine start and continue to run?	-	System OK	Go to *Step 3*
3	Perform a cylinder compression test. Is the cylinder compression for all of the cylinders at or above the value specified?	689 kPa (100 psi)	Go to *Step 7*	Go to *Step 4*
4	Inspect the timing belt alignment. Is the timing belt in alignment?	-	Go to *Step 6*	Go to *Step 5*
5	Align or replace the timing belt as needed. Is the repair complete?	-	Go to *Step 2*	-
6	Repair the internal engine damage as needed. Is the repair complete?	-	Go to *Step 2*	-
7	Inspect the fuel pump fuse. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
8	Replace the fuse. Is the repair complete?	-	Go to *Step 2*	-
9	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	-	Go to *Step 34*	Go to *Step 10*
10	1. Measure the resistance of the ignition wires. 2. Replace any of the ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	30,000 Ω	Go to *Step 2*	Go to *Step 11*

Engine Cranks But Will Not Start (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition OFF. 2. Disconnect the crankshaft position sensor (CPS) connector. 3. Turn the ignition ON. 4. Measure the voltage between the CPS connector terminals A and C. Does the voltage measure near the value specified?	1.08 V	Go to *Step 12*	Go to *Step 13*
12	Measure the voltage between the CPS connector terminals B and C. Does the voltage measure near the value specified?	1.08 V	Go to *Step 19*	Go to *Step 14*
13	Measure the voltage between the CPS connector terminals A and ground. Does the voltage measure near the value specified?	1.08 V	Go to *Step 15*	Go to *Step 16*
14	Measure the voltage between the CPS connector terminals B and ground. Does the voltage measure near the value specified?	1.08 V	Go to *Step 15*	Go to *Step 17*
15	Check for an open or short in the wire between the CPS connector terminal C and ground. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
16	Check for an open or short in the wire between the CPS connector terminal A and the ECM connector terminal A2. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
17	Check for an open or short in the wire between the CPS connector terminal B and the ECM connector terminal B3. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
18	Repair the wiring as needed. Is the repair complete?	-	Go to *Step 2*	-
19	1. Disconnect the direct ignition system (DIS) ignition coil connector to prevent the vehicle from starting. 2. Measure the voltage at the ECM connector terminal A2 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with ignition ON, 1.20 V during cranking	Go to *Step 20*	Go to *Step 21*
20	Measure the voltage at the ECM connector terminal B3 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with ignition ON, 1.20 V during cranking	Go to Step 22	Go to *Step 21*
21	Replace the crankshaft position sensor. Is the repair complete?	-	Go to *Step 2*	-
22	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the DIS ignition coil. 3. Connect a test light between terminal D of the DIS ignition coil connector and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 23*	Go to *Step 24*
23	Connect a test light between terminal C of the DIS ignition coil connector and battery positive. Is the test light on?	-	Go to *Step 27*	Go to *Step 25*

Engine Cranks But Will Not Start (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
24	Check for an open in the wiring between the battery and the DIS ignition coil connector terminal D. Is the problem found?	-	Go to *Step 26*	Go to Ignition 1 Relay Circuit Check"
25	Check for an open in the wire from the DIS ignition coil to ground. Is the problem found?	-	Go to *Step 26*	-
26	1. Repair the wiring as needed. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	Go to *Step 2*	Go to *Step 27*
27	1. Turn the ignition OFF. 2. Disconnect the DIS ignition coil connector. 3. While cranking the engine, measure the voltage at the DIS ignition coil connector terminal B. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 28*	Go to *Step 29*
28	While cranking the engine, measure the voltage at the DIS ignition coil connector terminal A. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 32*	Go to *Step 30*
29	Check for an open in the wire from the DIS ignition coil connector terminal B to the ECM connector terminal D10. Is the problem found?	-	Go to *Step 31*	Go to *Step 33*
30	Check for an open in the wire from the DIS ignition coil connector terminal A to the ECM connector terminal C3. Is the problem found?	-	Go to *Step 31*	Go to *Step 33*
31	1. Repair the wiring as needed. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	Go to *Step 2*	Go to *Step 32*
32	Replace the direct ignition system ignition coil. Is the repair complete?	-	Go to *Step 2*	-
33	Replace the electronic control module. Is the repair complete?	-	Go to *Step 2*	-
34	1. Turn the ignition OFF. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is any fuel pressure present?	-	Go to *Step 37*	Go to *Step 35*
35	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector terminals 3 and 2. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 36*	Go to *Step 46*

Engine Cranks But Will Not Start (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
36	Replace the fuel pump. Is the repair complete?	-	Go to *Step 2*	-
37	Is the fuel pressure within the value specified?	283-324 kPa (41-47 psi)	Go to *Step 41*	Go to *Step 38*
38	1. Check the fuel filter for a restriction. 2. Inspect the fuel lines for kinks and restrictions. Is the problem found?	-	Go to *Step 39*	Go to *Step 40*
39	1. Replace the fuel filter and/or the fuel lines as needed. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is the fuel pressure within the value specified?	283-324 kPa (41-47 psi)	Go to *Step 2*	Go to *Step 40*
40	1. Disconnect the vacuum line from the fuel pressure regulator. 2. Inspect the vacuum line for the presence of fuel. 3. Inspect the fuel pressure regulator vacuum port for the presence of fuel. Is any fuel present?	-	Go to *Step 43*	Go to *Step 44*
41	Check the fuel for contamination. Is the fuel contaminated?	-	Go to *Step 42*	Go to *Step 58*
42	1. Remove the contaminated fuel from the fuel tank. 2. Clean the fuel tank as needed. Is the repair complete?	-	Go to *Step 2*	-
43	Replace the fuel pressure regulator. Is the repair complete?	-	Go to *Step 2*	-
44	1. Remove the fuel pump assembly from the fuel tank. 2. Inspect the fuel pump sender and the fuel coupling hoses for a restriction. 3. Inspect the in-tank fuel filter for a restriction. Is the problem found?	-	Go to *Step 45*	Go to *Step 36*
45	Replace the fuel pump sender, the intank fuel filter, and/or the fuel coupling hoses as needed. Is the repair complete?	-	Go to *Step 2*	-
46	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector terminal 3 and a known good ground. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 47*	Go to *Step 48*
47	Repair the open wire between the fuel pump connector terminal 2 and ground. Is the repair complete?	-	Go to *Step 2*	-

Engine Cranks But Will Not Start (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
48	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 49*	Go to *Step 54*
49	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 86 and battery positive. 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 50*	Go to *Step 55*
50	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 51*	Go to *Step 57*
51	1. Turn the ignition OFF. 2. Check the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3 for an open or short to ground. Is the problem found?	-	Go to *Step 52*	Go to *Step 53*
52	Repair the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3. Is the repair complete?	-	Go to *Step 2*	-
53	Replace the fuel pump relay. Is the repair complete?	-	Go to *Step 2*	-
54	1. Inspect the engine fuse block fuse EF16. 2. Check for an open in the wiring between the ignition 1 relay connector terminal 87 and the fuel pump relay connector terminal 85. Is the problem found?	-	Go to *Step 65*	Go to "Ignition 1 Relay Circuit Check"
55	Check the wire between the fuel pump relay connector terminal 86 to the ECM connector terminal B6 for an open. Is the problem found?	-	Go to *Step 56*	Go to *Step 33*
56	Repair the wire between the fuel pump relay connector terminal 86 to the ECM connector terminal B6. Is the repair complete?	-	Go to *Step 2*	-
57	Repair the wire between the fuel pump relay connector terminal 30 and the battery. Is the repair complete?	-	Go to *Step 2*	-

Engine Cranks But Will Not Start (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
58	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors from all of the fuel injectors. 3. Turn the ignition ON. 4. Connect a test light between the fuel injector harness connector 1 and ground. 5. Repeat step 4 for each of the remaining fuel injectors. Is the test light on at all of the fuel injectors?	-	Go to *Step 59*	Go to *Step 62*
59	1. Turn the ignition OFF. 2. Connect a test light between the fuel injector harness connector terminal 2 and battery positive. 3. Crank the engine. 4. Repeat steps three and four for each of the remaining fuel injectors. Does the test light flash for all of the fuel injectors?	-	Go to *Step 60*	Go to *Step 63*
60	Measure the resistance of each fuel injector. Is the resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6-12.4 Ω	System OK	Go to *Step 61*
61	Replace any of the fuel injectors with a resistance out of specification. Is the repair complete?	-	Go to *Step 2*	-
62	Repair the open wire(s) between the fuel injector harness connector(s) terminal 1 and the battery. Is the repair complete?	-	Go to *Step 2*	-
63	1. Check for an open between the fuel injector harness connector terminal 2 and the ECM connector terminal C10 for the fuel injectors one and four. 2. Check for an open between the fuel injector harness connector terminal 2 and the ECM connector terminal C15 for the fuel injectors two and three. Is the problem found?	-	Go to *Step 64*	Go to *Step 66*
64	Repair the open fuel injector harness wire(s). Is the repair complete?	-	Go to *Step 2*	-
65	Replace the fuse or repair the wiring as needed. Is the repair complete?	-	Go to *Step 2*	-
66	1. Inspect the engine fuse block fuse EF17. 2. Check for an open between the circuits from terminal 1 for each of the four fuel injectors and the ignition 1 relay connector terminal 87. Is the problem found?	-	Go to *Step 65*	Go to "Ignition 1 Relay Circuit Check"

ENGINE CRANKS BUT WILL NOT START (2.0L DOHC)

Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. By performing a compression test, it can be determined if the engine has the mechanical ability to run.
9. It is important to check for the presence of spark from all of the ignition wires. If spark is present from one to three of the ignition coil terminals, the crankshaft position sensor (CPS) is OK.
19. In checking the electronic control module (ECM) outputs for the electronic spark timing signal, it recommended to use an oscilloscope to view the varying voltage signals. In measuring these outputs with a voltmeter, intermittent errors may occur that cannot be seen by a voltmeter.
35. This step checks for proper operation of the ECM's control of the fuel pump circuit.
59. This step checks for a ground signal being supplied by the ECM to operate the fuel injectors. If there is no ground present during the cranking of the engine, and the fuel injector wiring is OK, the ECM is at fault.

Engine Cranks But Will Not Start (2.0L DOHC)

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to Diagnostic System Check
2	Crank the engine. Does the engine start and continue to run?	-	System OK	Go to *Step 3*
3	Perform a cylinder compression test. Is the cylinder compression for all of the cylinders at or above the value specified?	689 kPa (100 psi)	Go to *Step 7*	Go to *Step 4*
4	Inspect the timing belt alignment. Is the timing belt in alignment?	-	Go to *Step 6*	Go to *Step 5*
5	Align or replace the timing belt as needed. Is the repair complete?	-	Go to *Step 2*	-
6	Repair the internal engine damage as needed. Is the repair complete?	-	Go to *Step 2*	-
7	Inspect the fuel pump fuse. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
8	Replace the fuse. Is the repair complete?	-	Go to *Step 2*	-
9	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	-	Go to *Step 34*	Go to *Step 10*
10	1. Measure the resistance of the ignition wires. 2. Replace any of the ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	30,000 Ω	Go to *Step 2*	Go to *Step 11*

Engine Cranks But Will Not Start (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition OFF. 2. Disconnect the crankshaft position sensor (CPS) connector. 3. Turn the ignition ON. 4. Measure the voltage between the CPS connector terminals A and C. Does the voltage measure near the value specified?	1.08 V	Go to *Step 12*	Go to *Step 13*
12	Measure the voltage between the CPS connector terminals B and C. Does the voltage measure near the value specified?	1.08 V	Go to *Step 19*	Go to *Step 14*
13	Measure the voltage between the CPS connector terminal A and ground. Does the voltage measure near the value specified?	1.08 V	Go to *Step 15*	Go to *Step 16*
14	Measure the voltage between the CPS connector terminal B and ground. Does the voltage measure near the value specified?	1.08 V	Go to *Step 15*	Go to *Step 17*
15	Check for an open or short in the wire between the CPS connector terminal C and ground. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
16	Check for an open or short in the wire between the CPS connector terminal A and the ECM connector terminal B14. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
17	Check for an open or short in the wire between the CPS connector terminal B and the ECM connector terminal A16. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
18	Repair the wiring as needed. Is the repair complete?	-	Go to *Step 2*	-
19	1. Disconnect the direct ignition system (DIS) ignition coil connector to prevent the vehicle from starting. 2. Measure the voltage at the ECM connector terminal B14 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with ignition ON, 1.20 V during cranking	Go to *Step 20*	Go to *Step 21*
20	Measure the voltage at the ECM connector terminal A16 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with ignition ON, 1.20 V during cranking	Go to Step 22	Go to *Step 21*
21	Replace the crankshaft position sensor. Is the repair complete?	-	Go to *Step 2*	-
22	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the DIS ignition coil. 3. Connect a test light between terminal D of the DIS ignition coil connector and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 23*	Go to *Step 24*
23	Connect a test light between terminal C of the DIS ignition coil connector and battery positive. Is the test light on?	-	Go to *Step 27*	Go to *Step 25*

Engine Cranks But Will Not Start (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
24	Check for an open in the wiring between the battery and the DIS ignition coil connector terminal D. Is the problem found?	-	Go to *Step 26*	Go to "Ignition 1 Relay Circuit Check"
25	Check for an open in the wire from the DIS ignition coil to ground. Is the problem found?	-	Go to *Step 26*	-
26	1. Repair the wiring as needed. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	Go to *Step 2*	Go to *Step 27*
27	1. Turn the ignition OFF. 2. Disconnect the DIS ignition coil connector. 3. While cranking the engine, measure the voltage at the DIS ignition coil connector terminal B. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 28*	Go to *Step 29*
28	While cranking the engine, measure the voltage at the DIS ignition coil connector terminal A. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 32*	Go to *Step 30*
29	Check for an open in the wire from the DIS ignition coil connector terminal B to the ECM connector terminal C14. Is the problem found?	-	Go to *Step 31*	Go to *Step 33*
30	Check for an open in the wire from the DIS ignition coil connector terminal A to the ECM connector terminal D14. Is the problem found?	-	Go to *Step 31*	Go to *Step 33*
31	1. Repair the wiring as needed. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	Go to *Step 2*	Go to *Step 32*
32	Replace the direct ignition system ignition coil. Is the repair complete?	-	Go to *Step 2*	-
33	Replace the electronic control module. Is the repair complete?	-	Go to *Step 2*	-
34	1. Turn the ignition OFF. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is any fuel pressure present?	-	Go to *Step 37*	Go to *Step 35*
35	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector terminals 3 and 2. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 36*	Go to *Step 46*

Engine Cranks But Will Not Start (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
36	Replace the fuel pump. Is the repair complete?	-	Go to *Step 2*	-
37	Is the fuel pressure within the value specified?	283-324 kPa (41-47 psi)	Go to *Step 41*	Go to *Step 38*
38	1. Check the fuel filter for a restriction. 2. Inspect the fuel lines for kinks and restrictions. Is the problem found?	-	Go to *Step 39*	Go to *Step 40*
39	1. Replace the fuel filter and/or the fuel lines as needed. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is the fuel pressure within the value specified?	283-324 kPa (41-47 psi)	Go to *Step 2*	Go to *Step 40*
40	1. Disconnect the vacuum line from the fuel pressure regulator. 2. Inspect the vacuum line for the presence of fuel. 3. Inspect the fuel pressure regulator vacuum port for the presence of fuel. Is any fuel present?	-	Go to *Step 43*	Go to *Step 44*
41	Check the fuel for contamination. Is the fuel contaminated?	-	Go to *Step 42*	Go to *Step 58*
42	1. Remove the contaminated fuel from the fuel tank. 2. Clean the fuel tank as needed. Is the repair complete?	-	Go to *Step 2*	-
43	Replace the fuel pressure regulator. Is the repair complete?	-	Go to *Step 2*	-
44	1. Remove the fuel pump assembly from the fuel tank. 2. Inspect the fuel pump sender and the fuel coupling hoses for a restriction. 3. Inspect the intank fuel filter for a restriction. Is the problem found?	-	Go to *Step 45*	Go to *Step 36*
45	Replace the fuel pump sender, the intank fuel filter, and/or the fuel coupling hoses as needed. Is the repair complete?	-	Go to *Step 2*	-
46	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector terminal 3 and a known good ground. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 47*	Go to *Step 48*
47	Repair the open wire between the fuel pump connector terminal 2 and ground. Is the repair complete?	-	Go to *Step 2*	-

Engine Cranks But Will Not Start (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
48	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 49*	Go to *Step 54*
49	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 86 and battery positive. 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 50*	Go to *Step 55*
50	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 51*	Go to *Step 57*
51	1. Turn the ignition OFF. 2. Check the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3 for an open or short to ground. Is the problem found?	-	Go to *Step 52*	Go to *Step 53*
52	Repair the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3. Is the repair complete?	-	Go to *Step 2*	-
53	Replace the fuel pump relay. Is the repair complete?	-	Go to *Step 2*	-
54	1. Inspect the engine fuse block fuse EF16. 2. Check for an open in the wiring between the ignition 1 relay connector terminal 87 and the fuel pump relay connector terminal 85. Is the problem found?	-	Go to *Step 65*	Go to "Ignition 1 Relay Circuit Check"
55	Check the wire between the fuel pump relay connector terminal 86 to the ECM connector terminal A12 for an open. Is the problem found?	-	Go to *Step 56*	Go to *Step 33*
56	Repair the wire between the fuel pump relay connector terminal 86 to the ECM connector terminal A12. Is the repair complete?	-	Go to *Step 2*	-
57	Repair the wire between the fuel pump relay connector terminal 30 and the battery. Is the repair complete?	-	Go to *Step 2*	-

Engine Cranks But Will Not Start (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
58	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors from all of the fuel injectors. 3. Turn the ignition ON. 4. Connect a test light between the fuel injector harness connector 1 and ground. 5. Repeat step 4 for each of the remaining fuel injectors. Is the test light on at all of the fuel injectors?	-	Go to *Step 59*	Go to *Step 62*
59	1. Turn the ignition OFF. 2. Connect a test light between the fuel injector harness connector terminal 2 and battery positive. 3. Crank the engine. 4. Repeat steps three and four for each of the remaining fuel injectors. Does the test light flash for all of the fuel injectors?	-	Go to *Step 60*	Go to *Step 63*
60	Measure the resistance of each fuel injector. Is the resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6-12.4 Ω	System OK	Go to *Step 61*
61	Replace any of the fuel injectors with a resistance out of specification. Is the repair complete?	-	Go to *Step 2*	-
62	Repair the open wire(s) between the fuel injector harness connector(s) terminal 1 and the battery. Is the repair complete?	-	Go to *Step 2*	-
63	1. Check for an open between the fuel injector harness connector terminal 2 and the ECM connector terminal C4 for the fuel injectors one and four. 2. Check for an open between the fuel injector harness connector terminal 2 and the ECM connector terminal C6 for the fuel injectors two and three. Is the problem found?	-	Go to *Step 64*	Go to *Step 66*
64	Repair the open fuel injector harness wire(s). Is the repair complete?	-	Go to *Step 2*	-
65	Replace the fuse or repair the wiring as needed. Is the repair complete?	-	Go to *Step 2*	-
66	1. Inspect the engine fuse block fuse EF17. 2. Check for an open between the circuit from terminal 1 for each of the four fuel injectors and the ignition 1 relay connector terminal 87. Is the problem found?	-	Go to *Step 65*	Go to "Ignition 1 Relay Circuit Check"

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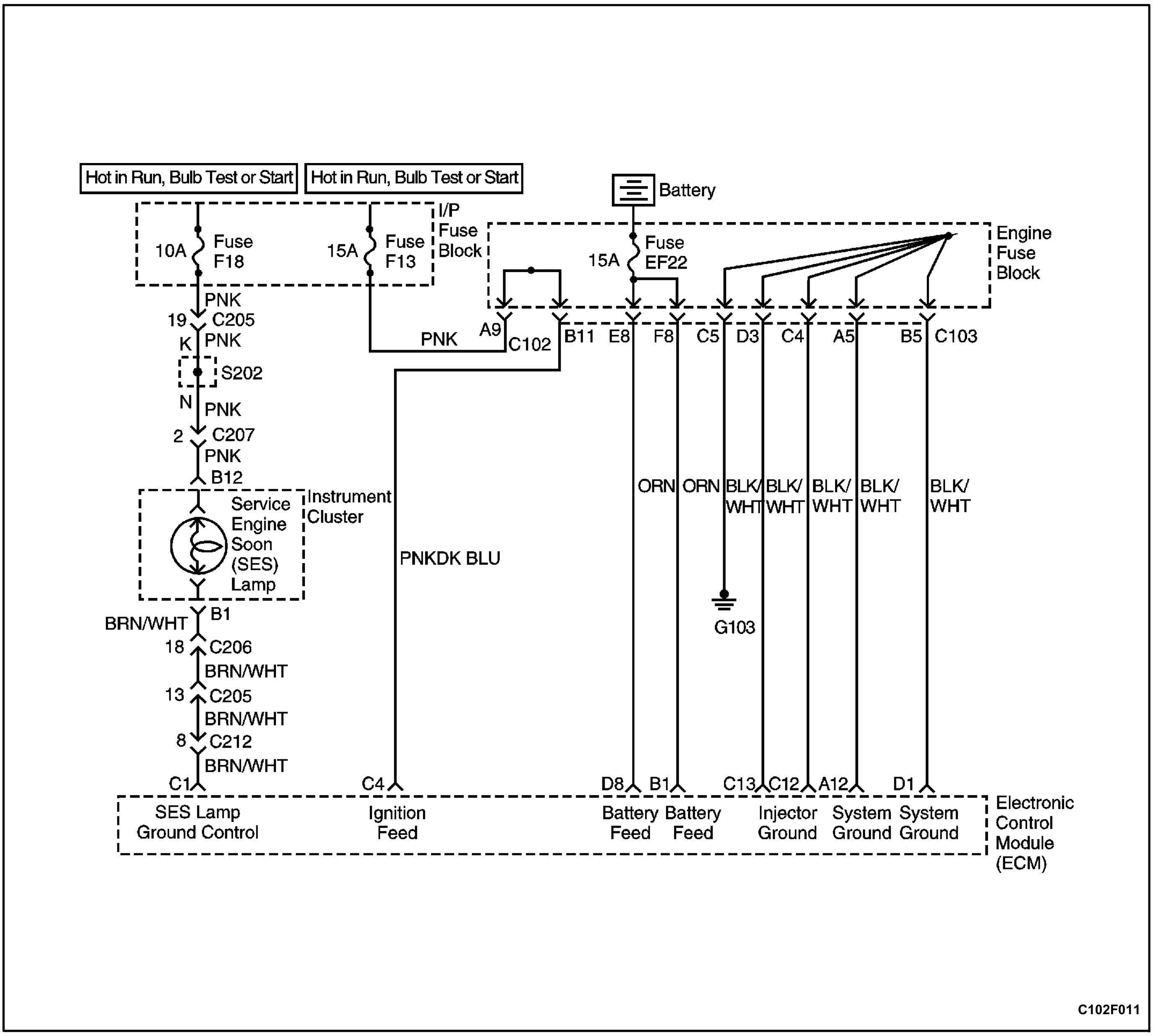

NO MALFUNCTION INDICATOR LAMP (2.0L SOHC)

Circuit Description

There should always be a steady malfunction indicator lamp (MIL) when the ignition is ON and the engine is stopped. Battery voltage is supplied directly to the MIL bulb. The electronic control module (ECM) will control the MIL lamp and turn it on by providing a ground path through the ECM connector terminal C1 wire to the MIL lamp.

Diagnostic Aids

- If the engine runs OK, inspect for a faulty malfunction indicator lamp bulb.
- If the engine cranks but will not start, check for open fuses and poor electronic control module (ECM) connections. Particularly check for ECM ignition and battery feeds, including clean and tight ECM ground connections.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This step checks for battery voltage in the instrument panel malfunction indicator lamp (MIL) bulb socket.
8. This step, along with step 9, checks for battery feed to the electronic control module (ECM).
10. This step checks for ignition feed to the ECM.
24. At this point the MIL lamp wiring is OK. The problem is a faulty ECM.

No Malfunction Indicator Lamp (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Start the engine. Does the engine start?	-	Go to *Step 2*	Go to *Step 7*
2	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) connectors. 3. Turn the ignition ON. 4. Connect a test light between the ECM connector terminal C1 and ground. Is the malfunction indicator lamp (MIL) on?	-	Go to *Step 14*	Go to *Step 3*
3	Inspect the kick panel fuse F18. Is the fuse OK?	-	Go to *Step 4*	Go to *Step 15*
4	Check the ignition feed to the MIL bulb using a voltmeter. Is the voltage within the value specified?	11-14 V	Go to *Step 5*	Go to *Step 16*
5	Inspect the MIL bulb. Is the MIL bulb OK?	-	Go to *Step 6*	Go to *Step 17*
6	Check for an open or short to voltage in the wire between the ECM connector terminal C1 and the MIL bulb. Is the problem found?	-	Go to *Step 18*	Go to *Step 13*
7	Inspect the ECM fuse F13. Is the problem found?	-	Go to *Step 19*	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Disconnect the ECM 24 pin connector. 3. Connect a test light to ECM connector terminal B1 and ground. Is the test light on?	-	Go to *Step 9*	Go to *Step 20*
9	1. Turn the ignition OFF. 2. Disconnect the ECM 32 pin connector. 3. Connect a test light between the ECM connector terminal D8 and ground. Is the test light on?	-	Go to *Step 10*	Go to *Step 21*
10	1. Turn the ignition OFF. 2. Connect a test light between the ECM connector terminal C4 and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 11*	Go to *Step 22*
11	Inspect the ECM connector terminals B1, D8, and C4 for damage or poor mating. Is the problem found?	-	Go to *Step 12*	Go to *Step 14*
12	Repair the ECM connector terminal(s) as needed. Is the repair complete?	-	Go to "Diagnostic System Check"	-
13	Inspect for damage or poor mating at the ECM connector terminal C1. Is the problem found?	-	Go to *Step 12*	Go to *Step 14*
14	Check the ECM connector terminals A12 and D1 for ground. Are the grounds OK?	-	Go to *Step 24*	Go to *Step 23*

No Malfunction Indicator Lamp (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
15	1. Turn the ignition OFF. 2. Replace the fuse. 3. Turn the ignition ON. Is the MIL lamp on?	-	Go to "Diagnostic System Check"	Go to *Step 4*
16	Repair the open in the ignition feed wire to the MIL bulb. Is the repair complete?	-	Go to "Diagnostic System Check"	-
17	Replace the service engine soon bulb. Is the repair complete?	-	Go to "Diagnostic System Check"	-
18	Repair the wire between the ECM connector terminal C1 and the MIL bulb. Is the repair complete?	-	Go to "Diagnostic System Check"	-
19	1. Turn the ignition OFF. 2. Replace the ECM fuse. 3. Turn the ignition ON. Is the MIL lamp on?	-	Go to "Diagnostic System Check"	Go to *Step 1*
20	Repair the wire between the ECM connector terminal B1 and the battery. Is the repair complete?	-	Go to "Diagnostic System Check"	-
21	Repair the wire between the ECM connector terminal D8 and the battery. Is the repair complete?	-	Go to "Diagnostic System Check"	-
22	Repair the wire between the ECM connector terminal C4 and fuse F13. Is the repair complete?	-	Go to "Diagnostic System Check"	-
23	Repair the open wire between the ECM connector terminals A12 and/or D1 and ground. Is the repair complete?	-	Go to "Diagnostic System Check"	-
24	Replace the electronic control module. Is the repair complete?	-	Go to "Diagnostic System Check"	-

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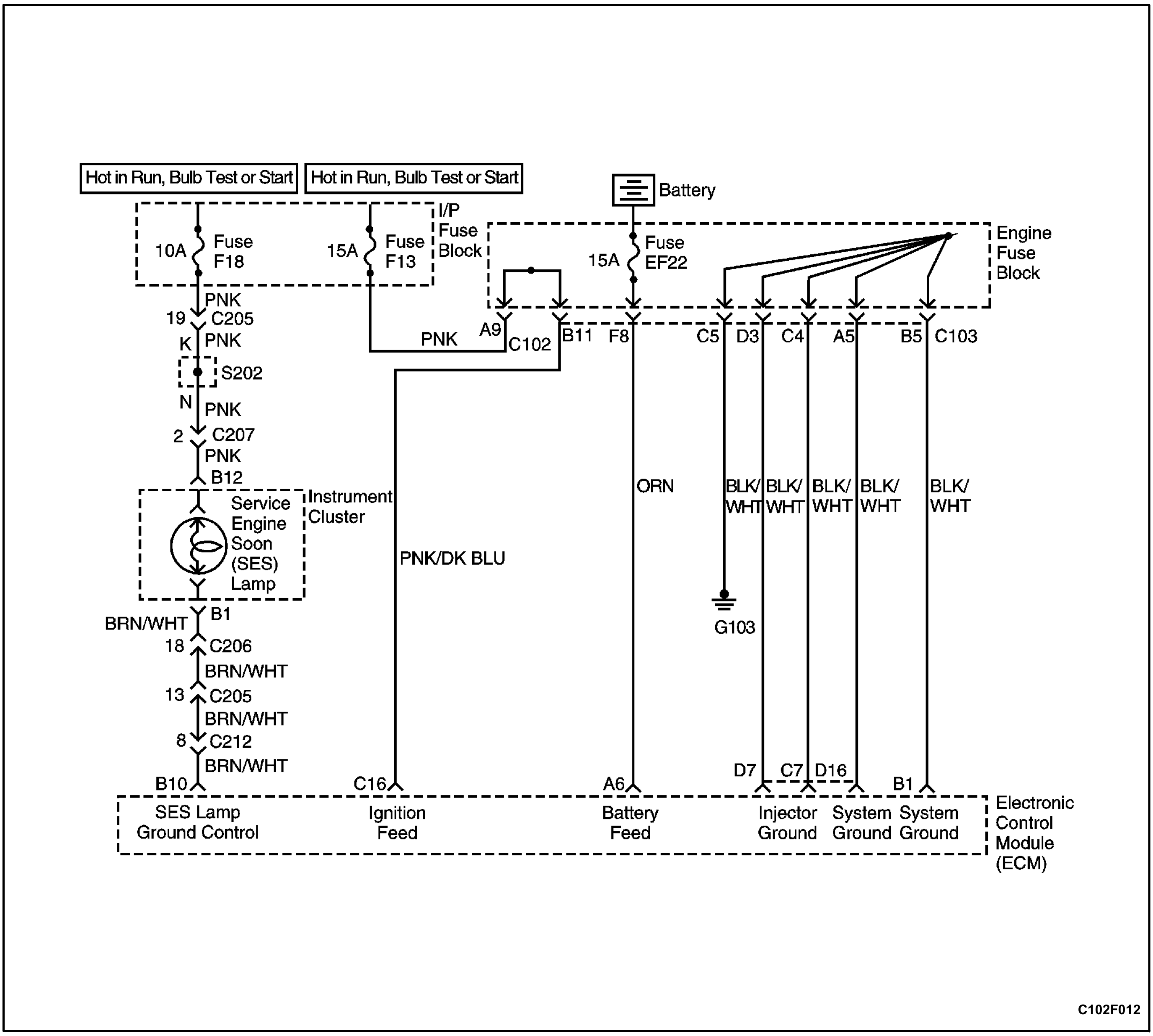

NO MALFUNCTION INDICATOR LAMP (2.0L DOHC)

Circuit Description

There should always be a steady malfunction indicator lamp (MIL) when the ignition is ON and the engine is stopped. Battery voltage is supplied directly to the MIL bulb. The electronic control module (ECM) will control the MIL lamp and turn it on by providing a ground path through the ECM connector terminal B10 wire to the MIL lamp.

Diagnostic Aids

- If the engine runs OK, inspect for a faulty malfunction indicator lamp bulb.
- If the engine cranks but will not start, check for open fuses and poor electronic control module (ECM) connections. Particularly check for ECM ignition and battery feeds, including clean and tight ECM ground connections.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This step checks for battery voltage in the instrument panel malfunction indicator lamp (MIL) bulb socket.
8. This step checks for battery feed to the electronic control module (ECM).
9. This step checks for ignition feed to the ECM.
22. At this point the MIL lamp wiring is OK. The problem is a faulty ECM.

No Malfunction Indicator Lamp (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Start the engine. Does the engine start?	-	Go to *Step 2*	Go to *Step 7*
2	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) connectors. 3. Turn the ignition ON. 4. Connect a test light between the ECM connector terminal B10 and ground. Is the malfunction indicator lamp (MIL) on?	-	Go to *Step 13*	Go to *Step 3*
3	Inspect the kick panel fuse F18. Is the fuse OK?	-	Go to *Step 4*	Go to *Step 14*
4	Check the ignition feed to the MIL bulb using a voltmeter. Is the voltage within the value specified?	11-14 V	Go to *Step 5*	Go to *Step 15*
5	Inspect the MIL bulb. Is the MIL bulb OK?	-	Go to *Step 6*	Go to *Step 16*
6	Check for an open or short to voltage in the wire between the ECM connector terminal B10 and the MIL bulb. Is the problem found?	-	Go to *Step 17*	Go to *Step 12*
7	Inspect the ECM fuse F13. Is the problem found?	-	Go to *Step 18*	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Disconnect the ECM red connector. 3. Connect a test light to ECM connector terminal A6 and ground. Is the test light on?	-	Go to *Step 9*	Go to *Step 19*
9	1. Turn the ignition OFF. 2. Disconnect the ECM white connector. 3. Connect a test light between the ECM connector terminal C16 and ground. Is the test light on?	-	Go to *Step 10*	Go to *Step 20*
10	Inspect the ECM connector terminals A6 and C16 for damage or poor mating. Is the problem found?	-	Go to *Step 11*	Go to *Step 13*
11	Repair the ECM connector terminal(s) as needed. Is the repair complete?	-	Go to "Diagnostic System Check"	-
12	Inspect for damage or poor mating at the ECM connector terminal B10. Is the problem found?	-	Go to *Step 11*	Go to *Step 13*
13	Check the ECM connector terminals B1 and D16 for ground. Are the grounds OK?	-	Go to *Step 22*	Go to *Step 21*
14	1. Turn the ignition OFF. 2. Replace the fuse. 3. Turn the ignition ON. Is the MIL lamp on?	-	Go to "Diagnostic System Check"	Go to *Step 4*

No Malfunction Indicator Lamp (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
15	Repair the open in the ignition feed wire to the MIL bulb. Is the repair complete?	-	Go to "Diagnostic System Check"	-
16	Replace the service engine soon bulb. Is the repair complete?	-	Go to "Diagnostic System Check"	-
17	Repair the wire between the ECM connector terminal B10 and the MIL bulb. Is the repair complete?	-	Go to "Diagnostic System Check"	-
18	1. Turn the ignition OFF. 2. Replace the ECM fuse. 3. Turn the ignition ON. Is the MIL lamp on?	-	Go to "Diagnostic System Check"	Go to *Step 1*
19	Repair the wire between the ECM connector terminal A6 and the battery. Is the repair complete?	-	Go to "Diagnostic System Check"	-
20	Repair the wire between the ECM connector terminal C16 and the battery. Is the repair complete?	-	Go to "Diagnostic System Check"	-
21	Repair the open wire between the ECM connector terminals B1 and/or D16 and ground. Is the repair complete?	-	Go to "Diagnostic System Check"	-
22	Replace the electronic control module. Is the repair complete?	-	Go to "Diagnostic System Check"	-

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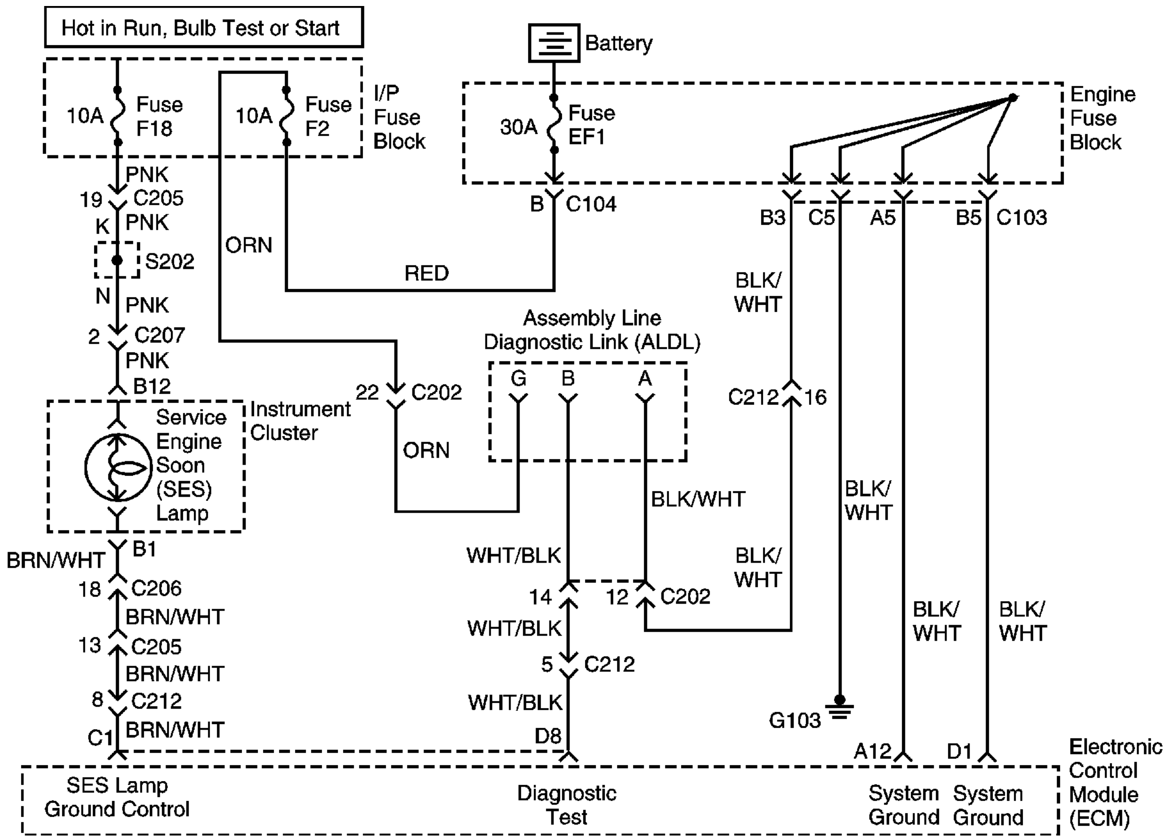


WILL NOT FLASH MALFUNCTION INDICATOR LAMP (2.0L SOHC)

Circuit Description

There should always be a steady malfunction indicator lamp (MIL) when the ignition is ON and the engine stopped. Battery ignition voltage is supplied directly to the MIL bulb. The electronic control module (ECM) will turn the MIL on by grounding the ECM connector terminal C1 wire. With the assembly line diagnostic link (ALDL) A and B terminals grounded, the MIL lamp should flash a Code 12 followed by any diagnostic trouble code(s) stored in the ECM memory. A steady MIL lamp suggests a short to ground in the ECM connector terminal C1 wire, or an open in the diagnostic test wire. A steady but dim light would indicate a failed quaddriver. The table will confirm and suggest the cause.

Diagnostic Aids

- If the engine runs OK, inspect for a faulty service engine soon (MIL) bulb.
- If the engine cranks but will not start, check for open fuses and poor electronic control module (ECM) connections. Particularly check for ECM ignition and battery feeds, including clean and tight ECM ground connections.

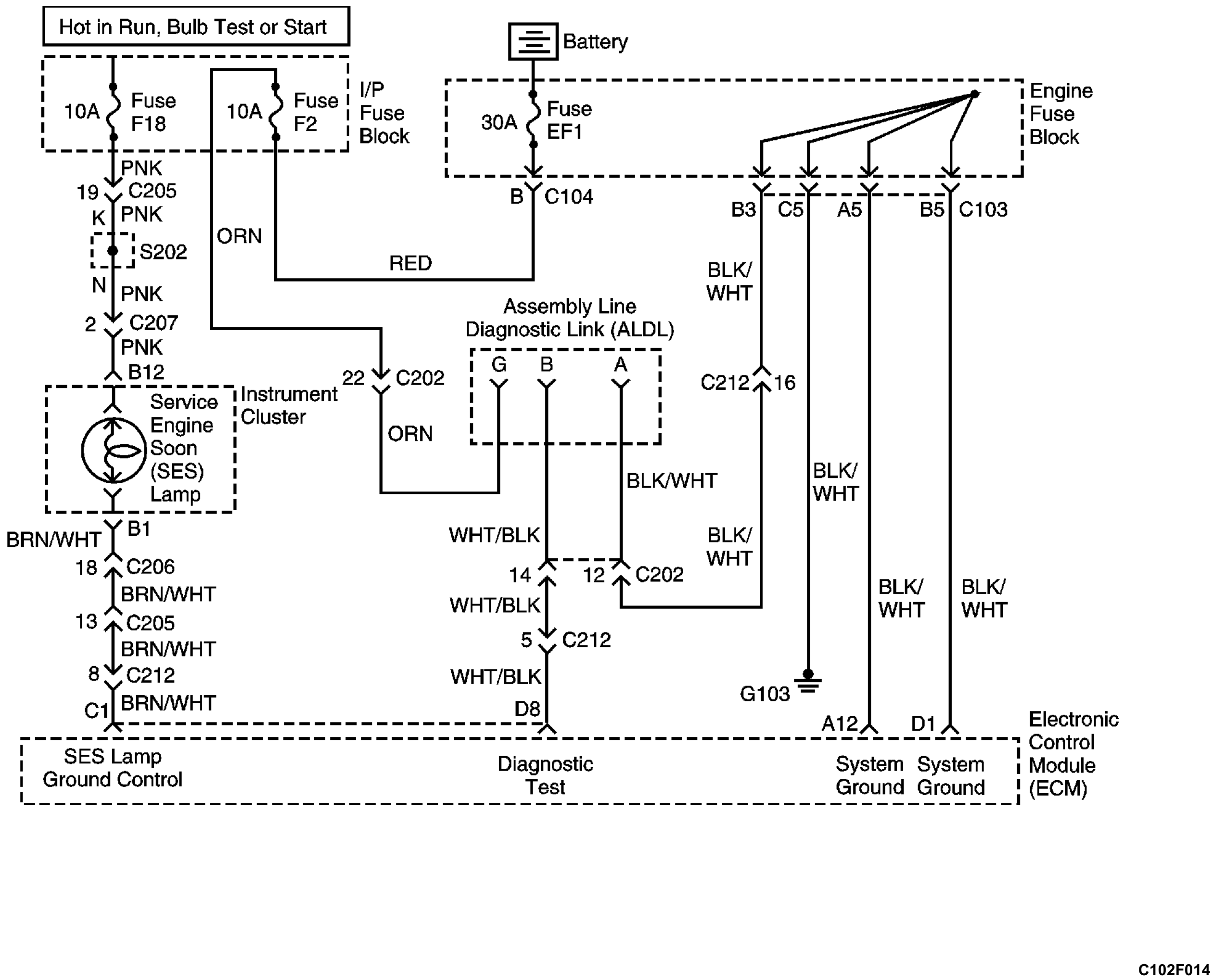
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. If the malfunction indicator lamp (MIL) is on when the electronic control module (ECM) white connector is disconnected, the wire to the ECM connector terminal C1 is shorted to ground.
5. This step will check for an open diagnostic test wire.
11. At this point the MIL wiring is OK. The problem is a faulty ECM.

Will Not Flash Malfunction Indicator Lamp (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Turn the ignition ON. Is the malfunction indicator lamp (MIL) on?	-	Go to *Step 2*	Go to "No Malfunction Indicator Lamp"
2	1. Turn the ignition OFF. 2. Jumper the assembly line diagnostic link (ALDL) terminals A and B. 3. Turn the ignition ON. Does the MIL lamp flash the diagnostic trouble code (DTC) 12?	-	Go to "Diagnostic System Check"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the ECM 32 pin connector. 3. Turn the ignition ON. Is the MIL on?	-	Go to *Step 4*	Go to *Step 5*
4	Repair the short to ground in the wire between the ECM connector terminal C1 and the MIL bulb. Is the repair complete?	-	Go to "Diagnostic System Check"	-
5	1. Turn the ignition OFF. 2. Reconnect the ECM 32 pin connector. 3. Turn the ignition ON. 4. Backprobe the ECM connector terminal D8 with a test light connected to ground. Does the MIL flash DTC 12?	-	Go to *Step 6*	Go to *Step 8*
6	Check for an open wire between the ECM connector terminal D8 and the ALDL terminal B. Is the problem found?	-	Go to *Step 10*	Go to *Step 7*
7	Repair the open wire between the ALDL terminal A and ground. Is the repair complete?	-	Go to "Diagnostic System Check"	-
8	Check for damage or poor mating at the ECM connector terminal D8. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	Repair the ECM connector terminal D8. Is the repair complete?	-	Go to "Diagnostic System Check"	-
10	Repair the wire between the ECM connector terminal D8 and the ALDL terminal B. Is the repair complete?	-	Go to "Diagnostic System Check"	-
11	Replace the electronic control module. Is the repair complete?	-	Go to "Diagnostic System Check"	-



WILL NOT FLASH MALFUNCTION INDICATOR LAMP (2.0L DOHC)

Circuit Description

There should always be a steady malfunction indicator lamp (MIL) when the ignition is ON and the engine stopped. Battery ignition voltage is supplied directly to the MIL bulb. The electronic control module (ECM) will turn the MIL on by grounding the ECM connector terminal B10 wire. With the assembly line diagnostic link (ALDL) A and B terminals grounded, the MIL lamp should flash a Code 12 followed by any diagnostic trouble code(s) stored in the ECM memory. A steady MIL lamp suggests a short to ground in the ECM connector terminal B10 wire, or an open in the diagnostic test wire. A steady but dim light would indicate a failed quaddriver. The table will confirm and suggest the cause.

Diagnostic Aids

- If the engine runs OK, inspect for a faulty service engine soon (MIL) bulb.
- If the engine cranks but will not start, check for open fuses and poor electronic control module (ECM) connections. Particularly check for ECM ignition and battery feeds, including clean and tight ECM ground connections.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. If the malfunction indicator lamp (MIL) is on when the electronic control module (ECM) red connector is disconnected, the wire to the ECM connector terminal B10 is shorted to ground.

5. This step will check for an open diagnostic test wire.

11. At this point the MIL wiring is OK. The problem is a faulty ECM.

Will Not Flash Malfunction Indicator Lamp (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Turn the ignition ON. Is the malfunction indicator lamp (MIL) on?	-	Go to *Step 2*	Go to "No Malfunction Indicator Lamp"
2	1. Turn the ignition OFF. 2. Jumper the assembly line diagnostic link (ALDL) terminals A and B. 3. Turn the ignition ON. Does the MIL lamp flash the diagnostic trouble code (DTC) 12?	-	Go to "Diagnostic System Check"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the ECM red connector. 3. Turn the ignition ON. Is the MIL on?	-	Go to *Step 4*	Go to *Step 5*
4	Repair the short to ground in the wire between the ECM connector terminal B10 and the MIL bulb. Is the repair complete?	-	Go to "Diagnostic System Check"	-
5	1. Turn the ignition OFF. 2. Reconnect the ECM red connector. 3. Turn the ignition ON. 4. Backprobe the ECM connector terminal B9 with a test light connected to ground. Does the MIL flash DTC 12?	-	Go to *Step 6*	Go to *Step 8*
6	Check for an open wire between the ECM connector terminal B9 and the ALDL terminal B. Is the problem found?	-	Go to *Step 10*	Go to *Step 7*
7	Repair the open wire between the ALDL terminal A and ground. Is the repair complete?	-	Go to "Diagnostic System Check"	-
8	Check for damage or poor mating at the ECM connector terminal B9. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	Repair the ECM connector terminal B9. Is the repair complete?	-	Go to "Diagnostic System Check"	-
10	Repair the wire between the ECM connector terminal B9 and the ALDL terminal B. Is the repair complete?	-	Go to "Diagnostic System Check"	-
11	Replace the electronic control module. Is the repair complete?	-	Go to "Diagnostic System Check"	-

FUEL SYSTEM PRESSURE TEST (Except Euro Stage-II)

Circuit Description

The fuel pump is an intānk fuel pump mounted to a fuel sender assembly. The fuel pump will remain on as long as the engine is cranking or running and the electronic control module (ECM) is receiving reference pulses from the crankshaft position sensor (CPS). If there are no reference pulses, the ECM will turn off the fuel pump two seconds after the ignition switch is turned ON or two seconds after the engine stops running. The fuel pump delivers fuel to the fuel rail and the fuel injectors, where the fuel system pressure is controlled from 284 to 325 kPa (41 to 47 psi) by the fuel pressure regulator. The excess fuel is returned to the fuel tank.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. When the engine is idling, the intake manifold vacuum is high. This vacuum is applied to the fuel pressure regulator diaphragm, offsetting the spring pressure inside the fuel pressure regulator and lowering the fuel pressure.

10. If there is fuel bleeding back through the fuel return outlet, this is due to a faulty fuel pressure regulator.

14. Another symptom often present when the fuel injectors are leaking is hard starting. Leaking fuel injectors can cause a flooding condition.

23. Fuel leaking from the fuel pump inlet is due to a faulty one-way check valve in the fuel pump.

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump fuse EF19 from the engine fuse box.
3. Start the engine and allow the engine to stall.
4. Crank the engine for an additional 10 seconds.

Fuel System Pressure Test

Step	Action	Value(s)	Yes	No
1	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	Go to *Step 2*	Go to *Step 5*
2	1. Disconnect the fuel pressure regulator vacuum hose. 2. Start the engine. 3. Allow the engine to idle. 4. Connect the fuel pressure regulator vacuum hose. Did the fuel pressure decrease?	-	System OK	Go to *Step 3*
3	1. Allow the engine to idle. 2. Disconnect the vacuum hose from the fuel pressure regulator. 3. Connect a vacuum pump with a gauge to the fuel pressure regulator vacuum port. 4. Apply 41-47 kPa (12-14 in. Hg) of vacuum to the fuel pressure regulator. Did the fuel pressure decrease?	-	Go to *Step 4*	Go to *Step 16*
4	1. Locate and correct the cause of the vacuum restriction to the fuel pressure regulator. 2. Confirm the operation of the fuel pressure regulator. Is the repair complete?	-	System OK	-

Fuel System Pressure Test (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified but not holding steady?	284-325 kPa (41-47 psi)	Go to *Step 6*	Go to *Step 17*
6	Inspect the fuel lines for a leak. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	1. Replace the fuel line(s) as needed. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
8	1. Remove the fuel pump assembly. 2. With the fuel pump under pressure, inspect the fuel pump coupling hoses for leaking. Is the problem found?	-	Go to *Step 9*	Go to *Step 10*
9	1. Tighten or replace the fuel pump coupling hoses as needed. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
10	With the fuel system under pressure, inspect the fuel return outlet for leaking. Is the problem found?	-	Go to *Step 11*	Go to *Step 12*
11	1. Replace the fuel pressure regulator. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
12	With the fuel system under pressure, inspect the fuel inlet for leaking. Is the problem found?	-	Go to *Step 13*	Go to *Step 14*
13	1. Replace the fuel pump assembly. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
14	1. Remove the fuel rail and the fuel injectors as an assembly. 2. With the fuel system under pressure, inspect all of the fuel injectors for leaking. Is the problem found?	-	Go to *Step 15*	-
15	1. Replace the leaking fuel injector(s). 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-

Fuel System Pressure Test (Cont'd)

Step	Action	Value(s)	Yes	No
16	1. Replace the fuel pressure regulator. 2. Disconnect the fuel pressure regulator vacuum hose. 3. Start the engine. 4. Allow the engine to idle. 5. Connect the fuel pressure regulator vacuum hose. Did the fuel pressure decrease?	-	System OK	-
17	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel system pressure below the values specified and holding steady?	284-325 kPa (41-47 psi)	Go to *Step 13*	Go to *Step 18*
18	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel system pressure below the values specified and not holding steady?	284-325 kPa (41-47 psi)	Go to *Step 19*	-
19	Inspect the fuel lines for leaks. Is the problem found?	-	Go to *Step 7*	Go to *Step 20*
20	1. Remove the fuel pump assembly. 2. With the fuel pump under pressure, inspect the fuel pump coupling hoses for leaking. Is the problem found?	-	Go to *Step 9*	Go to *Step 21*
21	1. Remove the fuel pump assembly. 2. With the fuel system under pressure, inspect the fuel return outlet for leaking. Is the problem found?	-	Go to *Step 11*	Go to *Step 22*
22	1. Remove the fuel pump assembly. 2. With the fuel system under pressure, inspect the fuel inlet for leaking. Is the problem found?	-	Go to *Step 13*	Go to *Step 23*
23	1. Remove the fuel rail and the fuel injectors as an assembly. 2. With the fuel system under pressure, inspect all of the fuel injectors for leaking. Is the problem found?	-	Go to *Step 15*	Go to *Step 13*

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FUEL SYSTEM PRESSURE TEST (Euro Stage-II Only)

Circuit Description

The fuel pump is an in-tank fuel pump mounted to a fuel sender assembly. The fuel pump will remain on as long as the engine is cranking or running and the electronic control module (ECM) is receiving reference pulses from the crankshaft position sensor (CPS). The fuel pump delivers fuel to the fuel rail and the fuel injectors, where the fuel system pressure is controlled from 284 to 325 kPa (41 to 47 psi) by the fuel pressure regulator. The excess fuel is returned to the fuel tank.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. When the engine is idling, the intake manifold vacuum is high. This vacuum is applied to the fuel pressure regulator diaphragm, offsetting the spring pressure inside the fuel pressure regulator and lowering the fuel pressure.
10. If there is fuel bleeding back through the fuel return outlet, this is due to a faulty fuel pressure regulator.
14. Another symptom often present when the fuel injectors are leaking is hard starting. Leaking fuel injectors can cause a flooding condition.
23. Fuel leaking from the fuel pump inlet is due to a faulty one-way check valve in the fuel pump.

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump fuse EF19 from the engine fuse box.
3. Start the engine and allow the engine to stall.
4. Crank the engine for an additional 10 seconds.

Fuel System Pressure Test

Step	Action	Value(s)	Yes	No
1	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Start the engine. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	Go to *Step 2*	Go to *Step 5*
2	1. Disconnect the fuel pressure regulator vacuum hose. 2. Allow the engine to idle. 3. Connect the fuel pressure regulator vacuum hose. Did the fuel pressure decrease?	-	System OK	Go to *Step 3*
3	1. Allow the engine to idle. 2. Disconnect the vacuum hose from the fuel pressure regulator. 3. Connect a vacuum pump with a gauge to the fuel pressure regulator vacuum port. 4. Apply 41-47 kPa (12-14 in. Hg) of vacuum to the fuel pressure regulator. Did the fuel pressure decrease?	-	Go to *Step 4*	Go to *Step 16*
4	1. Locate and correct the cause of the vacuum restriction to the fuel pressure regulator. 2. Confirm the operation of the fuel pressure regulator. Is the repair complete?	-	System OK	-

Fuel System Pressure Test (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Start the engine. Is the fuel pressure within the values specified but not holding steady?	284-325 kPa (41-47 psi)	Go to *Step 6*	Go to *Step 17*
6	Inspect the fuel lines for a leak. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	1. Replace the fuel line(s) as needed. 2. Install a fuel pressure gauge. 3. Start the engine. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
8	1. Remove the fuel pump assembly. 2. With the fuel pump under pressure, inspect the fuel pump coupling hoses for leaking. Is the problem found?	-	Go to *Step 9*	Go to *Step 10*
9	1. Tighten or replace the fuel pump coupling hoses as needed. 2. Install a fuel pressure gauge. 3. Start the engine. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
10	With the fuel system under pressure, inspect the fuel return outlet for leaking. Is the problem found?	-	Go to *Step 11*	Go to *Step 12*
11	1. Replace the fuel pressure regulator. 2. Install a fuel pressure gauge. 3. Start the engine. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
12	With the fuel system under pressure, inspect the fuel inlet for leaking. Is the problem found?	-	Go to *Step 13*	Go to *Step 14*
13	1. Replace the fuel pump assembly. 2. Install a fuel pressure gauge. 3. Start the engine. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
14	1. Remove the fuel rail and the fuel injectors as an assembly. 2. With the fuel system under pressure, inspect all of the fuel injectors for leaking. Is the problem found?	-	Go to *Step 15*	-
15	1. Replace the leaking fuel injector(s). 2. Install a fuel pressure gauge. 3. Start the engine. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-

Fuel System Pressure Test (Cont'd)

Step	Action	Value(s)	Yes	No
16	1. Replace the fuel pressure regulator. 2. Disconnect the fuel pressure regulator vacuum hose. 3. Start the engine. 4. Allow the engine to idle. 5. Connect the fuel pressure regulator vacuum hose. Did the fuel pressure decrease?	-	System OK	-
17	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Start the engine. Is the fuel system pressure below the values specified and holding steady?	284-325 kPa (41-47 psi)	Go to *Step 13*	Go to *Step 18*
18	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Start the engine. Is the fuel system pressure below the values specified and not holding steady?	284-325 kPa (41-47 psi)	Go to *Step 19*	-
19	Inspect the fuel lines for leaks. Is the problem found?	-	Go to *Step 7*	Go to *Step 20*
20	1. Remove the fuel pump assembly. 2. With the fuel pump under pressure, inspect the fuel pump coupling hoses for leaking. Is the problem found?	-	Go to *Step 9*	Go to *Step 21*
21	1. Remove the fuel pump assembly. 2. With the fuel system under pressure, inspect the fuel return outlet for leaking. Is the problem found?	-	Go to *Step 11*	Go to *Step 22*
22	1. Remove the fuel pump assembly. 2. With the fuel system under pressure, inspect the fuel inlet for leaking. Is the problem found?	-	Go to *Step 13*	Go to *Step 23*
23	1. Remove the fuel rail and the fuel injectors as an assembly. 2. With the fuel system under pressure, inspect all of the fuel injectors for leaking. Is the problem found?	-	Go to *Step 15*	Go to *Step 13*

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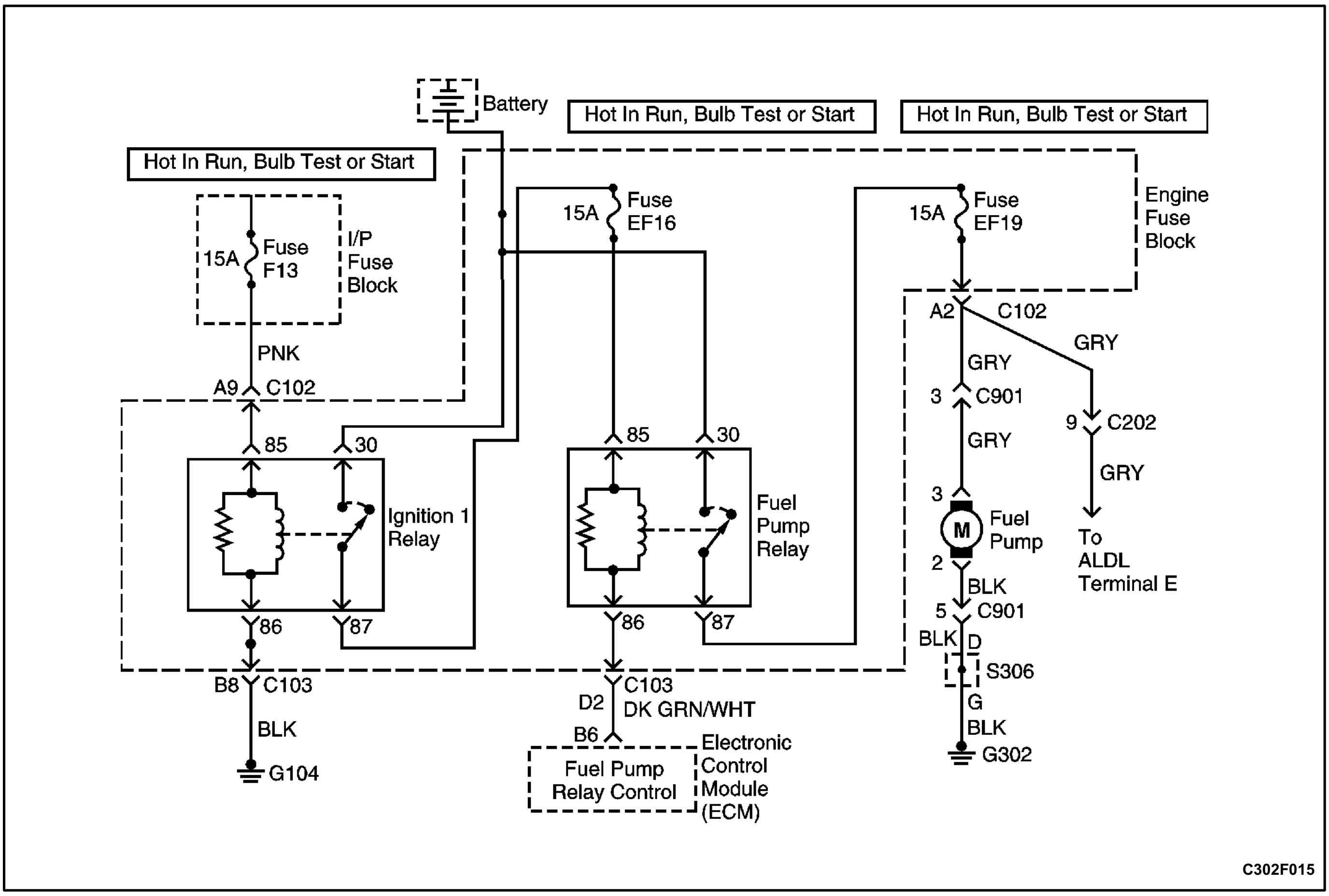

FUEL PUMP RELAY CIRCUIT CHECK (2.0L SOHC)

Circuit Description

When the ignition switch is turned ON, the electronic control module (ECM) will activate the fuel pump relay and run the intank fuel pump. The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

If there are no reference pulses, the ECM will shut off the fuel pump within 2 seconds after the ignition switch is turned ON.

Diagnostic Aids

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

Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks for the electronic control module (ECM) providing a ground for the operation of the fuel pump relay.
7. By confirming that the wiring is OK using steps 2 through 6, it can be determined that the fuel pump relay is at fault.
8. If there is no voltage present at the fuel pump relay connector terminal 85, the problem is an open engine fuse block fuse EF16, an open in the wiring between the fuel pump relay and the ignition 1 relay, or a fault is present in the ignition 1 relay circuit.
9. After determining that there is no ground being provided by the ECM to the fuel pump relay, the fault is either the ECM or the wiring between the ECM and the fuel pump relay.

Fuel Pump Relay Circuit Check (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF for 10 seconds. 2. Turn the ignition ON. 3. Listen for in tank fuel pump operation. Does the fuel pump operate for the time specified?	2 sec	System OK	Go to *Step 2*
2	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 3*	Go to *Step 8*
3	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 86 and battery positive. 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 4*	Go to *Step 9*
4	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 5*	Go to *Step 11*
5	Check for an open or short to ground in the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3. Is the problem found?	-	Go to *Step 6*	Go to *Step 7*
6	1. Repair the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
7	1. Replace the fuel pump relay. 2. Turn the ignition OFF for 10 seconds. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
8	Check for an open wire between the fuel pump relay connector terminal 85 and the ignition 1 relay connector terminal 87. Is the problem found?	-	Go to *Step 13*	Go to "Ignition 1 Relay Circuit Check"
9	Check for an open wire between the fuel pump relay connector terminal 86 to the ECM connector terminal B6. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
10	1. Repair the wire between the fuel pump relay connector terminal 86 to the ECM connector terminal B6. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-

Fuel Pump Relay Circuit Check (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Repair the wire between the fuel pump relay connector terminal 30 and the battery. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
12	1. Replace the electronic control module. 2. Turn the ignition OFF for 10 seconds. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
13	Repair the wire between the fuel pump relay connector terminal 85 and the battery. Is the repair complete?	-	System OK	-

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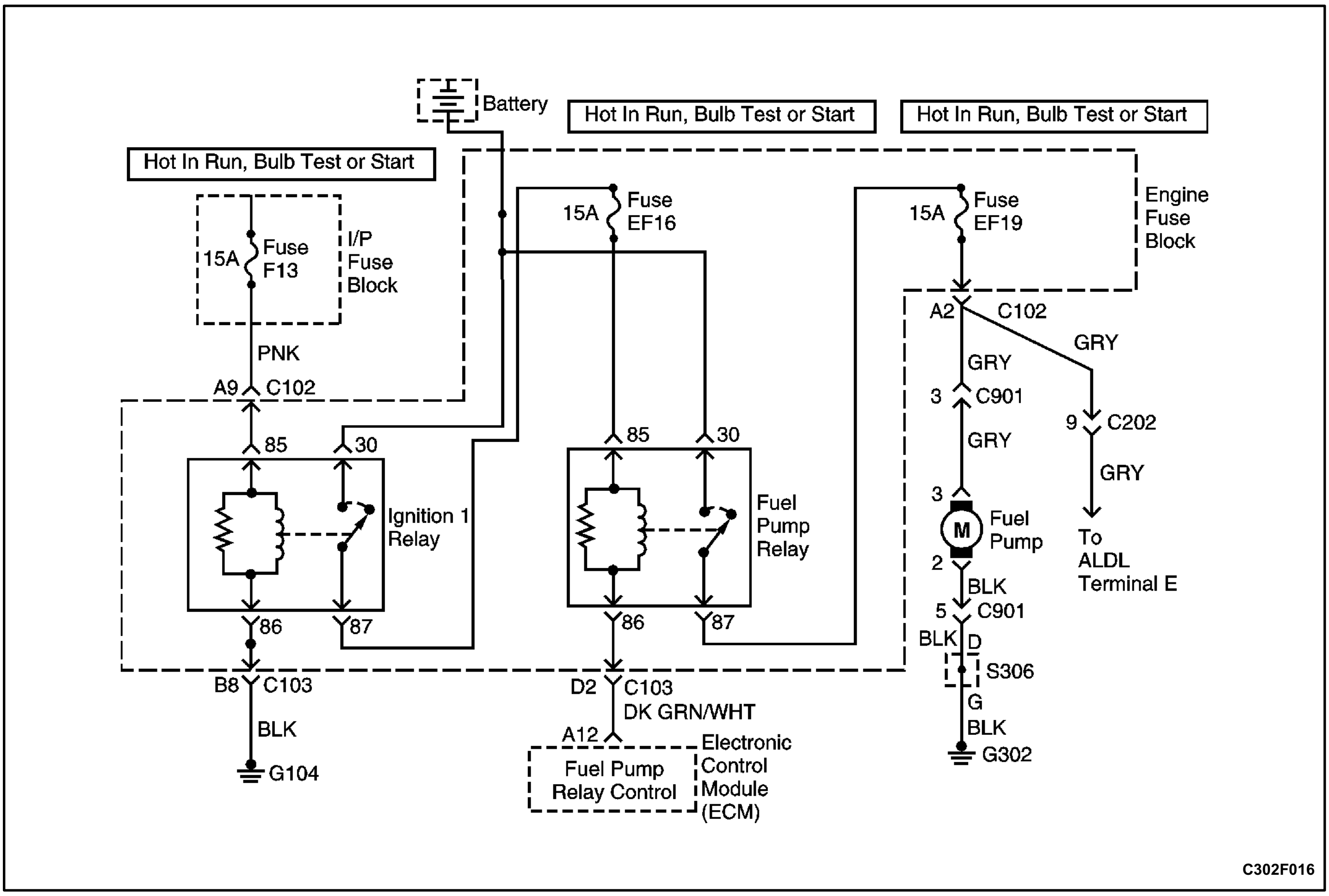

FUEL PUMP RELAY CIRCUIT CHECK (2.0L DOHC)
(Except Euro Stage-II)

Circuit Description

When the ignition switch is turned ON, the electronic control module (ECM) will activate the fuel pump relay and run the in tank fuel pump. The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

If there are no reference pulses, the ECM will shut off the fuel pump within 2 seconds after the ignition switch is turned ON.

Diagnostic Aids

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

Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks for the electronic control module (ECM) providing a ground for the operation of the fuel pump relay.
7. By confirming that the wiring is OK using steps 2 through 6, it can be determined that the fuel pump relay is at fault.
8. If there is no voltage present at the fuel pump relay connector terminal 85, the problem is an open engine fuse block fuse EF16, an open in the wiring between the fuel pump relay and the ignition 1 relay, or a fault is present in the ignition 1 relay circuit.
9. After determining that there is no ground being provided by the ECM to the fuel pump relay, the fault is either the ECM or the wiring between the ECM and the fuel pump relay.

Fuel Pump Relay Circuit Check (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF for 10 seconds. 2. Turn the ignition ON. 3. Listen for in tank fuel pump operation. Does the fuel pump operate for the time specified?	2 sec	System OK	Go to *Step 2*
2	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 3*	Go to *Step 8*
3	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 86 and battery positive. 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 4*	Go to *Step 9*
4	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 5*	Go to *Step 11*
5	Check for an open or short to ground in the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3. Is the problem found?	-	Go to *Step 6*	Go to *Step 7*
6	1. Repair the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
7	1. Replace the fuel pump relay. 2. Turn the ignition OFF for 10 seconds. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
8	Check for an open wire between the fuel pump relay connector terminal 85 and the ignition 1 relay connector terminal 87. Is the problem found?	-	Go to *Step 13*	Go to "Ignition 1 Relay Circuit Check"
9	Check for an open wire between the fuel pump relay connector terminal 86 to the ECM connector terminal A12. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
10	1. Repair the wire between the fuel pump relay connector terminal 86 to the ECM connector terminal A12. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-

Fuel Pump Relay Circuit Check (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Repair the wire between the fuel pump relay connector terminal 30 and the battery. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
12	1. Replace the electronic control module. 2. Turn the ignition OFF for 10 seconds. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
13	Repair the wire between the fuel pump relay connector terminal 85 and the battery. Is the repair complete?	-	System OK	-

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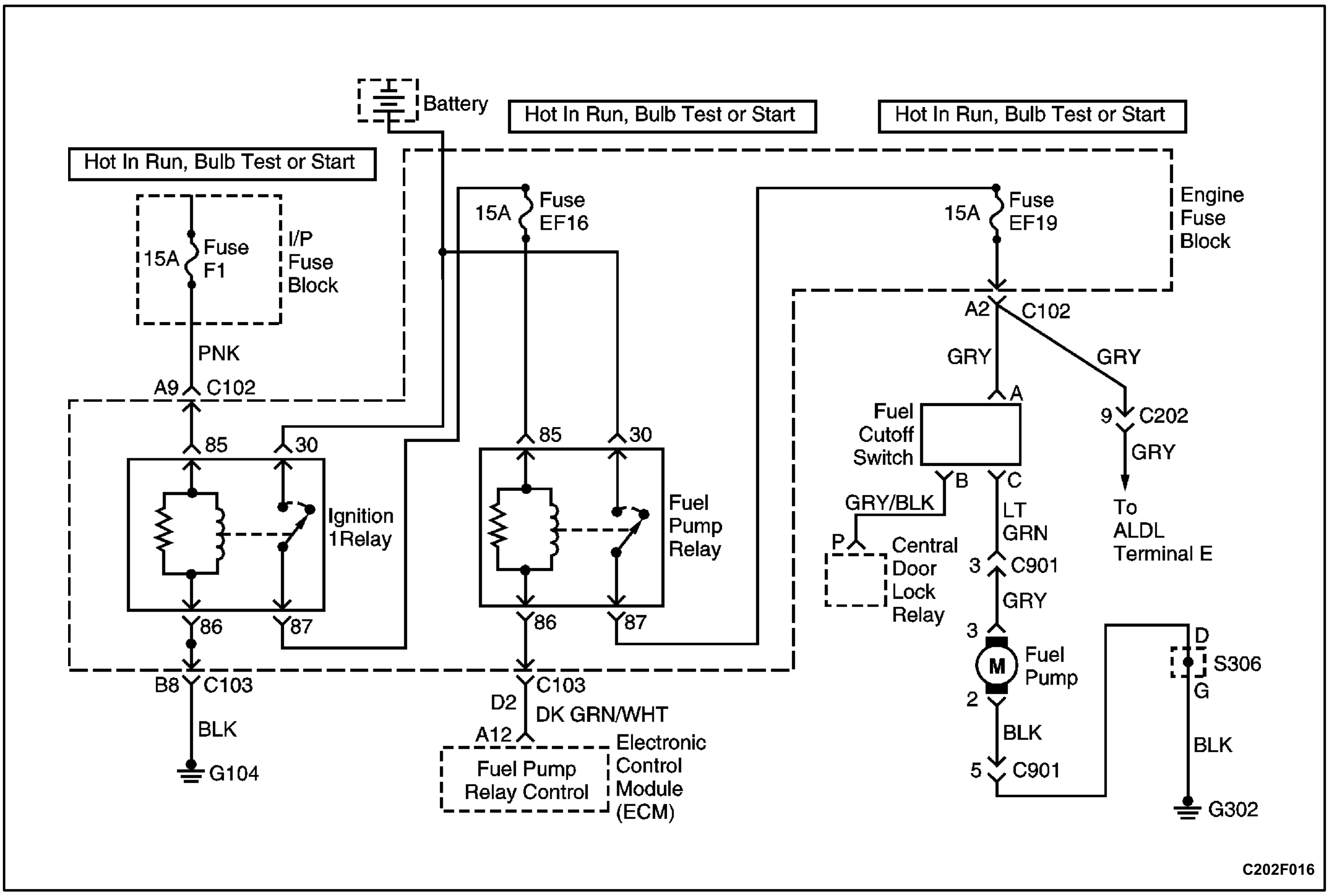

FUEL PUMP RELAY CIRCUIT CHECK (2.0L DOHC) (Euro Stage-II Only)

Circuit Description

When the engine started, the electronic control module (ECM) will activate the fuel pump relay and run the in-tank fuel pump. The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

If there are no reference pulses, the ECM will shut off the fuel pump.

Diagnostic Aids

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

Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks for the electronic control module (ECM) providing a ground for the operation of the fuel pump relay.
7. By confirming that the wiring is OK using steps 2 through 6, it can be determined that the fuel pump relay is at fault.
8. If there is no voltage present at the fuel pump relay connector terminal 85, the problem is an open engine fuse block fuse EF16, an open in the wiring between the fuel pump relay and the ignition 1 relay, or a fault is present in the ignition 1 relay circuit.
9. After determining that there is no ground being provided by the ECM to the fuel pump relay, the fault is either the ECM or the wiring between the ECM and the fuel pump relay.

Fuel Pump Relay Circuit Check (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF for 10 seconds. 2. Start the engine. Does the the engine started?	-	System OK	Go to *Step 2*
2	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 3*	Go to *Step 8*
3	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 86 and battery positive. 3. Start the engine. 4. The test light should light while cranking. Is the test light on?	-	Go to *Step 4*	Go to *Step 9*
4	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 5*	Go to *Step 11*
5	Check for an open or short to ground in the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3. Is the problem found?	-	Go to *Step 6*	Go to *Step 7*
6	1. Repair the wire between the fuel pump relay connector terminal 87 and the fuel pump connector terminal 3. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Start the engine. Does the engine started?	-	System OK	-
7	1. Replace the fuel pump relay. 2. Turn the ignition OFF for 10 seconds. 3. Start the engine. Does the engine started?	-	System OK	-
8	Check for an open wire between the fuel pump relay connector terminal 85 and the ignition 1 relay connector terminal 87. Is the problem found?	-	Go to *Step 13*	Go to "Ignition 1 Relay Circuit Check"
9	Check for an open wire between the fuel pump relay connector terminal 86 to the ECM connector terminal A12. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
10	1. Repair the wire between the fuel pump relay connector terminal 86 to the ECM connector terminal A12. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Start the engine. Does the engine started?	-	System OK	-

Fuel Pump Relay Circuit Check (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Repair the wire between the fuel pump relay connector terminal 30 and the battery. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Start the engine. Does the engine started?	-	System OK	-
12	1. Replace the electronic control module. 2. Turn the ignition OFF for 10 seconds. 3. Start the engine. Does the engine started?	-	System OK	-
13	Repair the wire between the fuel pump relay connector terminal 85 and the battery. Is the repair complete?	-	System OK	-

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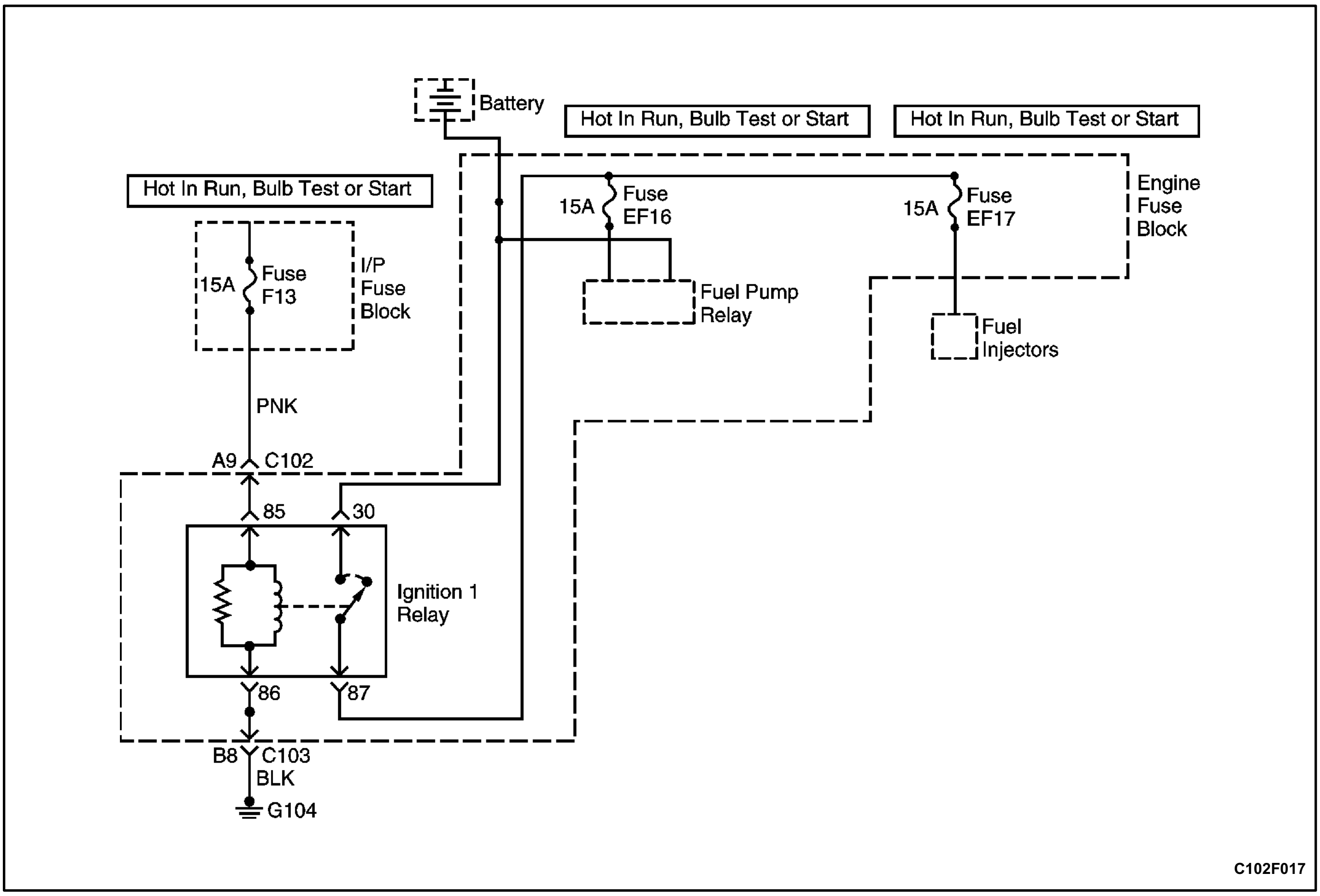


IGNITION 1 RELAY CIRCUIT CHECK

Circuit Description

When the ignition is turned ON or to the START position, the ignition 1 relay is energized. The ignition 1 relay then supplies voltage to the engine fuse box fuse EF16 and the engine fuse box fuse EF17. The direct ignition system ignition coil, the fuel pump relay (coil side), and the controlled canister purge solenoid are supplied voltage through the engine fuse box fuse EF16. The fuel injectors are supplied voltage through the engine fuse box fuse EF17.

Diagnostic Aids

- An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.
- A faulty ignition 1 relay will cause a no start condition. There will be no voltage supplied to the direct ignition system ignition coil, the fuel pump relay (coil side), or the fuel injectors. Without voltage supplied to these components, they will not operate.

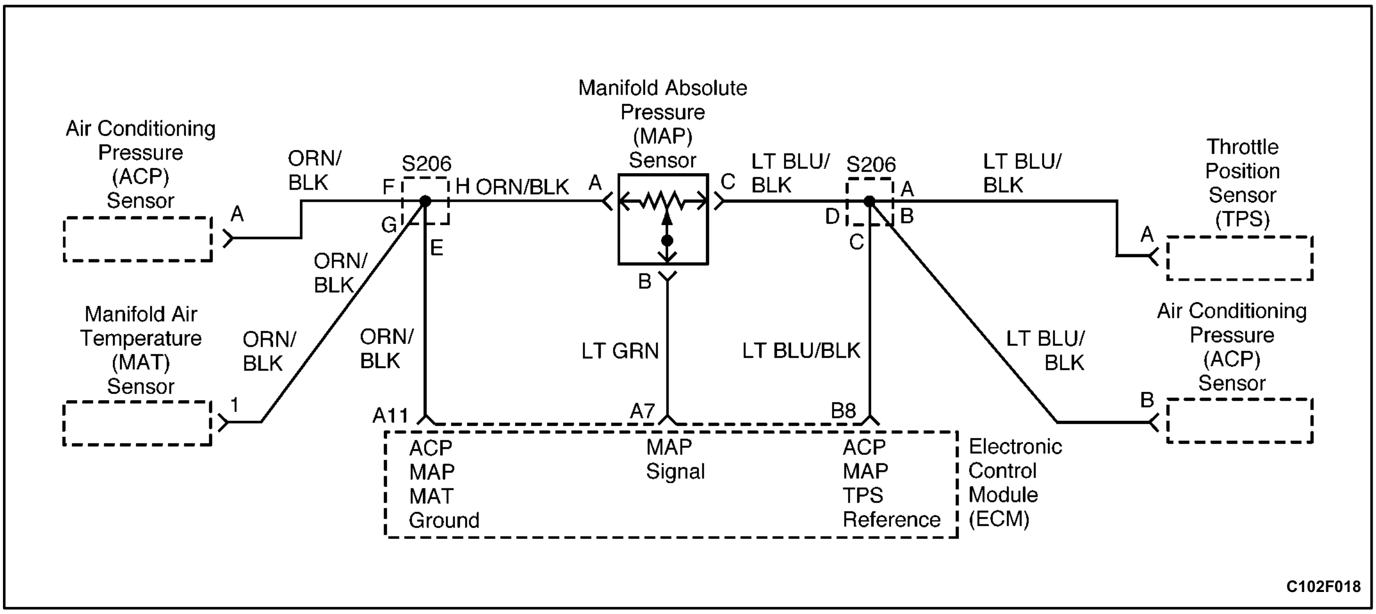
Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. If the test light is on at both of the fuse terminals, the ignition 1 relay is OK.
5. This step, along with steps 6, 7, and 8, checks for correct voltage and ground to the ignition 1 relay terminals.
14. After confirming correct voltage and ground to the ignition 1 relay terminals, it can be determined that the ignition 1 relay is faulty.

Ignition 1 Relay Circuit Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF. 2. Disconnect the engine fuse block fuses EF16 and EF17. 3. Turn the ignition ON. 4. With a test light connected to ground, probe the fuse terminals nearest the ignition 1 relay for fuses EF16 and EF17. Is the test light on at both terminals?	-	System OK	Go to *Step 2*
2	Check the test light. Is the test light on at only one terminal?	-	Go to *Step 9*	Go to *Step 3*
3	Check the test light. Is the test light off at both terminals?	-	Go to *Step 4*	-
4	1. Turn the ignition OFF. 2. Inspect the instrument panel fuse block fuse F13. Is the fuse OK?	-	Go to *Step 5*	Go to *Step 10*
5	1. Disconnect the ignition 1 relay. 2. Connect a test light between the ignition 1 relay connector terminal 85 and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 6*	Go to *Step 11*
6	Connect a test light between the ignition 1 relay connector terminal 86 and battery voltage. Is the test light on?	-	Go to *Step 7*	Go to *Step 12*
7	Connect a test light between the ignition 1 relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 8*	Go to *Step 13*
8	Check for an open in the wiring between the ignition 1 relay connector terminal 87 and the engine fuse block terminals for fuses EF16 and EF17. Is the problem found?	-	Go to *Step 9*	Go to *Step 14*
9	Repair the open in the wiring between the ignition 1 relay connector terminal 87 and the engine fuse block terminal(s) for fuses EF16 and/or EF17. Is the repair complete?	-	System OK	-
10	Replace the instrument panel fuse block fuse F13. Is the repair complete?	-	System OK	-
11	Repair the open in the wiring between the ignition 1 relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
12	Repair the open in the wiring between the ignition 1 relay connector terminal 86 and ground. Is the repair complete?	-	System OK	-
13	Repair the open in the wiring between the ignition 1 relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
14	Replace the ignition 1 relay. Is the repair complete?	-	System OK	-



MANIFOLD ABSOLUTE PRESSURE CHECK (2.0L SOHC)

Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load (intake manifold vacuum) and rpm changes. The MAP sensor converts these changes into a voltage output. The electronic control module (ECM) sends a 5 volt reference voltage to the MAP sensor. As the intake manifold pressure changes, the output voltage of the MAP sensor also changes. A low voltage (high vacuum) output of 1 to 2 volts is present at idle. A high voltage (low vacuum) output of 4.0 to 4.8 volts is present at wide open throttle. The MAP sensor is also used under certain conditions to measure barometric pressure. This allows the ECM to make adjustments for altitude changes. The ECM uses the MAP sensor for fuel delivery and ignition timing changes.

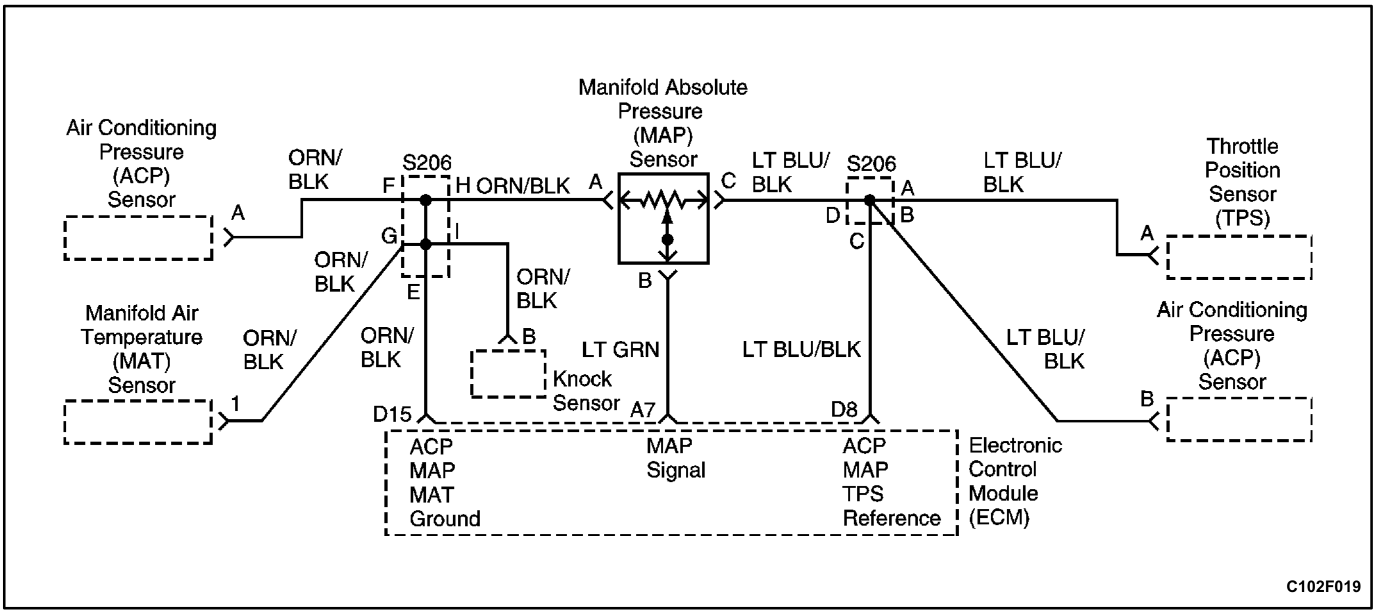
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. Applying 34 kPa (10 inches Hg) of vacuum to the manifold absolute pressure (MAP) sensor should cause the voltage to change. Subtract the second voltage reading from the first. That voltage value should be more than 1.5 volts. When applying vacuum to the MAP sensor, the change in the voltage should happen instantly. A slow voltage change indicates a faulty MAP sensor.
3. Disconnect the MAP sensor from the bracket and twist the MAP sensor. Output changes more than 0.1 volt indicate a faulty connector or connection.

Manifold Absolute Pressure Check (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF. 2. Connect a scan tool to the assembly line diagnostic link (ALDL). 3. Turn the ignition ON. 4. Compare the manifold absolute pressure (MAP) sensor voltage reading from the scanner with that from a known good vehicle. Is the difference in the two voltage readings less than the value specified?	0.4 V	Go to *Step 2*	Go to *Step 5*
2	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. Disconnect the MAP sensor vacuum line. 4. Connect a hand vacuum pump to the MAP sensor. 5. Turn the ignition ON. 6. Note the MAP sensor voltage. 7. Apply 34 kPa (10 in. Hg) of vacuum to the MAP sensor and note the voltage change. Is the difference in voltage readings more than the value specified?	1.5 V	System OK	Go to *Step 3*
3	Inspect the MAP sensor connector terminals. Is the problem found?	-	Go to *Step 4*	Go to *Step 5*
4	Repair the MAP sensor connector terminals as needed. Is the repair complete?	-	System OK	-
5	Replace the manifold absolute pressure sensor. Is the repair complete?	-	System OK	-



MANIFOLD ABSOLUTE PRESSURE CHECK (2.0L DOHC)

Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load (intake manifold vacuum) and rpm changes. The MAP sensor converts these changes into a voltage output. The electronic control module (ECM) sends a 5 volt reference voltage to the MAP sensor. As the intake manifold pressure changes, the output voltage of the MAP sensor also changes. A low voltage (high vacuum) output of 1 to 2 volts is present at idle. A high voltage (low vacuum) output of 4.0 to 4.8 volts is present at wide open throttle. The MAP sensor is also used under certain conditions to measure barometric pressure. This allows the ECM to make adjustments for altitude changes. The ECM uses the MAP sensor for fuel delivery and ignition timing changes.

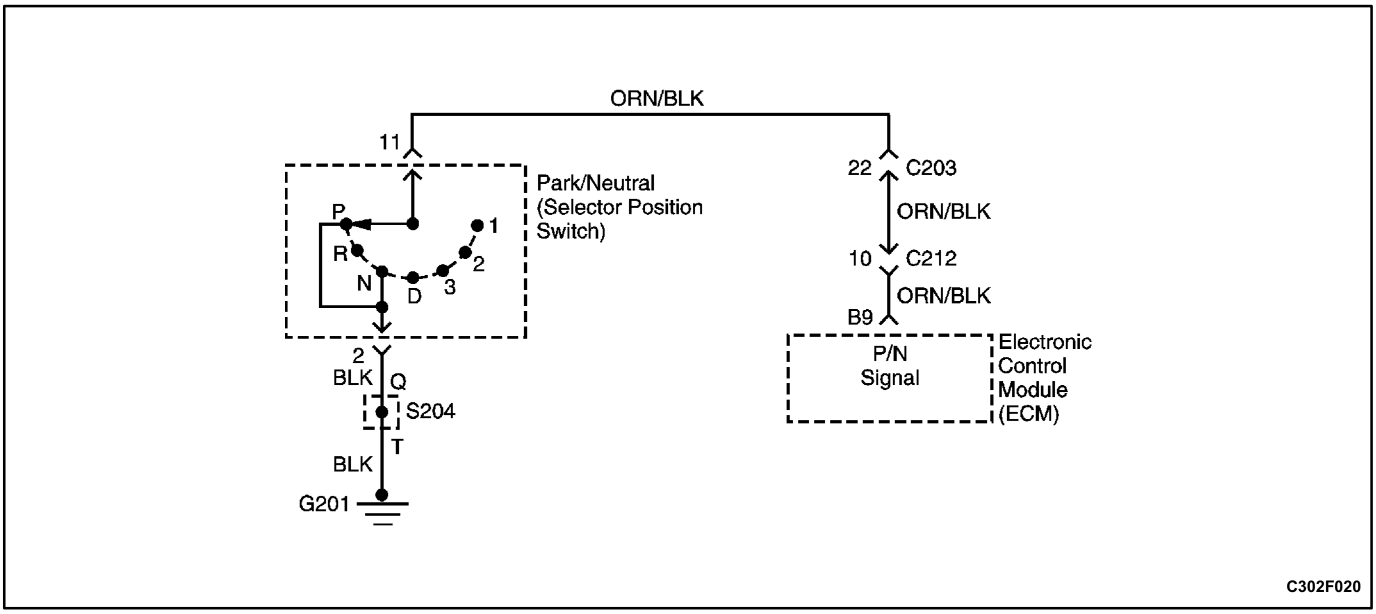
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. Applying 34 kPa (10 inches Hg) of vacuum to the manifold absolute pressure (MAP) sensor should cause the voltage to change. Subtract the second voltage reading from the first. That voltage value should be more than 1.5 volts. When applying vacuum to the MAP sensor, the change in the voltage should happen instantly. A slow voltage change indicates a faulty MAP sensor.
3. Disconnect the MAP sensor from the intake manifold and twist the MAP sensor. Output changes more than 0.1 volt indicate a faulty connector or connection.

Manifold Absolute Pressure Check (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF. 2. Connect a scan tool to the assembly line diagnostic link (ALDL). 3. Turn the ignition ON. 4. Compare the manifold absolute pressure (MAP) sensor voltage reading from the scanner with that from a known good vehicle. Is the difference in the two voltage readings less than the value specified?	0.4 V	Go to *Step 2*	Go to *Step 5*
2	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. Disconnect the MAP sensor vacuum line. 4. Connect a hand vacuum pump to the MAP sensor. 5. Turn the ignition ON. 6. Note the MAP sensor voltage. 7. Apply 34 kPa (10 in. Hg) of vacuum to the MAP sensor and note the voltage change. Is the difference in voltage readings more than the value specified?	1.5 V	System OK	Go to *Step 3*
3	Inspect the MAP sensor connector terminals. Is the problem found?	-	Go to *Step 4*	Go to *Step 5*
4	Repair the MAP sensor connector terminals as needed. Is the repair complete?	-	System OK	-
5	Replace the manifold absolute pressure sensor. Is the repair complete?	-	System OK	-



PARK/NEUTRAL SWITCH (2.0L SOHC)

Circuit Description

The park/neutral (P/N) switch contacts are a part of the selector position switch. The contacts are closed to ground in park and neutral and open in the drive ranges.

The electronic control module (ECM) supplies ignition voltage through a current limiting resistor to the signal wire and senses a closed switch when the voltage on the signal wire drops to less than 1 volt. The ECM uses the P/N signal as one of the inputs to control idle air and spark timing.

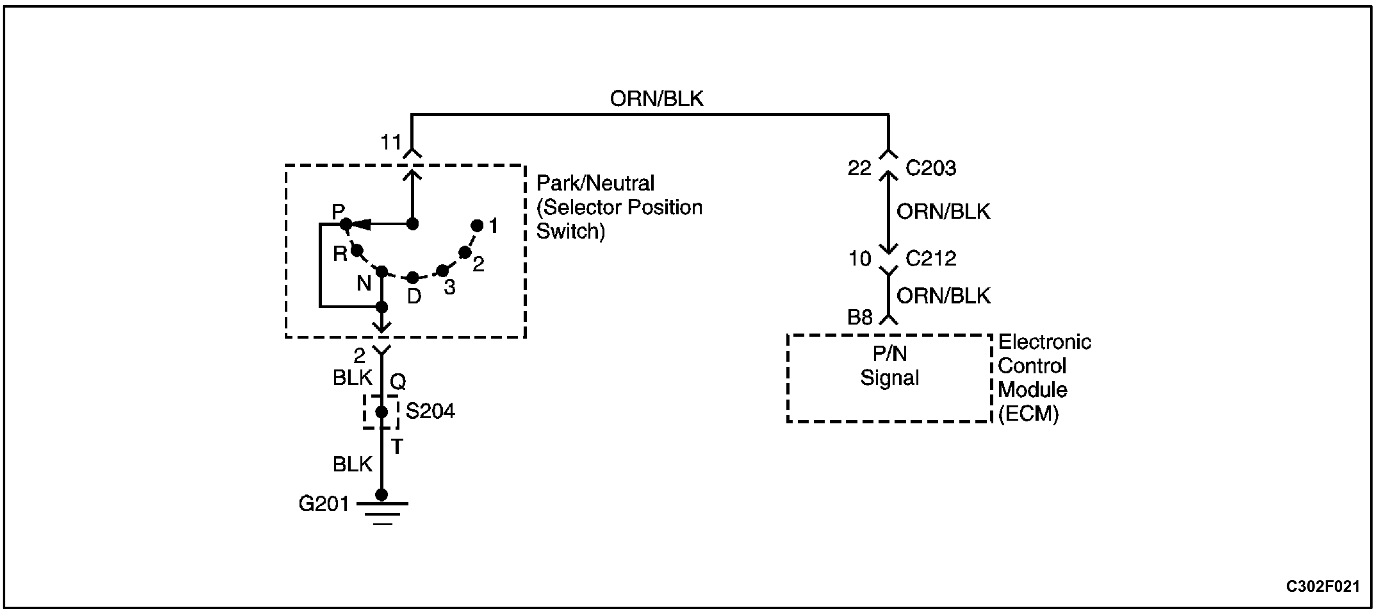
Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. Checks for the park/neutral (P/N) switch closed to ground in the park position. Different makes of scan tools will read park/neutral differently. Refer to the tool operations manual for the type of display used.
2. Checks for an open P/N switch in the drive range.

Park/Neutral Switch (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	1. Connect a scan tool to the assembly line diagnostic link (ALDL). 2. Place the transaxle in P (Park). 3. Turn the ignition ON. Does the scan tool indicate park or neutral?	-	Go to *Step 2*	Go to *Step 10*
2	Place the transaxle in D (Drive). Does the scan tool indicate drive?	-	System OK	Go to *Step 3*
3	Disconnect the park/neutral (P/N) switch. Does the scan tool indicate drive?	-	Go to *Step 4*	Go to *Step 7*
4	Check the P/N switch adjustment. Is the problem found?	-	Go to *Step 5*	Go to *Step 6*
5	Adjust the P/N switch. Is the repair complete?	-	System OK	-
6	Replace the P/N switch. Is the repair complete?	-	System OK	-
7	Check for an open or short to ground in the wire between the P/N switch connector terminal 11 and the ECM connector terminal B9. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
8	Repair the open or short to ground in the wire between the P/N switch connector terminal 11 and the ECM connector terminal B9. Is the repair complete?	-	System OK	-
9	Replace the electronic control module. Is the repair complete?	-	System OK	-
10	1. Disconnect the P/N switch. 2. Jumper the P/N switch connector terminals 11 and 2. 3. Turn the ignition ON. Does the scan tool indicate park?	-	Go to *Step 4*	Go to *Step 11*
11	Jumper the P/N switch connector terminal 11 to ground. Does the scan tool indicate park?	-	Go to *Step 12*	Go to *Step 7*
12	Repair the open wire between the P/N switch connector terminal 2 and ground. Is the repair complete?	-	System OK	-



PARK/NEUTRAL SWITCH (2.0L DOHC)

Circuit Description

The park/neutral (P/N) switch contacts are a part of the selector position switch. The contacts are closed to ground in park and neutral and open in the drive ranges.

The electronic control module (ECM) supplies ignition voltage through a current limiting resistor to the signal wire and senses a closed switch when the voltage on the signal wire drops to less than 1 volt. The ECM uses the P/N signal as one of the inputs to control idle air and spark timing.

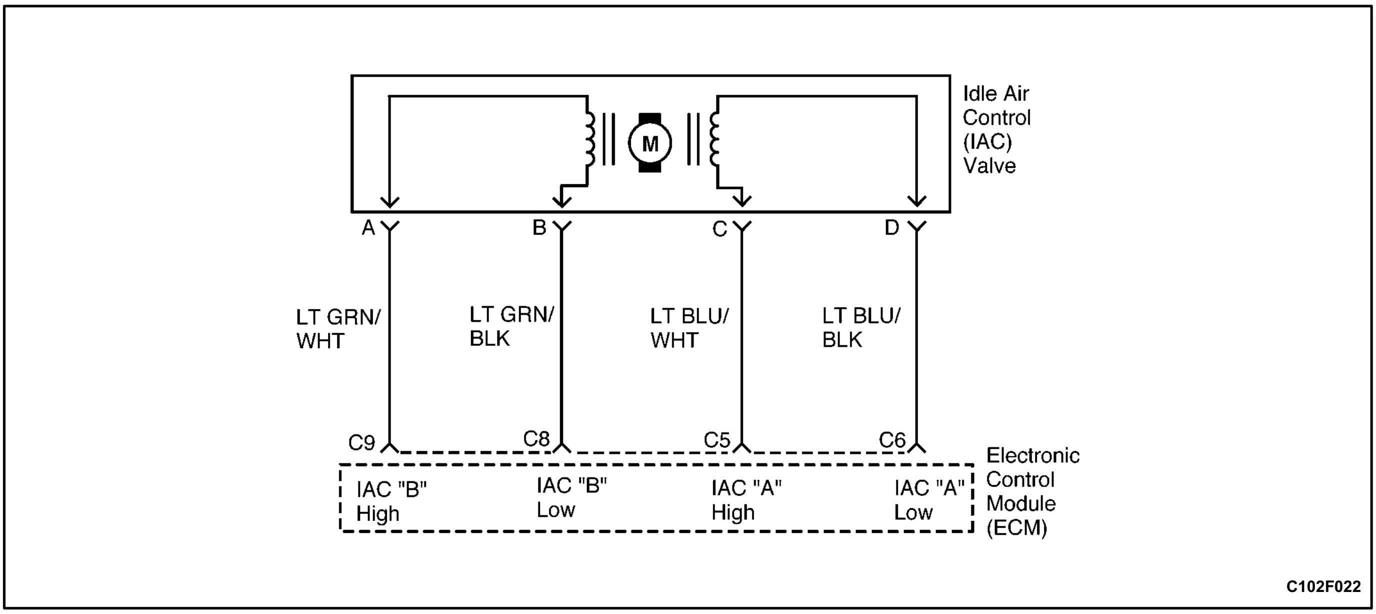
Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. Checks for the park/neutral (P/N) switch closed to ground in the park position. Different makes of scan tools will read park/neutral differently. Refer to the tool operations manual for the type of display used.
2. Checks for an open P/N switch in the drive range.

Park/Neutral Switch (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	1. Connect a scan tool to the assembly line diagnostic link (ALDL). 2. Place the transaxle in P (Park). 3. Turn the ignition ON. Does the scan tool indicate park or neutral?	-	Go to *Step 2*	Go to *Step 10*
2	Place the transaxle in D (Drive). Does the scan tool indicate drive?	-	System OK	Go to *Step 3*
3	Disconnect the park/neutral (P/N) switch. Does the scan tool indicate drive?	-	Go to *Step 4*	Go to *Step 7*
4	Check the P/N switch adjustment. Is the problem found?	-	Go to *Step 5*	Go to *Step 6*
5	Adjust the P/N switch. Is the repair complete?	-	System OK	-
6	Replace the P/N switch. Is the repair complete?	-	System OK	-
7	Check for an open or short to ground in the wire between the P/N switch connector terminal 11 and the ECM connector terminal B9. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
8	Repair the open or short to ground in the wire between the P/N switch connector terminal 11 and the ECM connector terminal B9. Is the repair complete?	-	System OK	-
9	Replace the electronic control module. Is the repair complete?	-	System OK	-
10	1. Disconnect the P/N switch. 2. Jumper the P/N switch connector terminals 11 and 2. 3. Turn the ignition ON. Does the scan tool indicate park?	-	Go to *Step 4*	Go to *Step 11*
11	Jumper the P/N switch connector terminal 11 to ground. Does the scan tool indicate park?	-	Go to *Step 12*	Go to *Step 7*
12	Repair the open wire between the P/N switch connector terminal 2 and ground. Is the repair complete?	-	System OK	-



IDLE AIR CONTROL SYSTEM CHECK (2.0L SOHC)

Circuit Description

The electronic control module (ECM) controls the engine idle speed with the idle air control (IAC) valve. To increase the idle speed, the ECM pulls the IAC pintle away from its seat, allowing more air to pass by the throttle bore. To decrease the idle speed, it extends the IAC valve pintle toward its seat, reducing bypass air flow. A scan tool will read the ECM commands to the IAC valve in counts. The higher counts indicate more air bypass (higher idle). The lower counts indicate less air is allowed to bypass (lower idle).

Diagnostic Aids

If the idle is too high, stop the engine. Fully extend the idle air control (IAC) valve with a IAC tester. Start the engine. If the idle speed is above 800 rpm, locate and repair the vacuum leak. Also, check for a binding throttle plate or throttle linkage or an incorrect base idle setting.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. The idle air control (IAC) valve is extended and retracted by the IAC driver. IAC valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be removed from the throttle body and tested. Connect the IAC driver to the removed IAC valve and turn the ignition ON. Do not start the engine.
5. This step checks the quality of the IAC valve movement in step 2. Fully extending the IAC valve may cause an engine stall. This may be normal.
6. Steps 2 and 5 verify proper IAC valve operation. This step checks the IAC circuit for a wiring or electronic control module (ECM) fault.

Idle Air Control Valve Reset Procedure

Whenever the battery cable or the electronic control module (ECM) connector or the ECM fuse EF22 is disconnected (more than 10 seconds) or replaced the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.
4. Start the engine in park/neutral.
5. Allow the engine to run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.
7. Turn the A/C OFF for 10 seconds, if equipped.
8. If the vehicle is equipped with an automatic transaxle, apply the parking brake. While depressing the brake pedal, place the transaxle in D (drive).
9. Turn the A/C ON for 10 seconds, if equipped.
10. Turn the A/C OFF for 10 seconds, if equipped.
11. Turn the ignition OFF. The idle learn procedure is complete.

Idle Air Control System Check (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Connect the idle air control driver to the idle air control (IAC) valve. 3. Connect a scan tool to the assembly line diagnostic link (ALDL). 4. Start the engine. 5. With the IAC driver, extend and retract the IAC valve. Engine rpm should increase and decrease as the IAC valve is cycled. Does the engine rpm change?	-	Go to *Step 5*	Go to *Step 3*
3	1. Remove the IAC valve. 2. Inspect the IAC passages for restrictions. Is the problem found?	-	Go to *Step 4*	Go to *Step 19*
4	Clean the IAC passages. Is the repair complete?	-	System OK	-
5	1. Turn the ignition OFF. 2. Start the engine. 3. Using the IAC driver, extend and retract the IAC valve. Engine rpm should increase and decrease as the IAC valve is cycled. Does the rpm change smoothly within the value specified with each flash of the IAC driver?	700-1500 rpm	Go to *Step 6*	Go to *Step 3*
6	1. Turn the ignition OFF. 2. Connect the IAC driver to the IAC valve. 3. Install an IAC node light to the IAC valve connector. 4. Start the engine. 5. Cycle the IAC driver. 6. Watch the node lights of the IAC driver. Do both lights cycle red and green but never off as the rpm is changed?	-	Go to *Step 7*	Go to *Step 9*
7	1. Measure the resistance of the IAC valve between terminals A and B. 2. Measure the resistance of the IAC valve between terminals C and D. Does the resistance measure within the value specified?	40-80 Ω	Go to *Step 8*	Go to *Step 19*
8	1. Measure the resistance of the IAC valve between terminals B and C. 2. Measure the resistance of the IAC valve between terminals A and D. Does the ohmmeter show the specified value?	∞	Go to "Diagnostic Aids"	Go to *Step 19*
9	Inspect the IAC connector terminals. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
10	Repair or replace the IAC connector terminals as needed. Is the repair complete?	-	System OK	-

Idle Air Control System Check (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open or short in the wire between the IAC connector terminal A and the electronic control module (ECM) connector terminal C9. Is the problem found?	-	Go to *Step 15*	Go to *Step 12*
12	Check for an open or short in the wire between the IAC connector terminal B and the electronic control module (ECM) connector terminal C8. Is the problem found?	-	Go to *Step 15*	Go to *Step 13*
13	Check for an open or short in the wire between the IAC connector terminal C and the electronic control module (ECM) connector terminal C5. Is the problem found?	-	Go to *Step 15*	Go to *Step 14*
14	Check for an open or short in the wire between the IAC connector terminal D and the electronic control module (ECM) connector terminal C6. Is the problem found?	-	Go to *Step 15*	Go to *Step 16*
15	Repair the wire as needed. Is the repair complete?	-	System OK	-
16	Inspect the ECM connector terminals. Is the problem found?	-	Go to *Step 17*	Go to *Step 18*
17	Repair the ECM connector terminals as needed. Is the repair complete?	-	System OK	-
18	Replace the electronic control module. Is the repair complete?	-	System OK	-
19	Replace the idle air control valve. Is the repair complete?	-	System OK	-

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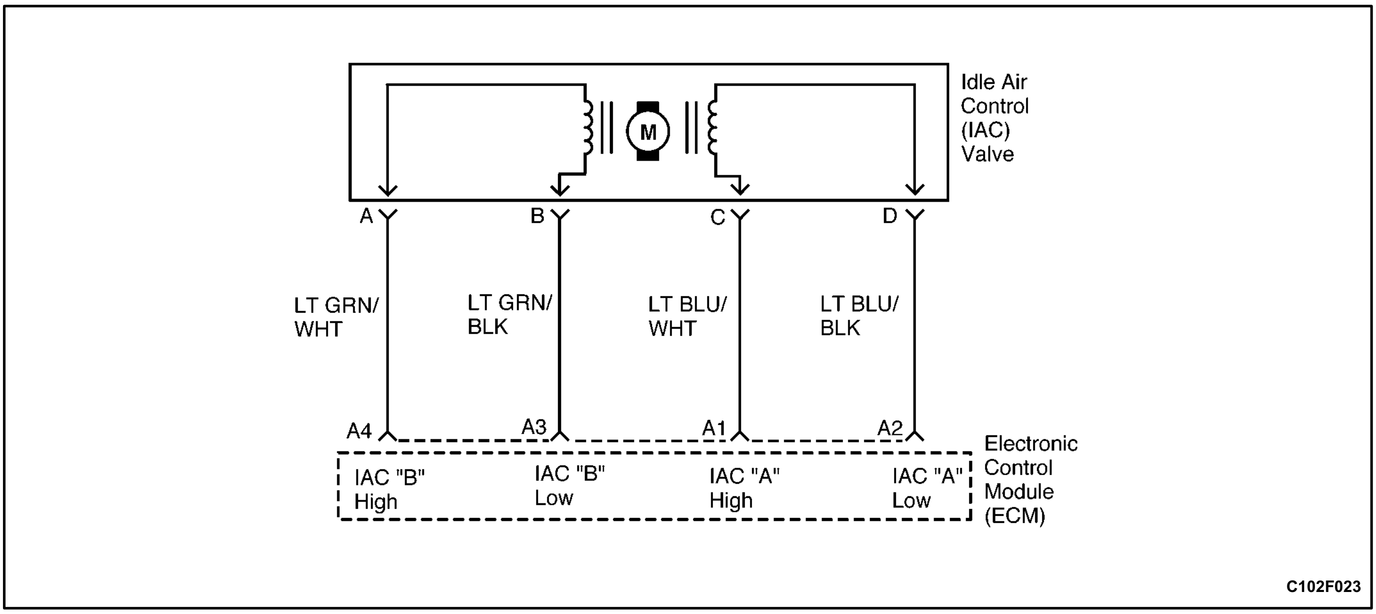

IDLE AIR CONTROL SYSTEM CHECK (2.0L DOHC)

Circuit Description

The electronic control module (ECM) controls the engine idle speed with the idle air control (IAC) valve. To increase the idle speed, the ECM pulls the IAC pintle away from its seat, allowing more air to pass by the throttle bore. To decrease the idle speed, it extends the IAC valve pintle toward its seat, reducing bypass air flow. A scan tool will read the ECM commands to the IAC valve in counts. The higher counts indicate more air bypass (higher idle). The lower counts indicate less air is allowed to bypass (lower idle).

Diagnostic Aids

If the idle is too high, stop the engine. Fully extend the idle air control (IAC) valve with a IAC tester. Start the engine. If the idle speed is above 800 rpm, locate and repair the vacuum leak. Also, check for a binding throttle plate or throttle linkage or an incorrect base idle setting.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. The idle air control (IAC) valve is extended and retracted by the IAC driver. IAC valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be removed from the throttle body and tested. Connect the IAC driver to the removed IAC valve and turn the ignition ON. Do not start the engine.
5. This step checks the quality of the IAC valve movement in step 2. Fully extending the IAC valve may cause an engine stall. This may be normal.
6. Steps 2 and 5 verify proper IAC valve operation. This step checks the IAC circuit for a wiring or electronic control module (ECM) fault.

Idle Air Control Valve Reset Procedure

Whenever the battery cable or the electronic control module (ECM) connector or the ECM fuse EF22 is disconnected (more than 10 seconds) or replaced the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.
4. Start the engine in park/neutral.
5. Allow the engine to run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.
7. Turn the A/C OFF for 10 seconds, if equipped.
8. If the vehicle is equipped with an automatic transaxle, apply the parking brake. While depressing the brake pedal, place the transaxle in D (drive).
9. Turn the A/C ON for 10 seconds, if equipped.
10. Turn the A/C OFF for 10 seconds, if equipped.
11. Turn the ignition OFF. The idle learn procedure is complete.

Idle Air Control System Check (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Connect the idle air control driver to the idle air control (IAC) valve. 3. Connect a scan tool to the assembly line diagnostic link (ALDL). 4. Start the engine. 5. With the IAC driver, extend and retract the IAC valve. Engine rpm should increase and decrease as the IAC valve is cycled. Does the engine rpm change?	-	Go to *Step 5*	Go to *Step 3*
3	1. Remove the IAC valve. 2. Inspect the IAC passages for restrictions. Is the problem found?	-	Go to *Step 4*	Go to *Step 19*
4	Clean the IAC passages. Is the repair complete?	-	System OK	-
5	1. Turn the ignition OFF. 2. Start the engine. 3. Using the IAC driver, extend and retract the IAC valve. Engine rpm should increase and decrease as the IAC valve is cycled. Does the rpm change smoothly within the value specified with each flash of the IAC driver?	700-1500 rpm	Go to *Step 6*	Go to *Step 3*
6	1. Turn the ignition OFF. 2. Connect the IAC driver to the IAC valve. 3. Install an IAC node light to the IAC valve connector. 4. Start the engine. 5. Cycle the IAC driver. 6. Watch the node lights of the IAC driver. Do both lights cycle red and green but never off as the rpm is changed?	-	Go to *Step 7*	Go to *Step 9*
7	1. Measure the resistance of the IAC valve between terminals A and B. 2. Measure the resistance of the IAC valve between terminals C and D. Does the resistance measure within the value specified?	40-80 Ω	Go to *Step 8*	Go to *Step 19*
8	1. Measure the resistance of the IAC valve between terminals B and C. 2. Measure the resistance of the IAC valve between terminals A and D. Does the ohmmeter show the specified value?	∞	Go to "Diagnostic Aids"	Go to *Step 19*
9	Inspect the IAC connector terminals. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
10	Repair or replace the IAC connector terminals as needed. Is the repair complete?	-	System OK	-

Idle Air Control System Check (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open or short in the wire between the IAC connector terminal A and the electronic control module (ECM) connector terminal A4. Is the problem found?	-	Go to *Step 15*	Go to *Step 12*
12	Check for an open or short in the wire between the IAC connector terminal B and the electronic control module (ECM) connector terminal A3. Is the problem found?	-	Go to *Step 15*	Go to *Step 13*
13	Check for an open or short in the wire between the IAC connector terminal C and the electronic control module (ECM) connector terminal A1. Is the problem found?	-	Go to *Step 15*	Go to *Step 14*
14	Check for an open or short in the wire between the IAC connector terminal D and the electronic control module (ECM) connector terminal A2. Is the problem found?	-	Go to *Step 15*	Go to *Step 16*
15	Repair the wire as needed. Is the repair complete?	-	System OK	-
16	Inspect the ECM connector terminals. Is the problem found?	-	Go to *Step 17*	Go to *Step 18*
17	Repair the ECM connector terminals as needed. Is the repair complete?	-	System OK	-
18	Replace the electronic control module. Is the repair complete?	-	System OK	-
19	Replace the idle air control valve. Is the repair complete?	-	System OK	-

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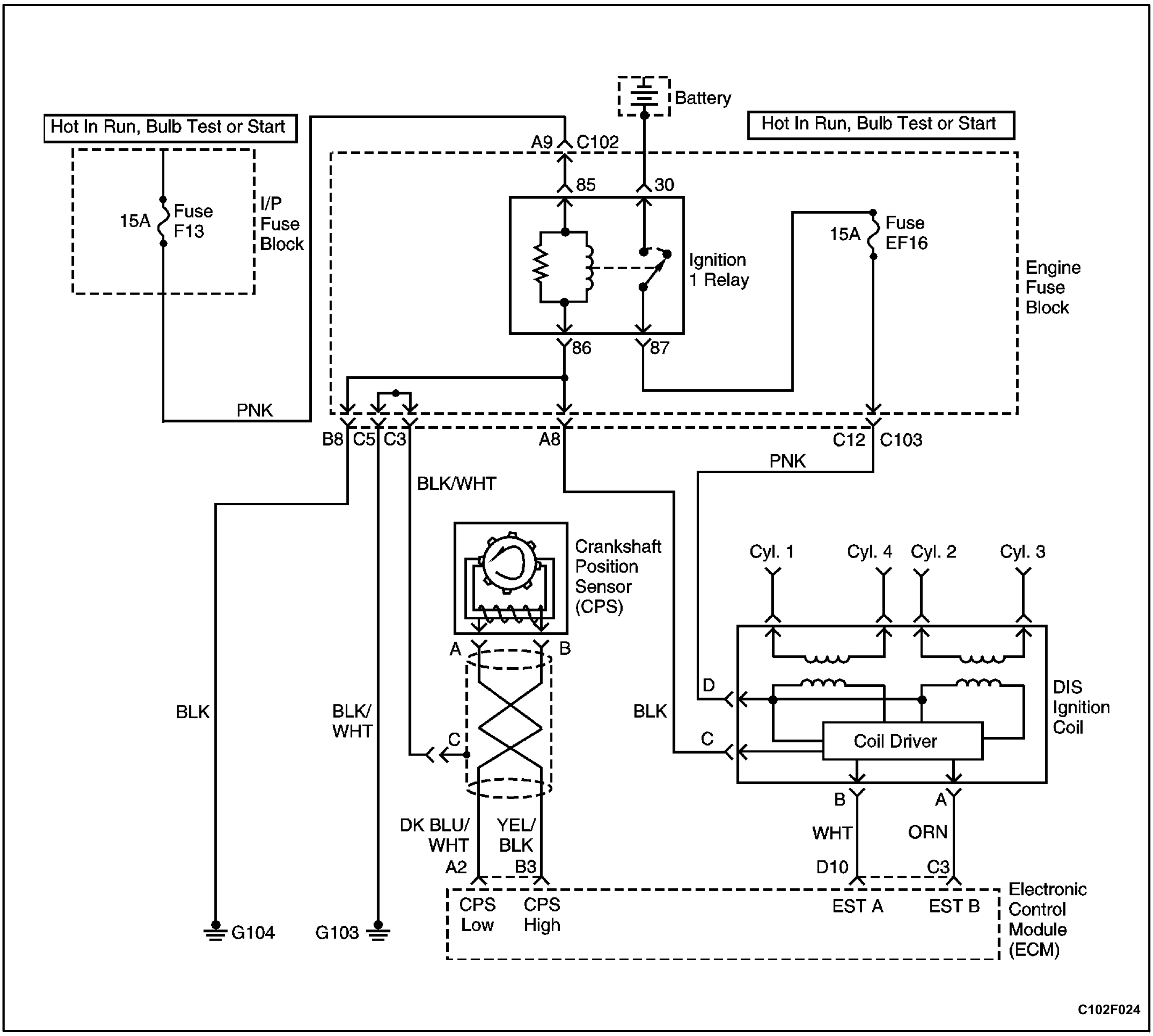


IGNITION SYSTEM CHECK (2.0L SOHC)

Circuit Description

The direct ignition system (DIS) uses a waste spark method of spark distribution. In this type of DIS system, the crankshaft position sensor (CPS) is mounted to the oil pump near a slotted wheel that is a part of the crankshaft pulley. The CPS sends reference pulses to the electronic control module (ECM). The ECM then triggers the DIS ignition coil. Once the ECM triggers the DIS ignition coil, both of the connected spark plugs fire at the same time. One cylinder is on its compression stroke at the same time that the other is on the exhaust stroke, resulting in lower energy needed to fire the spark plug in the cylinder on its exhaust stroke. This leaves the remainder of the high voltage to be used to fire the spark plug in the cylinder on its compression stroke. Since the CPS is in a fixed position, timing adjustments are not possible or needed.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. It is important to check for the presence of spark to all of the cylinders to isolate the problem to either direct ignition system (DIS) ignition coil inputs or outputs.

5. In checking the electronic control module (ECM) outputs for the electronic spark timing signal, it recommended to use an oscilloscope to view the varying voltage signals. In measuring these outputs with a voltmeter, intermittent errors may occur that cannot be seen by a voltmeter.
6. After confirming ECM inputs for the electronic spark timing to the DIS ignition coil are OK, it can be determined that a faulty DIS ignition coil is at fault.
11. After confirming proper crankshaft position sensor inputs to the ECM and no wiring problems present, it can be determined that the ECM is at fault.
24. This step, along with step 25, checks for battery voltage and a ground to the DIS ignition coil.
26. If the wiring between the DIS ignition coil and the ignition 1 relay connector terminal 87 is OK, the problem is in the ignition 1 relay circuit.

Ignition System Check (2.0L SOHC)

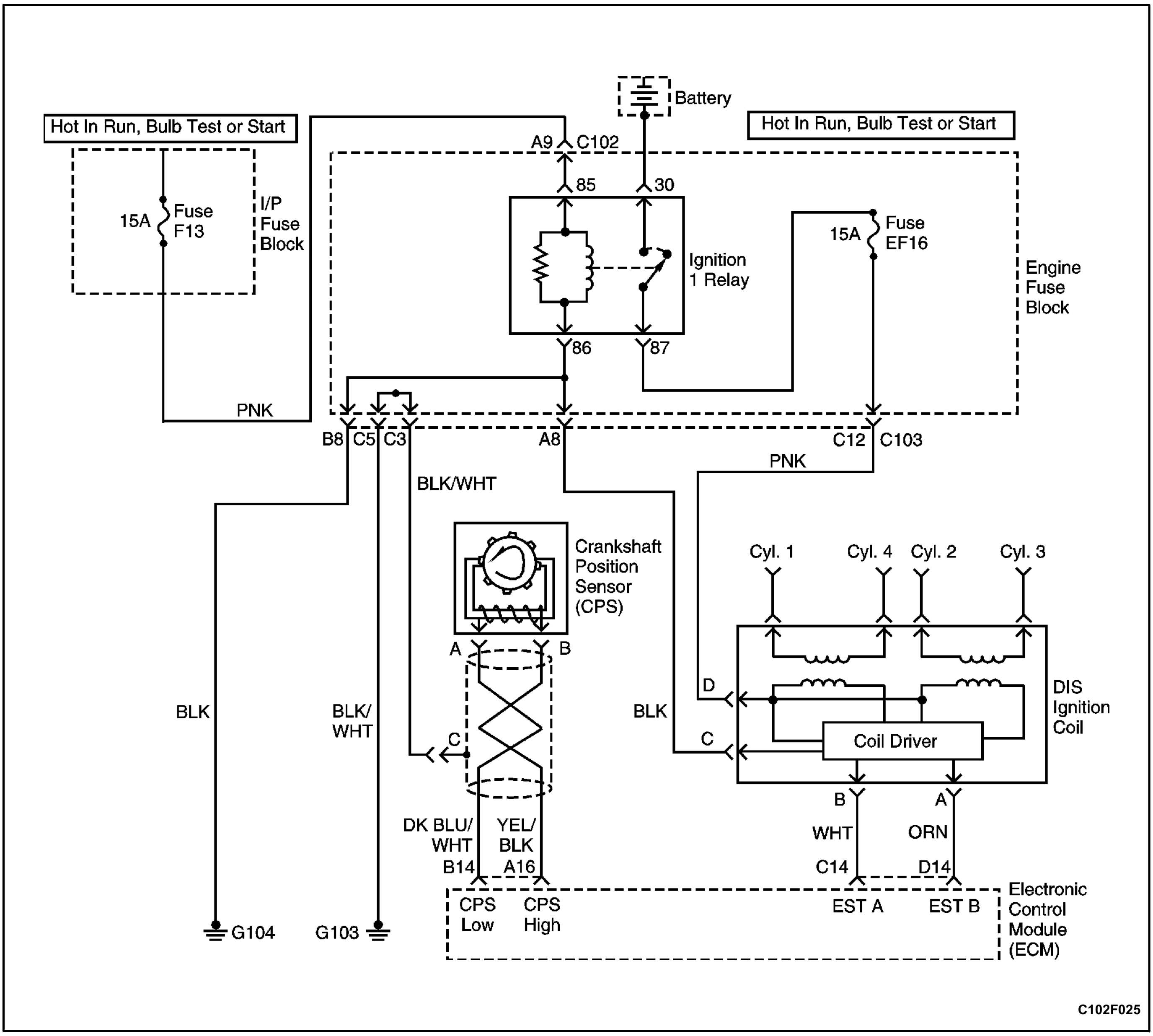
Step	Action	Value(s)	Yes	No
1	1. Remove the spark plugs. 2. Inspect for wet spark plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Replace the spark plugs as needed. Is the repair complete?	-	System OK	Go to *Step 2*
2	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	-	System OK	Go to *Step 3*
3	1. Measure the resistance of the ignition wires. 2. Replace any ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	30,000 Ω	System OK	Go to *Step 4*
4	Is spark present from at least one of the ignition wires, but not all of the ignition wires?	-	Go to *Step 5*	Go to *Step 12*
5	1. Turn the ignition OFF. 2. Disconnect the direct ignition system (DIS) ignition coil connector. 3. While cranking the engine, measure the voltage at the DIS ignition coil connector terminal B. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 6*	Go to *Step 7*
6	While cranking the engine, measure the voltage at the DIS ignition coil connector terminal A. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 10*	Go to *Step 8*
7	Check for an open in the wire from the DIS ignition coil connector terminal B to the electronic control module (ECM) connector terminal D10. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
8	Check for an open in the wire from the DIS ignition coil connector terminal A to the ECM connector terminal C3. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair the wiring as needed. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	System OK	-

Ignition System Check (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Replace the direct ignition system ignition coil. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	System OK	-
11	1. Replace the electronic control module. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	System OK	-
12	1. Turn the ignition OFF. 2. Disconnect the crankshaft position sensor (CPS) connector. 3. Measure the resistance between the CPS terminals A and B. Is the resistance within the value specified?	400-600 Ω	Go to *Step 13*	Go to *Step 28*
13	1. Measure the resistance between the CPS terminals A and C. 2. Measure the resistance between the CPS terminals B and C. Is the resistance infinite (open circuit)?	-	Go to *Step 14*	Go to *Step 28*
14	1. Turn the ignition ON. 2. Measure the voltage between the CPS connector terminals A and C. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 20*	Go to *Step 15*
15	Measure the voltage between the CPS connector terminal A and ground. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 17*	Go to *Step 16*
16	Check the wire between the CPS connector terminal A and the ECM connector terminal A2 for an open or short. Is the problem found?	-	Go to *Step 18*	Go to *Step 11*
17	Check the wire between the CPS connector terminal C and ground for an open or short. Is the problem found?	-	Go to *Step 19*	Go to *Step 11*
18	Repair the wire between the CPS connector terminal A and the ECM connector terminal A2. Is the repair complete?	-	System OK	-
19	Repair the wire between the CPS connector terminal C and ground. Is the repair complete?	-	System OK	-
20	1. Turn the ignition ON. 2. Measure the voltage between the CPS connector terminals B and C. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 24*	Go to *Step 21*
21	Measure the voltage between the CPS connector terminal B and ground. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 17*	Go to *Step 22*

Ignition System Check (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
22	Check the wire between the CPS connector terminal B and the ECM connector terminal B3 for an open or short. Is the problem found?	-	Go to *Step 23*	Go to *Step 11*
23	Repair the wire between the CPS connector terminal B and the ECM connector terminal B3. Is the repair complete?	-	System OK	-
24	1. Turn the ignition OFF. 2. Connect a test light between the DIS ignition coil connector terminal D and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 25*	Go to *Step 26*
25	Connect a test light between the DIS ignition coil connector terminal C and battery positive. Is the test light on?	-	Go to *Step 5*	Go to *Step 27*
26	Check for an open in the wiring between the DIS ignition coil connector, terminal D and the ignition 1 relay connector terminal 87. Is the problem found?	-	Go to *Step 29*	Go to "Ignition 1 Relay Circuit Check"
27	Repair the wire between the DIS ignition coil connector terminal C and ground. Is the repair complete?	-	System OK	-
28	Replace the crankshaft position sensor. Is the repair complete?	-	System OK	-
29	Repair the open in the wiring between the DIS ignition coil connector terminal D and the ignition 1 relay connector terminal 87. Is the repair complete?	-	System OK	-



IGNITION SYSTEM CHECK (2.0L DOHC)

Circuit Description

The direct ignition system (DIS) uses a waste spark method of spark distribution. In this type of DIS system, the crankshaft position sensor (CPS) is mounted to the oil pump near a slotted wheel that is a part of the crankshaft pulley. The CPS sends reference pulses to the electronic control module (ECM). The ECM then triggers the DIS ignition coil. Once the ECM triggers the DIS ignition coil, both of the connected spark plugs fire at the same time. One cylinder is on its compression stroke at the same time that the other is on the exhaust stroke, resulting in lower energy needed to fire the spark plug in the cylinder on its exhaust stroke. This leaves the remainder of the high voltage to be used to fire the spark plug in the cylinder on its compression stroke. Since the CPS is in a fixed position, timing adjustments are not possible or needed.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. It is important to check for the presence of spark to all of the cylinders to isolate the problem to either direct ignition system (DIS) ignition coil inputs or outputs.

5. In checking the electronic control module (ECM) outputs for the electronic spark timing signal, it recommended to use an oscilloscope to view the varying voltage signals. In measuring these outputs with a voltmeter, intermittent errors may occur that cannot be seen by a voltmeter.
6. After confirming ECM inputs for the electronic spark timing to the DIS ignition coil are OK, it can be determined that a faulty DIS ignition coil is at fault.
11. After confirming proper crankshaft position sensor inputs to the ECM and no wiring problems present, it can be determined that the ECM is at fault.
24. This step, along with step 25, checks for battery voltage and a ground to the DIS ignition coil.
26. If the wiring between the DIS ignition coil and the ignition 1 relay connector terminal 87 is OK, the problem is in the ignition 1 relay circuit.

Ignition System Check (2.0L DOHC)

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

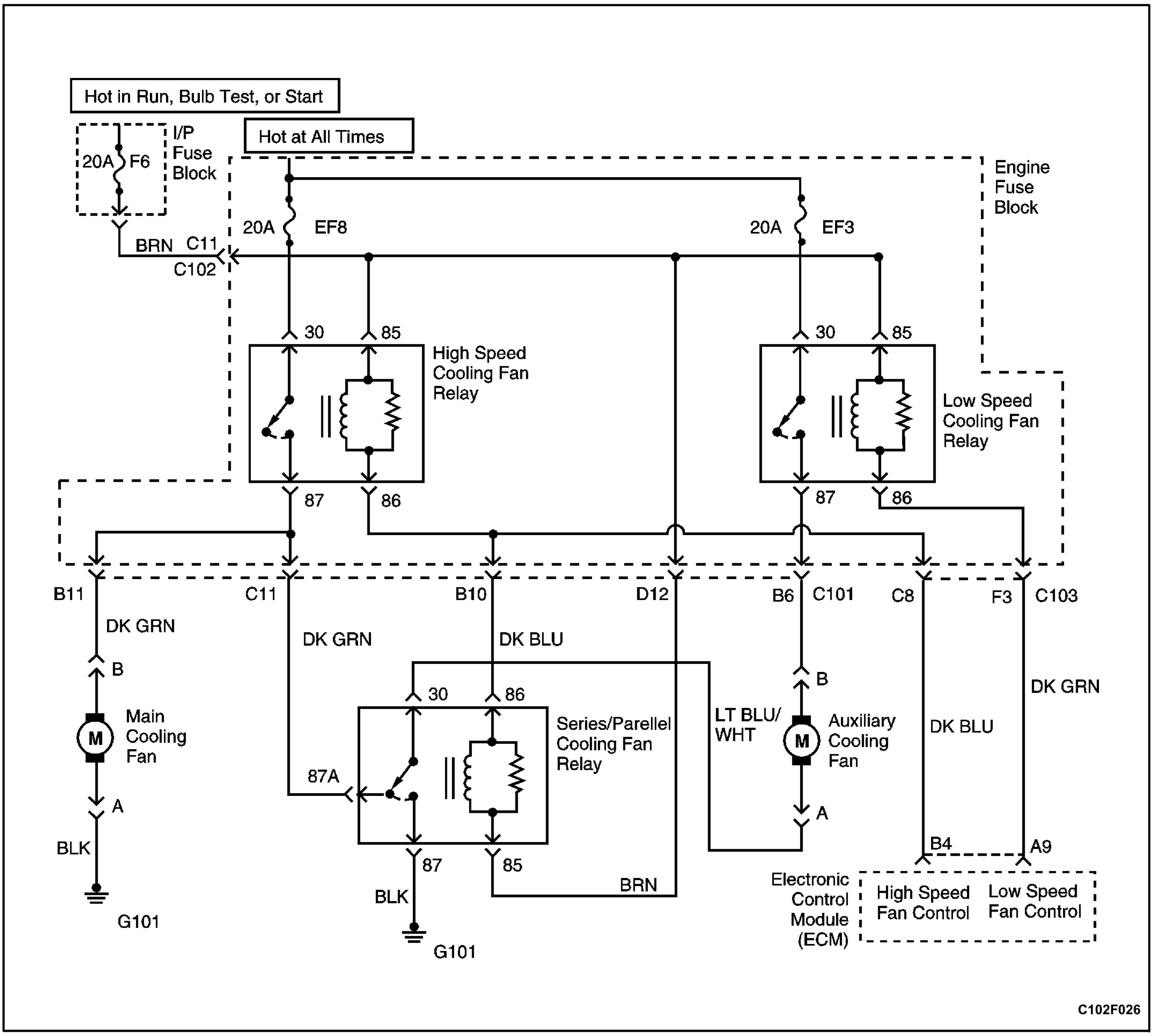
Step	Action	Value(s)	Yes	No
1	1. Remove the spark plugs. 2. Inspect for wet spark plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Replace the spark plugs as needed. Is the repair complete?	-	System OK	Go to *Step 2*
2	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	-	System OK	Go to *Step 3*
3	1. Measure the resistance of the ignition wires. 2. Replace any ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	30,000 Ω	System OK	Go to *Step 4*
4	Is spark present from at least one of the ignition wires, but not all of the ignition wires?	-	Go to *Step 5*	Go to *Step 12*
5	1. Turn the ignition OFF. 2. Disconnect the direct ignition system (DIS) ignition coil connector. 3. While cranking the engine, measure the voltage at the DIS ignition coil connector terminal B. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 6*	Go to *Step 7*
6	While cranking the engine, measure the voltage at the DIS ignition coil connector terminal A. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 10*	Go to *Step 8*
7	Check for an open in the wire from the DIS ignition coil connector terminal B to the electronic control module (ECM) connector terminal C14. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
8	Check for an open in the wire from the DIS ignition coil connector terminal A to the ECM connector terminal D14. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*

Ignition System Check (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Repair the wiring as needed. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	System OK	-
10	1. Replace the direct ignition system ignition coil. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	System OK	-
11	1. Replace the electronic control module. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	System OK	-
12	1. Turn the ignition OFF. 2. Disconnect the crankshaft position sensor (CPS) connector. 3. Measure the resistance between the CPS terminals A and B. Is the resistance within the value specified?	400-600 Ω	Go to *Step 13*	Go to *Step 28*
13	1. Measure the resistance between the CPS terminals A and C. 2. Measure the resistance between the CPS terminals B and C. Is the resistance infinite (open circuit)?	-	Go to *Step 14*	Go to *Step 28*
14	1. Turn the ignition ON. 2. Measure the voltage between the CPS connector terminals A and C. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 20*	Go to *Step 15*
15	Measure the voltage between the CPS connector terminal A and ground. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 17*	Go to *Step 16*
16	Check the wire between the CPS connector terminal A and the ECM connector terminal B14 for an open or short. Is the problem found?	-	Go to *Step 18*	Go to *Step 11*
17	Check the wire between the CPS connector terminal C and ground for an open or short. Is the problem found?	-	Go to *Step 19*	Go to *Step 11*
18	Repair the wire between the CPS connector terminal A and the ECM connector terminal B14. Is the repair complete?	-	System OK	-
19	Repair the wire between the CPS connector terminal C and ground. Is the repair complete?	-	System OK	-
20	1. Turn the ignition ON. 2. Measure the voltage between the CPS connector terminals B and C. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 24*	Go to *Step 21*

Ignition System Check (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
21	Measure the voltage between the CPS connector terminal B and ground. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 17*	Go to *Step 22*
22	Check the wire between the CPS connector terminal B and the ECM connector terminal A16 for an open or short. Is the problem found?	-	Go to *Step 23*	Go to *Step 11*
23	Repair the wire between the CPS connector terminal B and the ECM connector terminal A16. Is the repair complete?	-	System OK	-
24	1. Turn the ignition OFF. 2. Connect a test light between the DIS ignition coil connector terminal D and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 25*	Go to *Step 26*
25	Connect a test light between the DIS ignition coil connector terminal C and battery positive. Is the test light on?	-	Go to *Step 5*	Go to *Step 27*
26	Check for an open in the wiring between the DIS ignition coil connector, terminal D and the ignition 1 relay connector terminal 87. Is the problem found?	-	Go to *Step 29*	Go to Ignition 1 Relay Circuit Check"
27	Repair the wire between the DIS ignition coil connector terminal C and ground. Is the repair complete?	-	System OK	-
28	Replace the crankshaft position sensor. Is the repair complete?	-	System OK	-
29	Repair the open in the wiring between the DIS ignition coil connector terminal D and the ignition 1 relay connector terminal 87. Is the repair complete?	-	System OK	-



CIRCUIT CHECK - WITH A/C (2.0L SOHC)

Circuit Description

The engine cooling fan circuit operates the main cooling fan and the auxiliary cooling fan. The cooling fans are controlled by the electronic control module (ECM) based on inputs from the coolant temperature sensor (CTS) and the air conditioning pressure (ACP) sensor. The ECM controls the low speed cooling fan operation by internally grounding the ECM connector terminal A9. This energizes the low speed cooling fan relay and operates the main cooling fan and the auxiliary cooling fan at low speed as the cooling fans are connected in a series circuit. The ECM controls the high speed cooling fan operation by internally grounding the ECM connector terminal A9 and the ECM connector terminal B4 at the same time. This energizes the low speed cooling fan relay, the high speed cooling fan relay, and the series/parallel cooling fan relay resulting in high speed fan operation as the cooling fans are now connected in a parallel circuit.

Diagnostic Aids

- If the owner complained of an overheating problem, it must be determined if the complaint was due to an actual boil over, or the engine coolant temperature gauge indicated overheating. If the engine is overheating and the cooling fans are on, the cooling system should be checked.
- If the engine fuse block fuses EF3 or EF8 become open (blown) immediately after installation, inspect for a short to ground in the wiring of the appropriate circuit. If the fuses become open (blown) when the cooling fans are to be turned on by the electronic control module (ECM), suspect a faulty cooling fan motor.
- The ECM will turn the cooling fans on at low speed when the coolant temperature is 96°C (205°F). The ECM will turn the cooling fans off when the coolant temperature is 93°C (199°F).

- The ECM will turn the cooling fans on at high speed when the coolant temperature is 100°C (212°F). The ECM will change the cooling fans from high speed to low speed when the coolant temperature is 97°C (207°F).
- The ECM will turn the cooling fans on at low speed when the A/C system is on. The ECM will change the cooling fans from low speed to high speed when the high side A/C pressure is 1 859 kPa (270 psi) then return to low speed when the high side A/C pressure is 1 449 kPa (210 psi).
- The cooling fan circuit can be checked quickly by disconnecting the ECM red connector and grounding the connector terminal A9. This should create low speed cooling fan operation with the ignition ON. By grounding the ECM connector terminals A9 and B4 and turning the ignition ON, high speed cooling fan operation should be achieved.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This step, along with step 5, checks for the ability of the electronic control module (ECM) to operate the cooling fans.
8. This step, along with step 9, checks for the ability of the ECM to operate the cooling fans in response to A/C pressure readings.
16. After confirming battery voltage and the ECM supplying a ground to the coil side of the low speed cooling fan relay, by jumpering connector terminals 30 and 87 it will be determined if the relay is at fault or a wiring problem is present.
31. This step checks for the presence of battery voltage to the main cooling fan when the A/C is on. If battery voltage is present and the cooling fans are not operating, the problem is in the ground side of the cooling fan circuit.
37. By directly grounding the ECM connector terminals A9 and B4, the main and auxiliary cooling fans should run at high speed.

Engine Cooling Fan Circuit Check - With A/C (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Check the engine fuse block fuse EF3. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Check the engine fuse block fuse EF8. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. 3. Connect a scan tool to the assembly line diagnostic link (ALDL). 4. Start the engine. 5. The cooling fans should run at low speed when the coolant temperature reaches 96°C (207°F). Do the cooling fans run at low speed?	-	Go to *Step 5*	Go to *Step 10*

Engine Cooling Fan Circuit Check - With A/C (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. 3. Connect a scan tool to the ALDL. 4. Start the engine. 5. The cooling fans should run at high speed when the coolant temperature reaches 100°C (214°F). Do the cooling fans run at high speed?	-	Go to *Step 6*	Go to *Step 33*
6	1. Turn the ignition OFF. 2. Start the engine. 3. Turn the A/C switch ON. Does the A/C compressor clutch engage?	-	Go to *Step 8*	Go to *Step 7*
7	1. Diagnose the A/C compressor clutch circuit. 2. Repair the A/C compressor clutch circuit as needed. 3. Start the engine. 4. Turn the A/C switch ON. Does the A/C compressor clutch engage?	-	Go to *Step 8*	-
8	Do the cooling fans run at low speed?	-	Go to *Step 9*	Go to *Step 31*
9	1. Turn the ignition OFF. 2. Connect the A/C pressure gauges. 3. Start the engine. 4. Turn the A/C switch ON. 5. The cooling fans should run at high speed when the high side A/C pressure reaches 1 859 kPa (270 psi). Do the cooling fans run at high speed?	-	System OK	-
10	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. The coolant temperature should be above 96°C (205°C). 4. Disconnect the auxiliary cooling fan connector. 5. Turn the ignition ON. 6. Connect a test light between the auxiliary cooling fan connector terminal B and ground. Is the test light on?	-	Go to *Step 11*	Go to *Step 12*
11	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. The coolant temperature should be above 96°C (205°C). 4. Disconnect the auxiliary cooling fan connector. 5. Connect a test light between the auxiliary cooling fan connector terminal A and battery positive. Is the test light on?	-	Go to *Step 28*	Go to *Step 17*
12	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 13*	Go to *Step 24*

Engine Cooling Fan Circuit Check - With A/C (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Turn the ignition OFF. 2. Connect the low speed cooling fan relay. 3. Disconnect the electronic control module (ECM) red connector. 4. Connect a fused jumper between the ECM connector terminal A9 and ground. 5. Turn the ignition ON. Do the cooling fans run at low speed?	-	Go to *Step 30*	Go to *Step 14*
14	Check for an open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A9. Is the problem found?	-	Go to *Step 25*	Go to *Step 15*
15	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 16*	Go to *Step 23*
16	Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 26*	Go to *Step 17*
17	1. Disconnect the series/parallel cooling fan relay. 2. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 3. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 27*	Go to *Step 18*
18	Check the wire between the low speed cooling fan relay connector terminal 87 to the auxiliary cooling fan connector terminal B for an open. Is the problem found?	-	Go to *Step 22*	Go to *Step 19*
19	Check the wire between the auxiliary cooling fan connector terminal A and the series/parallel cooling fan relay connector terminal 30 for an open. Is the problem found?	-	Go to *Step 22*	Go to *Step 20*
20	Check the wire between the series/parallel cooling fan relay connector terminal 87 and the main cooling fan connector terminal B for an open. Is the problem found?	-	Go to *Step 22*	Go to *Step 21*
21	Check for an open wire between the main cooling fan connector terminal A and ground. Is the problem found?	-	Go to *Step 22*	Go to *Step 29*
22	Repair the open wire as needed. Is the repair complete?	-	System OK	-
23	Repair the open between the low speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
24	Repair the open between the low speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-

Engine Cooling Fan Circuit Check - With A/C (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
25	Repair the open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A9. Is the repair complete?	-	System OK	-
26	Replace the low speed cooling fan relay. Is the repair complete?	-	System OK	-
27	Replace the series/parallel cooling fan relay. Is the repair complete?	-	System OK	-
28	Replace the auxiliary cooling fan. Is the repair complete?	-	System OK	-
29	Replace the main cooling fan. Is the repair complete?	-	System OK	-
30	Replace the ECM. Is the repair complete?	-	System OK	-
31	1. Turn the ignition OFF. 2. Disconnect the auxiliary cooling fan connector. 3. Connect a test light between the auxiliary cooling fan connector terminal B and ground. 4. Turn the A/C switch ON. 5. Start the engine. Is the test light on?	-	Go to *Step 32*	Go to *Step 12*
32	1. Turn the ignition OFF. 2. Connect a test light between the auxiliary cooling fan connector terminal A and battery positive. 3. Turn the A/C switch ON. 4. Start the engine. Is the test light on?	-	Go to *Step 28*	Go to *Step 17*
33	1. Turn the ignition OFF. 2. Disconnect the high speed cooling fan relay. 3. Connect a test light between the high speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 34*	Go to *Step 44*
34	1. Turn the ignition OFF. 2. Connect a test light between the high speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 35*	Go to *Step 45*
35	1. Disconnect the series/parallel cooling fan relay. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 85 and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 36*	Go to *Step 46*
36	1. Turn the ignition OFF. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 37*	Go to *Step 47*

Engine Cooling Fan Circuit Check - With A/C (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
37	1. Connect the auxiliary cooling fan connector. 2. Connect the high speed cooling fan relay. 3. Connect the series/parallel cooling fan relay. 4. Disconnect the ECM red connector. 5. Connect a fused jumper between the ECM connector terminal A9 and ground. 6. Connect a fused jumper between the ECM connector terminal B4 and ground. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 30*	Go to *Step 38*
38	1. Turn the ignition OFF. 2. Check for an open wire between the high speed cooling fan relay connector terminal 86 and the ECM connector terminal B4. Is the problem found?	-	Go to *Step 22*	Go to *Step 39*
39	1. Disconnect the high speed cooling fan relay. 2. Connect a test light between the high speed cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 40*	Go to *Step 48*
40	1. Disconnect the ECM red connector. 2. Connect a fused jumper between the ECM connector terminal B4 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a test light between the series/parallel cooling fan relay connector terminal 86 and battery positive. Is the test light on?	-	Go to *Step 41*	Go to *Step 49*
41	1. Connect the series/parallel cooling fan relay. 2. Connect a fused jumper between the ECM connector terminal B4 and ground. 3. Disconnect the high speed cooling fan relay. 4. Connect a fused jumper between the high speed cooling fan relay connector terminals 30 and 87. 5. Disconnect the low speed cooling fan relay. 6. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 43*	Go to *Step 42*
42	1. Turn the ignition OFF. 2. Connect a fused jumper between the ECM connector terminal B4 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. 5. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 6. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 27*	-

Engine Cooling Fan Circuit Check - With A/C (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
43	Replace the high speed cooling fan relay. Is the repair complete?	-	System OK	-
44	Repair the open wire between the high speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
45	Repair the open wire between the high speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
46	Repair the open wire between the series/parallel cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
47	Repair the open wire between the series/parallel cooling fan relay connector terminal 87 and ground. Is the repair complete?	-	System OK	-
48	Repair the open wire between the high speed cooling fan relay connector terminal 87 and the main cooling fan connector terminal B. Is the repair complete?	-	System OK	-
49	Repair the open wire between the series/parallel cooling fan relay connector terminal 86 and the ECM connector terminal B4. Is the repair complete?	-	System OK	-

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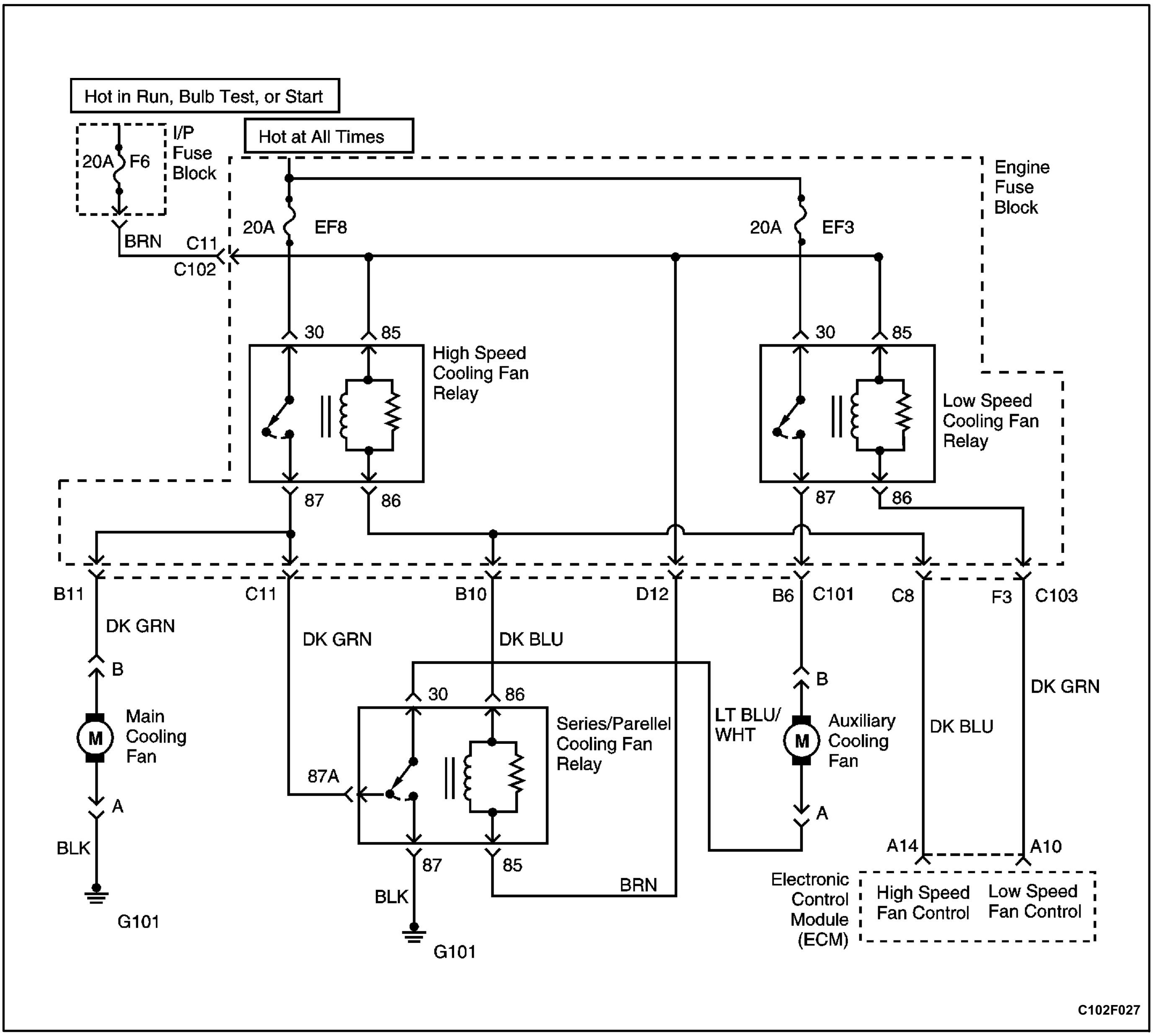

ENGINE COOLING FAN CIRCUIT CHECK - WITH A/C (2.0L DOHC)

Circuit Description

The engine cooling fan circuit operates the main cooling fan and the auxiliary cooling fan. The cooling fans are controlled by the electronic control module (ECM) based on inputs from the coolant temperature sensor (CTS) and the air conditioning pressure (ACP) sensor. The ECM controls the low speed cooling fan operation by internally grounding the ECM connector terminal A10. This energizes the low speed cooling fan relay and operates the main cooling fan and the auxiliary cooling fan at low speed as the cooling fans are connected in a series circuit. The ECM controls the high speed cooling fan operation by internally grounding the ECM connector terminal A10 and the ECM connector terminal A14 at the same time. This energizes the low speed cooling fan relay, the high speed cooling fan relay, and the series/parallel cooling fan relay resulting in high speed fan operation as the cooling fans are now connected in a parallel circuit.

Diagnostic Aids

- If the owner complained of an overheating problem, it must be determined if the complaint was due to an actual boil over, or the engine coolant temperature gauge indicated overheating. If the engine is overheating and the cooling fans are on, the cooling system should be checked.
- If the engine fuse block fuses EF3 or EF8 become open (blown) immediately after installation, inspect for a short to ground in the wiring of the appropriate circuit. If the fuses become open (blown) when the cooling fans are to be turned on by the electronic control module (ECM), suspect a faulty cooling fan motor.
- The ECM will turn the cooling fans on at low speed when the coolant temperature is 93°C (199°F). The ECM will turn the cooling fans off when the coolant temperature is 90°C (194°F).

- ✳ The ECM will turn the cooling fans on at high speed when the coolant temperature is 97°C (207°F). The ECM will change the cooling fans from high speed to low speed when the coolant temperature is 94°C (201°F).
- ✳ The ECM will turn the cooling fans on at low speed when the A/C system is on. The ECM will change the cooling fans from low speed to high speed when the high side A/C pressure is 1 859 kPa (270 psi) then return to low speed when the high side A/C pressure is 1 449 kPa (210 psi).
- ✳ The cooling fan circuit can be checked quickly by disconnecting the ECM red connector and grounding the connector terminal A10. This should create low speed cooling fan operation with the ignition ON. By grounding the ECM connector terminals A10 and A14 and turning the ignition ON, high speed cooling fan operation should be achieved.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This step, along with step 5, checks for the ability of the electronic control module (ECM) to operate the cooling fans.
8. This step, along with step 9, checks for the ability of the ECM to operate the cooling fans in response to A/C pressure readings.
16. After confirming battery voltage and the ECM supplying a ground to the coil side of the low speed cooling fan relay, by jumpering connector terminals 30 and 87 it will be determined if the relay is at fault or a wiring problem is present.
31. This step checks for the presence of battery voltage to the main cooling fan when the A/C is on. If battery voltage is present and the cooling fans are not operating, the problem is in the ground side of the cooling fan circuit.
37. By directly grounding the ECM connector terminals A10 and A14, the main and auxiliary cooling fans should run at high speed.

Engine Cooling Fan Circuit Check - With A/C (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Check the engine fuse block fuse EF3. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Check the engine fuse block fuse EF8. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. 3. Connect a scan tool to the assembly line diagnostic link (ALDL). 4. Start the engine. 5. The cooling fans should run at low speed when the coolant temperature reaches 93°C (199°F). Do the cooling fans run at low speed?	-	Go to *Step 5*	Go to *Step 10*

Engine Cooling Fan Circuit Check - With A/C (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. 3. Connect a scan tool to the ALDL. 4. Start the engine. 5. The cooling fans should run at high speed when the coolant temperature reaches 97°C (207°F). Do the cooling fans run at high speed?	-	Go to *Step 6*	Go to *Step 33*
6	1. Turn the ignition OFF. 2. Start the engine. 3. Turn the A/C switch ON. Does the A/C compressor clutch engage?	-	Go to *Step 8*	Go to *Step 7*
7	1. Diagnose the A/C compressor clutch circuit. 2. Repair the A/C compressor clutch circuit as needed. 3. Start the engine. 4. Turn the A/C switch ON. Does the A/C compressor clutch engage?	-	Go to *Step 8*	-
8	Do the cooling fans run at low speed?	-	Go to *Step 9*	Go to *Step 31*
9	1. Turn the ignition OFF. 2. Connect the A/C pressure gauges. 3. Start the engine. 4. Turn the A/C switch ON. 5. The cooling fans should run at high speed when the high side A/C pressure reaches 1 859 kPa (270 psi). Do the cooling fans run at high speed?	-	System OK	-
10	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. The coolant temperature should be above 93°C (199°F). 4. Disconnect the auxiliary cooling fan connector. 5. Turn the ignition ON. 6. Connect a test light between the auxiliary cooling fan connector terminal B and ground. Is the test light on?	-	Go to *Step 11*	Go to *Step 12*
11	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. The coolant temperature should be above 93°C (199°F). 4. Disconnect the auxiliary cooling fan connector. 5. Connect a test light between the auxiliary cooling fan connector terminal A and battery positive. Is the test light on?	-	Go to *Step 28*	Go to *Step 17*
12	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 13*	Go to *Step 24*

Engine Cooling Fan Circuit Check - With A/C (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Turn the ignition OFF. 2. Connect the low speed cooling fan relay. 3. Disconnect the electronic control module (ECM) red connector. 4. Connect a fused jumper between the ECM connector terminal A10 and ground. 5. Turn the ignition ON. Do the cooling fans run at low speed?	-	Go to *Step 30*	Go to *Step 14*
14	Check for an open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A10. Is the problem found?	-	Go to *Step 25*	Go to *Step 15*
15	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 16*	Go to *Step 23*
16	Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 26*	Go to *Step 17*
17	1. Disconnect the series/parallel cooling fan relay. 2. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 3. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 27*	Go to *Step 18*
18	Check the wire between the low speed cooling fan relay connector terminal 87 to the auxiliary cooling fan connector terminal B for an open. Is the problem found?	-	Go to *Step 22*	Go to *Step 19*
19	Check the wire between the auxiliary cooling fan connector terminal A and the series/parallel cooling fan relay connector terminal 30 for an open. Is the problem found?	-	Go to *Step 22*	Go to *Step 20*
20	Check the wire between the series/parallel cooling fan relay connector terminal 87 and the main cooling fan connector terminal B for an open. Is the problem found?	-	Go to *Step 22*	Go to *Step 21*
21	Check for an open wire between the main cooling fan connector terminal A and ground. Is the problem found?	-	Go to *Step 22*	Go to *Step 29*
22	Repair the open wire as needed. Is the repair complete?	-	System OK	-
23	Repair the open between the low speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
24	Repair the open between the low speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-

Engine Cooling Fan Circuit Check - With A/C (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
25	Repair the open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A10. Is the repair complete?	-	System OK	-
26	Replace the low speed cooling fan relay. Is the repair complete?	-	System OK	-
27	Replace the series/parallel cooling fan relay. Is the repair complete?	-	System OK	-
28	Replace the auxiliary cooling fan. Is the repair complete?	-	System OK	-
29	Replace the main cooling fan. Is the repair complete?	-	System OK	-
30	Replace the ECM. Is the repair complete?	-	System OK	-
31	1. Turn the ignition OFF. 2. Disconnect the auxiliary cooling fan connector. 3. Connect a test light between the main cooling fan connector terminal B and ground. 4. Turn the A/C switch ON. 5. Start the engine. Is the test light on?	-	Go to *Step 32*	Go to *Step 12*
32	1. Turn the ignition OFF. 2. Connect a test light between the auxiliary cooling fan connector terminal A and battery positive. 3. Turn the A/C switch ON. 4. Start the engine. Is the test light on?	-	Go to *Step 28*	Go to *Step 17*
33	1. Turn the ignition OFF. 2. Disconnect the high speed cooling fan relay. 3. Connect a test light between the high speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 34*	Go to *Step 44*
34	1. Turn the ignition OFF. 2. Connect a test light between the high speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 35*	Go to *Step 45*
35	1. Disconnect the series/parallel cooling fan relay. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 85 and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 36*	Go to *Step 46*
36	1. Turn the ignition OFF. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 37*	Go to *Step 47*

Engine Cooling Fan Circuit Check - With A/C (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
37	1. Connect the auxiliary cooling fan connector. 2. Connect the high speed cooling fan relay. 3. Connect the series/parallel cooling fan relay. 4. Disconnect the ECM red connector. 5. Connect a fused jumper between the ECM connector terminal A10 and ground. 6. Connect a fused jumper between the ECM connector terminal A14 and ground. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 30*	Go to *Step 38*
38	1. Turn the ignition OFF. 2. Check for an open wire between the high speed cooling fan relay connector terminal 86 and the ECM connector terminal A14. Is the problem found?	-	Go to *Step 22*	Go to *Step 39*
39	1. Disconnect the high speed cooling fan relay. 2. Connect a test light between the high speed cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 40*	Go to *Step 48*
40	1. Disconnect the ECM red connector. 2. Connect a fused jumper between the ECM connector terminal A14 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a test light between the series/parallel cooling fan relay connector terminal 86 and battery positive. Is the test light on?	-	Go to *Step 41*	Go to *Step 49*
41	1. Connect the series/parallel cooling fan relay. 2. Connect a fused jumper between the ECM connector terminal A14 and ground. 3. Disconnect the high speed cooling fan relay. 4. Connect a fused jumper between the high speed cooling fan relay connector terminals 30 and 87. 5. Disconnect the low speed cooling fan relay. 6. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 43*	Go to *Step 42*
42	1. Turn the ignition OFF. 2. Connect a fused jumper between the ECM connector terminal A14 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. 5. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 6. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 27*	-

Engine Cooling Fan Circuit Check - With A/C (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
43	Replace the high speed cooling fan relay. Is the repair complete?	-	System OK	-
44	Repair the open wire between the high speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
45	Repair the open wire between the high speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
46	Repair the open wire between the series/parallel cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
47	Repair the open wire between the series/parallel cooling fan relay connector terminal 87 and ground. Is the repair complete?	-	System OK	-
48	Repair the open wire between the high speed cooling fan relay connector terminal 87 and the main cooling fan connector terminal B. Is the repair complete?	-	System OK	-
49	Repair the open wire between the series/parallel cooling fan relay connector terminal 86 and the ECM connector terminal A14. Is the repair complete?	-	System OK	-

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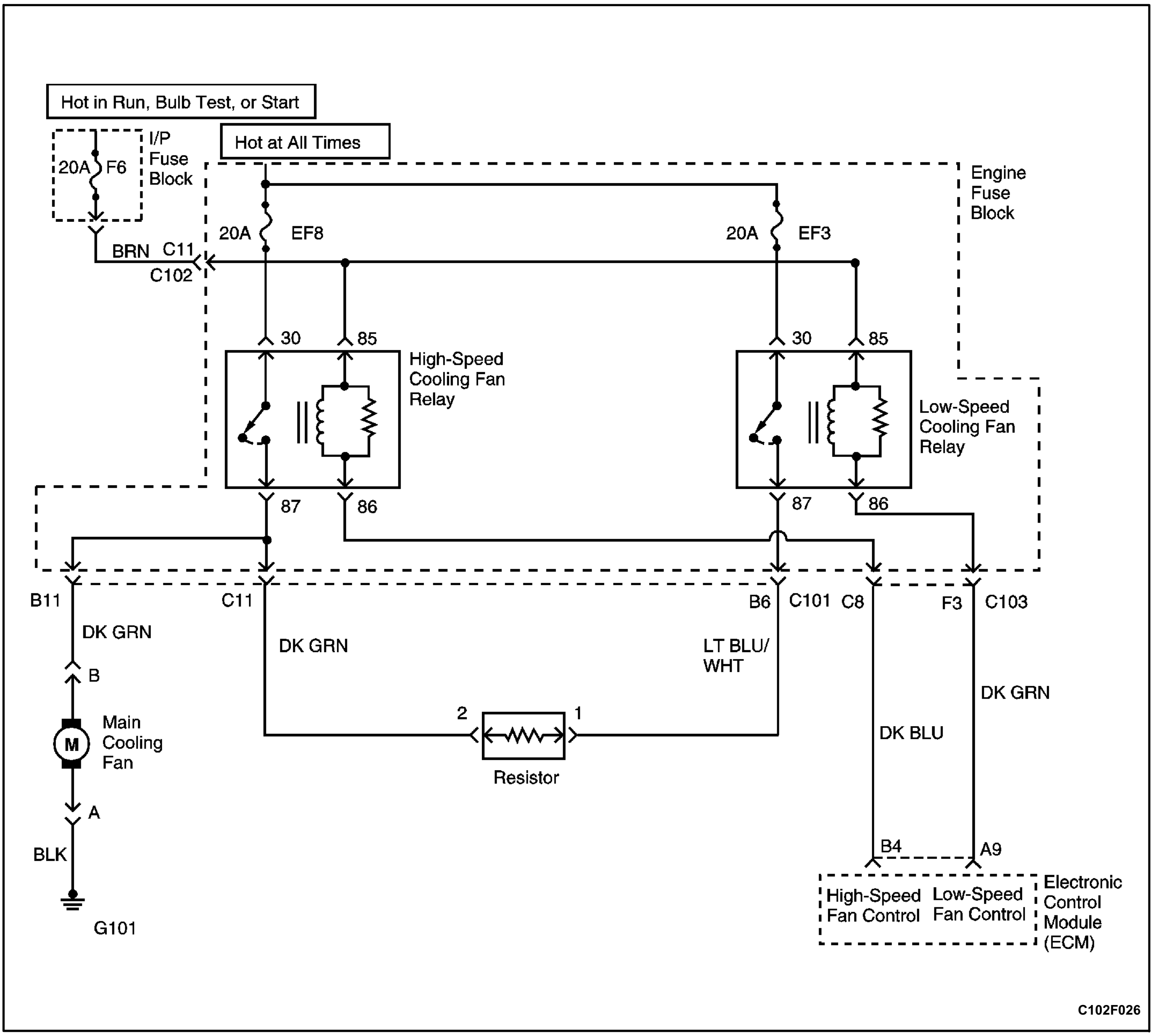


ENGINE COOLING FAN CIRCUIT CHECK - WITHOUT A/C (2.0L SOHC)

Circuit Description

The engine cooling fan circuit operates the main cooling fan and the auxiliary cooling fan. The cooling fans are controlled by the electronic control module (ECM) based on inputs from the coolant temperature sensor (CTS) and the air conditioning pressure (ACP) sensor. The ECM controls the low speed cooling fan operation by internally grounding the ECM connector terminal A9. This energizes the low speed cooling fan relay and operates the main cooling fan and the auxiliary cooling fan at low speed as the cooling fans are connected in a series circuit. The ECM controls the high speed cooling fan operation by internally grounding the ECM connector terminal A9 and the ECM connector terminal B4 at the same time. This energizes the low speed cooling fan relay, the high speed cooling fan relay, and the series/parallel cooling fan relay resulting in high speed fan operation as the cooling fans are now connected in a parallel circuit.

Diagnostic Aids

✳ If the owner complained of an overheating problem, it must be determined if the complaint was due to an actual boil over, or the engine coolant temperature gauge indicated overheating. If the engine is overheating and the cooling fans are on, the cooling system should be checked.

✳ If the engine fuse block fuses EF3 or EF8 become open (blown) immediately after installation, inspect for a short to ground in the wiring of the appropriate circuit. If the fuses become open (blown) when the cooling fans are to be turned on by the electronic control module (ECM), suspect a faulty cooling fan motor.

✳ The ECM will turn the cooling fans on at low speed when the coolant temperature is 96°C (205°F). The ECM will turn the cooling fans off when the coolant temperature is 93°C (199°F).

✳ The ECM will turn the cooling fans on at high speed when the coolant temperature is 100°C (212°F). The ECM will change the cooling fans from high speed to low speed when the coolant temperature is 97°C (207°F).

✳ The cooling fan circuit can be checked quickly by disconnecting the ECM red connector and grounding the connector terminal A9. This should create low speed cooling fan operation with the ignition ON. By grounding the ECM connector terminals A9 and B4 and turning the ignition ON, high speed cooling fan operation should be achieved.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This step, along with step 5, checks for the ability of the electronic control module (ECM) to operate the cooling fans.

8. This step, along with step 9, checks for the ability of the ECM to operate the cooling fans in response to A/C pressure readings.

16. After confirming battery voltage and the ECM supplying a ground to the coil side of the low speed cooling fan relay, by jumpering connector terminals 30 and 87 it will be determined if the relay is at fault or a wiring problem is present.

31. This step checks for the presence of battery voltage to the main cooling fan when the A/C is on. If battery voltage is present and the cooling fans are not operating, the problem is in the ground side of the cooling fan circuit.

37. By directly grounding the ECM connector terminals A9 and B4, the main and auxiliary cooling fans should run at high speed.

Engine Cooling Fan Circuit Check - Without A/C (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Check the engine fuse block fuse EF3. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Check the engine fuse block fuse EF8. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Connect a scan tool to the assembly line diagnostic link (ALDL). 3. Start the engine. 4. The cooling fans should run at low speed when the coolant temperature reaches 96°C (207°F). Do the cooling fans run at low speed?	-	Go to *Step 5*	Go to *Step 6*
5	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. Start the engine. 4. The cooling fans should run at high speed when the coolant temperature reaches 100°C (214°F). Do the cooling fans run at high speed?	-	System OK	Go to *Step 27*

Engine Cooling Fan Circuit Check - Without A/C (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. The coolant temperature should be above 96°C (205°C). 4. Disconnect the auxiliary cooling fan connector. 5. Turn the ignition ON. 6. Connect a test light between the auxiliary cooling fan connector terminal B and ground. Is the test light on?	-	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. The coolant temperature should be above 96°C (205°C). 4. Disconnect the auxiliary cooling fan connector. 5. Connect a test light between the auxiliary cooling fan connector terminal A and battery positive. Is the test light on?	-	Go to *Step 24*	Go to *Step 13*
8	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 9*	Go to *Step 20*
9	1. Turn the ignition OFF. 2. Connect the low speed cooling fan relay. 3. Disconnect the electronic control module (ECM) red connector. 4. Connect a fused jumper between the ECM connector terminal A9 and ground. 5. Turn the ignition ON. Do the cooling fans run at low speed?	-	Go to *Step 26*	Go to *Step 10*
10	Check for an open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A9. Is the problem found?	-	Go to *Step 21*	Go to *Step 11*
11	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 12*	Go to *Step 19*
12	Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 22*	Go to *Step 13*

Engine Cooling Fan Circuit Check - Without A/C (2.0L SOHC) (Cont'd)

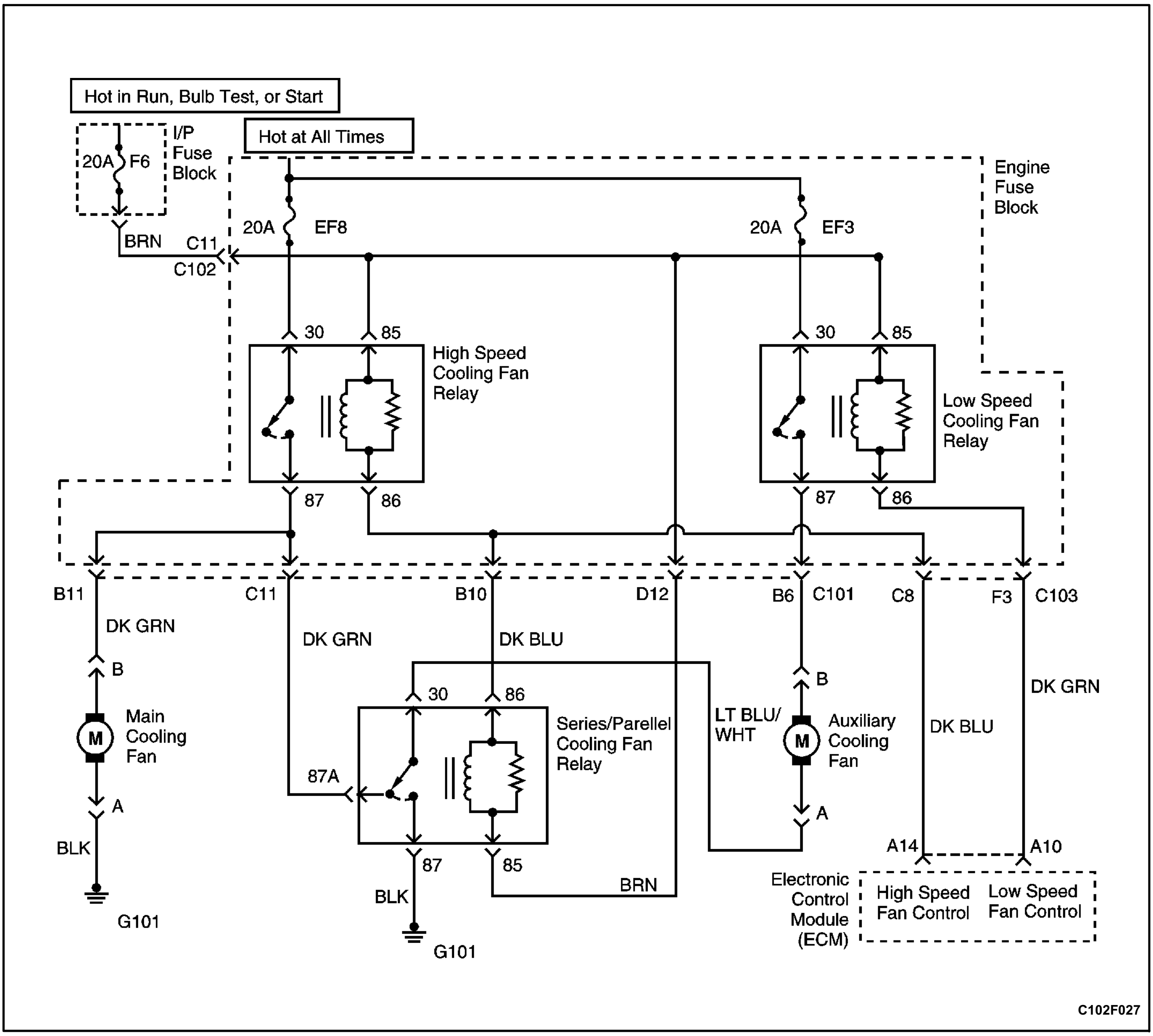
Step	Action	Value(s)	Yes	No
13	1. Disconnect the series/parallel cooling fan relay. 2. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 3. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 23*	Go to *Step 14*
14	Check the wire between the low speed cooling fan relay connector terminal 87 to the auxiliary cooling fan connector terminal B for an open. Is the problem found?	-	Go to *Step 18*	Go to *Step 15*
15	Check the wire between the auxiliary cooling fan connector terminal A and the series/parallel cooling fan relay connector terminal 30 for an open. Is the problem found?	-	Go to *Step 18*	Go to *Step 16*
16	Check the wire between the series/parallel cooling fan relay connector terminal 87 and the main cooling fan connector terminal B for an open. Is the problem found?	-	Go to *Step 18*	Go to *Step 17*
17	Check for an open wire between the main cooling fan connector terminal A and ground. Is the problem found?	-	Go to *Step 18*	Go to *Step 25*
18	Repair the open wire as needed. Is the repair complete?	-	System OK	-
19	Repair the open between the low speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
20	Repair the open between the low speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
21	Repair the open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A9. Is the repair complete?	-	System OK	-
22	Replace the low speed cooling fan relay. Is the repair complete?	-	System OK	-
23	Replace the series/parallel cooling fan relay. Is the repair complete?	-	System OK	-
24	Replace the auxiliary cooling fan. Is the repair complete?	-	System OK	-
25	Replace the main cooling fan. Is the repair complete?	-	System OK	-
26	Replace the ECM. Is the repair complete?	-	System OK	-

Engine Cooling Fan Circuit Check - Without A/C (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
27	1. Turn the ignition OFF. 2. Disconnect the high speed cooling fan relay. 3. Connect a test light between the high speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 28*	Go to *Step 38*
28	1. Turn the ignition OFF. 2. Connect a test light between the high speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 29*	Go to *Step 39*
29	1. Disconnect the series/parallel cooling fan relay. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 85 and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 30*	Go to *Step 40*
30	1. Turn the ignition OFF. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 31*	Go to *Step 41*
31	1. Connect the auxiliary cooling fan connector. 2. Connect the high speed cooling fan relay. 3. Connect the series/parallel cooling fan relay. 4. Disconnect the ECM red connector. 5. Connect a fused jumper between the ECM connector terminal A9 and ground. 6. Connect a fused jumper between the ECM connector terminal B4 and ground. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 26*	Go to *Step 32*
32	1. Turn the ignition OFF. 2. Check for an open wire between the high speed cooling fan relay connector terminal 86 and the ECM connector terminal B4. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
33	1. Disconnect the high speed cooling fan relay. 2. Connect a test light between the high speed cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 34*	Go to *Step 42*
34	1. Disconnect the ECM red connector. 2. Connect a fused jumper between the ECM connector terminal B4 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a test light between the series/parallel cooling fan relay connector terminal 86 and battery positive. Is the test light on?	-	Go to *Step 35*	Go to *Step 43*

Engine Cooling Fan Circuit Check - Without A/C (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
35	1. Connect the series/parallel cooling fan relay. 2. Connect a fused jumper between the ECM connector terminal B4 and ground. 3. Disconnect the high speed cooling fan relay. 4. Connect a fused jumper between the high speed cooling fan relay connector terminals 30 and 87. 5. Disconnect the low speed cooling fan relay. 6. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 37*	Go to *Step 36*
36	1. Turn the ignition OFF. 2. Connect a fused jumper between the ECM connector terminal B4 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. 5. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 6. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 23*	-
37	Replace the high speed cooling fan relay. Is the repair complete?	-	System OK	-
38	Repair the open wire between the high speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
39	Repair the open wire between the high speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
40	Repair the open wire between the series/parallel cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
41	Repair the open wire between the series/parallel cooling fan relay connector terminal 87 and ground. Is the repair complete?	-	System OK	-
42	Repair the open wire between the high speed cooling fan relay connector terminal 87 and the main cooling fan connector terminal B. Is the repair complete?	-	System OK	-
43	Repair the open wire between the series/parallel cooling fan relay connector terminal 86 and the ECM connector terminal B4. Is the repair complete?	-	System OK	-



ENGINE COOLING FAN CIRCUIT CHECK - WITHOUT A/C (2.0L DOHC)

Circuit Description

The engine cooling fan circuit operates the main cooling fan and the auxiliary cooling fan. The cooling fans are controlled by the electronic control module (ECM) based on inputs from the coolant temperature sensor (CTS) and the air conditioning pressure (ACP) sensor. The ECM controls the low speed cooling fan operation by internally grounding the ECM connector terminal A10. This energizes the low speed cooling fan relay and operates the main cooling fan and the auxiliary cooling fan at low speed as the cooling fans are connected in a series circuit. The ECM controls the high speed cooling fan operation by internally grounding the ECM connector terminal A10 and the ECM connector terminal A14 at the same time. This energizes the low speed cooling fan relay, the high speed cooling fan relay, and the series/parallel cooling fan relay resulting in high speed fan operation as the cooling fans are now connected in a parallel circuit.

Diagnostic Aids

✳ If the owner complained of an overheating problem, it must be determined if the complaint was due to an actual boil over, or the engine coolant temperature gauge indicated overheating. If the engine is overheating and the cooling fans are on, the cooling system should be checked.

✳ If the engine fuse block fuses EF3 or EF8 become open (blown) immediately after installation, inspect for a short to ground in the wiring of the appropriate circuit. If the fuses become open (blown) when the cooling fans are to be turned on by the electronic control module (ECM), suspect a faulty cooling fan motor.

✳ The ECM will turn the cooling fans on at low speed when the coolant temperature is 93°C (199°F). The ECM will turn the cooling fans off when the coolant temperature is 90°C (194°F).

- ✳ The ECM will turn the cooling fans on at high speed when the coolant temperature is 97°C (207°F). The ECM will change the cooling fans from high speed to low speed when the coolant temperature is 94°C (201°F).
- ✳ The cooling fan circuit can be checked quickly by disconnecting the ECM red connector and grounding the connector terminal A10. This should create low speed cooling fan operation with the ignition ON. By grounding the ECM connector terminals A10 and A14 and turning the ignition ON, high speed cooling fan operation should be achieved.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This step, along with step 5, checks for the ability of the electronic control module (ECM) to operate the cooling fans.

8. This step, along with step 9, checks for the ability of the ECM to operate the cooling fans in response to A/C pressure readings.

16. After confirming battery voltage and the ECM supplying a ground to the coil side of the low speed cooling fan relay, by jumpering connector terminals 30 and 87 it will be determined if the relay is at fault or a wiring problem is present.

31. This step checks for the presence of battery voltage to the main cooling fan when the A/C is on. If battery voltage is present and the cooling fans are not operating, the problem is in the ground side of the cooling fan circuit.

37. By directly grounding the ECM connector terminals A10 and A14, the main and auxiliary cooling fans should run at high speed.

Engine Cooling Fan Circuit Check - Without A/C (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Check the engine fuse block fuse EF3. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Check the engine fuse block fuse EF8. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Connect a scan tool to the assembly line diagnostic link (ALDL). 3. Start the engine. 4. The cooling fans should run at low speed when the coolant temperature reaches 93°C (199°F). Do the cooling fans run at low speed?	-	Go to *Step 5*	Go to *Step 6*
5	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. Start the engine. 4. The cooling fans should run at high speed when the coolant temperature reaches 97°C (207°F). Do the cooling fans run at high speed?	-	System OK	Go to *Step 27*

Engine Cooling Fan Circuit Check - Without A/C (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. The coolant temperature should be above 93°C (199°F). 4. Disconnect the auxiliary cooling fan connector. 5. Turn the ignition ON. 6. Connect a test light between the auxiliary cooling fan connector terminal B and ground. Is the test light on?	-	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition OFF. 2. Connect a scan tool to the ALDL. 3. The coolant temperature should be above 93°C (199°F). 4. Disconnect the auxiliary cooling fan connector. 5. Connect a test light between the auxiliary cooling fan connector terminal A and battery positive. Is the test light on?	-	Go to *Step 24*	Go to *Step 13*
8	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 9*	Go to *Step 20*
9	1. Turn the ignition OFF. 2. Connect the low speed cooling fan relay. 3. Disconnect the electronic control module (ECM) red connector. 4. Connect a fused jumper between the ECM connector terminal A10 and ground. 5. Turn the ignition ON. Do the cooling fans run at low speed?	-	Go to *Step 26*	Go to *Step 10*
10	Check for an open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A10. Is the problem found?	-	Go to *Step 21*	Go to *Step 11*
11	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 12*	Go to *Step 19*
12	Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 22*	Go to *Step 13*

Engine Cooling Fan Circuit Check - Without A/C (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Disconnect the series/parallel cooling fan relay. 2. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 3. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 23*	Go to *Step 14*
14	Check the wire between the low speed cooling fan relay connector terminal 87 to the auxiliary cooling fan connector terminal B for an open. Is the problem found?	-	Go to *Step 18*	Go to *Step 15*
15	Check the wire between the auxiliary cooling fan connector terminal A and the series/parallel cooling fan relay connector terminal 30 for an open. Is the problem found?	-	Go to *Step 18*	Go to *Step 16*
16	Check the wire between the series/parallel cooling fan relay connector terminal 87 and the main cooling fan connector terminal B for an open. Is the problem found?	-	Go to *Step 18*	Go to *Step 17*
17	Check for an open wire between the main cooling fan connector terminal A and ground. Is the problem found?	-	Go to *Step 18*	Go to *Step 25*
18	Repair the open wire as needed. Is the repair complete?	-	System OK	-
19	Repair the open between the low speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
20	Repair the open between the low speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
21	Repair the open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A10. Is the repair complete?	-	System OK	-
22	Replace the low speed cooling fan relay. Is the repair complete?	-	System OK	-
23	Replace the series/parallel cooling fan relay. Is the repair complete?	-	System OK	-
24	Replace the auxiliary cooling fan. Is the repair complete?	-	System OK	-
25	Replace the main cooling fan. Is the repair complete?	-	System OK	-
26	Replace the ECM. Is the repair complete?	-	System OK	-

Engine Cooling Fan Circuit Check - Without A/C (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
27	1. Turn the ignition OFF. 2. Disconnect the high speed cooling fan relay. 3. Connect a test light between the high speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 28*	Go to *Step 38*
28	1. Turn the ignition OFF. 2. Connect a test light between the high speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 29*	Go to *Step 39*
29	1. Disconnect the series/parallel cooling fan relay. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 85 and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 30*	Go to *Step 40*
30	1. Turn the ignition OFF. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 31*	Go to *Step 41*
31	1. Connect the auxiliary cooling fan connector. 2. Connect the high speed cooling fan relay. 3. Connect the series/parallel cooling fan relay. 4. Disconnect the ECM red connector. 5. Connect a fused jumper between the ECM connector terminal A10 and ground. 6. Connect a fused jumper between the ECM connector terminal A14 and ground. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 26*	Go to *Step 32*
32	1. Turn the ignition OFF. 2. Check for an open wire between the high speed cooling fan relay connector terminal 86 and the ECM connector terminal A14. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
33	1. Disconnect the high speed cooling fan relay. 2. Connect a test light between the high speed cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 34*	Go to *Step 42*
34	1. Disconnect the ECM red connector. 2. Connect a fused jumper between the ECM connector terminal A14 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a test light between the series/parallel cooling fan relay connector terminal 86 and battery positive. Is the test light on?	-	Go to *Step 35*	Go to *Step 43*

Engine Cooling Fan Circuit Check - Without A/C (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
35	1. Connect the series/parallel cooling fan relay. 2. Connect a fused jumper between the ECM connector terminal A14 and ground. 3. Disconnect the high speed cooling fan relay. 4. Connect a fused jumper between the high speed cooling fan relay connector terminals 30 and 87. 5. Disconnect the low speed cooling fan relay. 6. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 37*	Go to *Step 36*
36	1. Turn the ignition OFF. 2. Connect a fused jumper between the ECM connector terminal A14 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. 5. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 6. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 23*	-
37	Replace the high speed cooling fan relay. Is the repair complete?	-	System OK	-
38	Repair the open wire between the high speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
39	Repair the open wire between the high speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
40	Repair the open wire between the series/parallel cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
41	Repair the open wire between the series/parallel cooling fan relay connector terminal 87 and ground. Is the repair complete?	-	System OK	-
42	Repair the open wire between the high speed cooling fan relay connector terminal 87 and the main cooling fan connector terminal B. Is the repair complete?	-	System OK	-
43	Repair the open wire between the series/parallel cooling fan relay connector terminal 86 and the ECM connector terminal A14. Is the repair complete?	-	System OK	-

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FUEL INJECTOR BALANCE TEST

A fuel injector tester is used to energize the injector for a precise amount of time, thus spraying a measured amount of fuel into the intake manifold. This causes a drop in the fuel rail pressure that can be recorded and used to compare each of the fuel injectors. All of the fuel injectors should have the same pressure drop 10 kPa (1.5 psi).

Injector Balance Test Example

Cylinder	1	2	3	4
First Reading	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)
Second Reading	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)
Amount Of Drop	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)
Average Range: 156-176 kPa (22.5-25.5 psi)	Injector OK	Faulty Injector - Too Much Pressure Drop	Injector OK	Faulty Injector - Too Little Pressure Drop

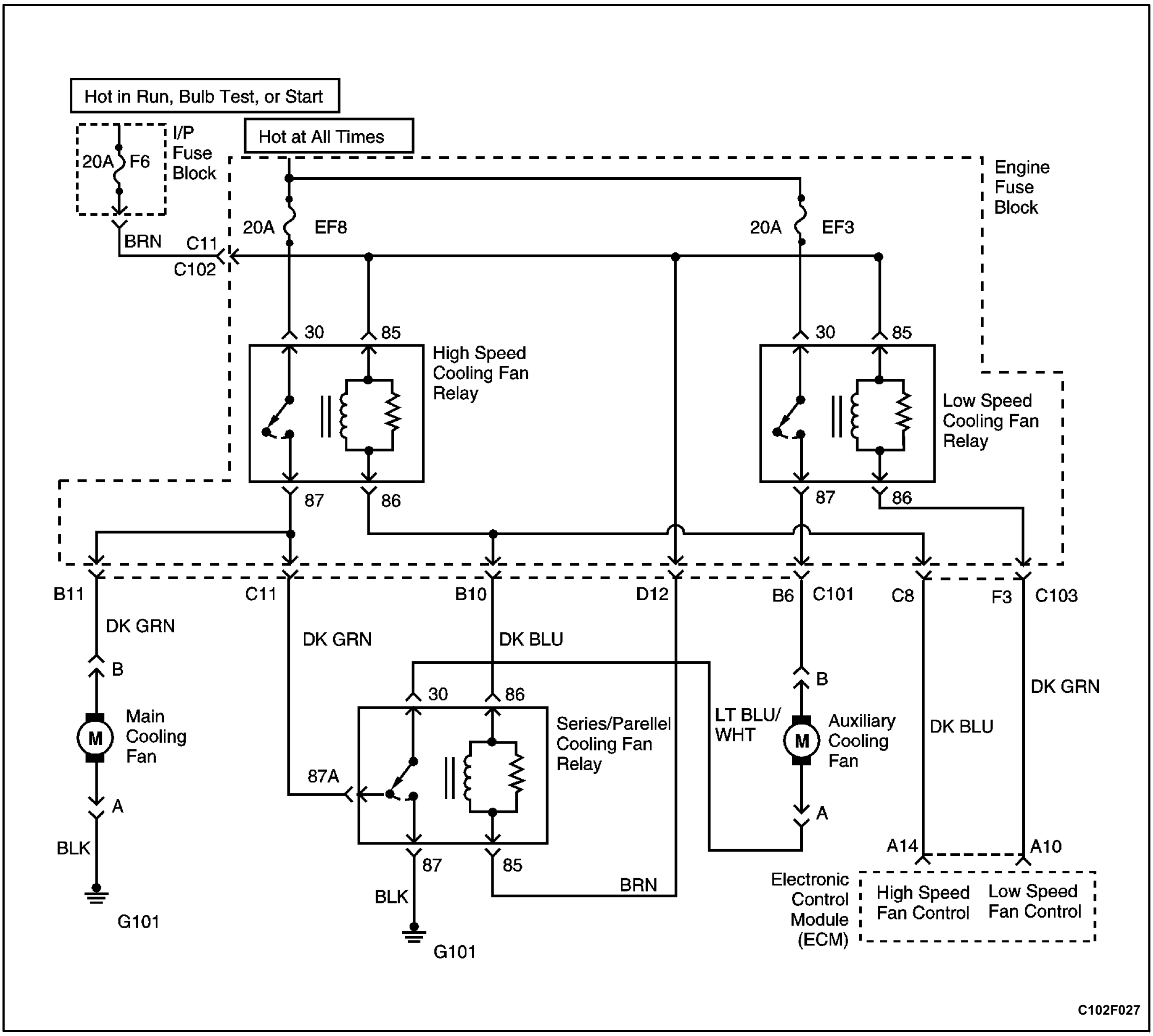
Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Notice: In order to prevent flooding of the engine, do not perform the Injector Balance Test more than once (including any retest on faulty fuel injectors) without running the engine.

Test

1. An engine cool down period of 10 minutes is necessary in order to avoid irregular readings due to hot soak fuel boiling.
2. Connect the fuel pressure gauge carefully to avoid any fuel spillage.
3. The fuel pump should run about 2 seconds after the ignition is turned to the ON position. (Except Euro Stage-II).
   ✳ Use jump wire for Euro Stage-II, connect terminal D12 of C103 to ground for 2 seconds.
4. Insert a clear tube attached to the vent valve of the fuel pressure gauge into a suitable container.
5. Bleed the air from the fuel pressure gauge and hose until all of the air is bled from the fuel pressure gauge.
6. The ignition switch must be in the OFF position at least 10 seconds in order to complete the electronic control module (ECM) shutdown cycle.
7. Turn the ignition ON in order to get the fuel pressure to its maximum level. (Except Euro Stage-II).
   ✳ For Euro Stage-II, connect the terminal D12 of C103 to ground for 2 seconds.
8. Allow the fuel pressure to stabilize and then record this initial pressure reading. Wait until there is no movement of the needle on the fuel pressure gauge.
9. Follow the manufacturer's instructions for the use of the adapter harness. Energize the fuel injector tester once and note the fuel pressure drop at its lowest point. Record this second reading. Subtract it from the first reading to determine the amount of the fuel pressure drop.
10. Disconnect the fuel injector tester from the fuel injector.
11. After turning the ignition ON (except Euro Stage-II) or connect the terminal D12 of C103 to ground (Euro Stage-II), in order to obtain maximum pressure once again, make a connection at the next fuel injector. Energize the fuel injector tester and record the fuel pressure reading. Repeat this procedure for all the injectors.
12. Retest any of the fuel injectors that the pressure drop exceeds the 10 kPa (1.5 psi) specification.
13. Replace any of the fuel injectors that fail the retest.
14. If the pressure drop of all of the fuel injectors is within 10 kPa (1.5 psi), then the fuel injectors are flowing normally and no replacement should be necessary.
15. Reconnect the fuel injector harness and review the symptom diagnostic tables.



DIAGNOSTIC TROUBLE CODE (DTC) 3
FAN NUMBER TWO LOW (2.0L DOHC)

Circuit Description

The high speed cooling fan relay is controlled by the electronic control module (ECM). The ECM applies a ground to the high speed cooling fan relay, while also applying ground to the low speed cooling fan relay, to achieve high speed cooling fan operation. The ECM determines when to activate the high speed cooling fan relay depending on the coolant temperature and the A/C system high side pressure.

DTC 3 Will Set When

✳ A short to ground condition exists.

✳ This condition is present for more than 2 seconds.

Diagnostic Aids

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

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This step checks for a shorted relay.
6. This step checks for a shorted relay.
11. This step checks for the ability of the ECM to ground the fan circuits.

DTC 3 - Fan Number Two Low (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	Inspect the fuse F6. Is the fuse in good condition?	-	Go to *Step 4*	Go to *Step 3*
3	1. Replace the fuse. 2. Clear any diagnostic trouble codes (DTCs) from the electronic control module (ECM). 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
4	1. Disconnect the high speed cooling fan relay. 2. Measure the resistance between the high speed cooling fan relay terminals 85 and 86. Is the circuit shorted to ground?	-	Go to *Step 5*	Go to *Step 6*
5	1. Replace the high speed cooling fan relay. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Disconnect the series/parallel cooling fan relay. 2. Measure the resistance between the series/parallel cooling fan relay terminals 85 and 86. Is the circuit shorted to ground?	-	Go to *Step 7*	Go to *Step 8*
7	1. Replace the series/parallel cooling fan relay. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	Check for a short to ground in the wiring between the high speed cooling fan relay connector terminal 86 and the ECM connector terminal A14. Is the problem found?	-	Go to *Step 10*	Go to *Step 9*
9	Check for a short to ground in the wiring between the series/parallel cooling fan relay connector terminal 86 and ECM connector terminal A14. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
10	1. Repair the short to ground in the wiring. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Turn the ignition OFF. 2. Connect the high speed cooling fan relay. 3. Connect the series/parallel cooling fan relay. 4. Connect the ECM red connector. 5. Jumper terminals A and B of the assembly line diagnostic link (ALDL) connector. 6. Turn the ignition ON. 7. With a test light connected to battery voltage, backprobe the ECM connector terminal A14. Is the test light on?	-	Go to "Diagnostic Aids"	Go to *Step 12*

DTC 3 - Fan Number Two Low (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Turn the ignition OFF. 2. Disconnect the ECM red connector. 3. Inspect for a poor connection at the ECM connector terminal A14. Is the problem found?	-	Go to *Step 13*	Go to *Step 14*
13	1. Repair or replace the connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
14	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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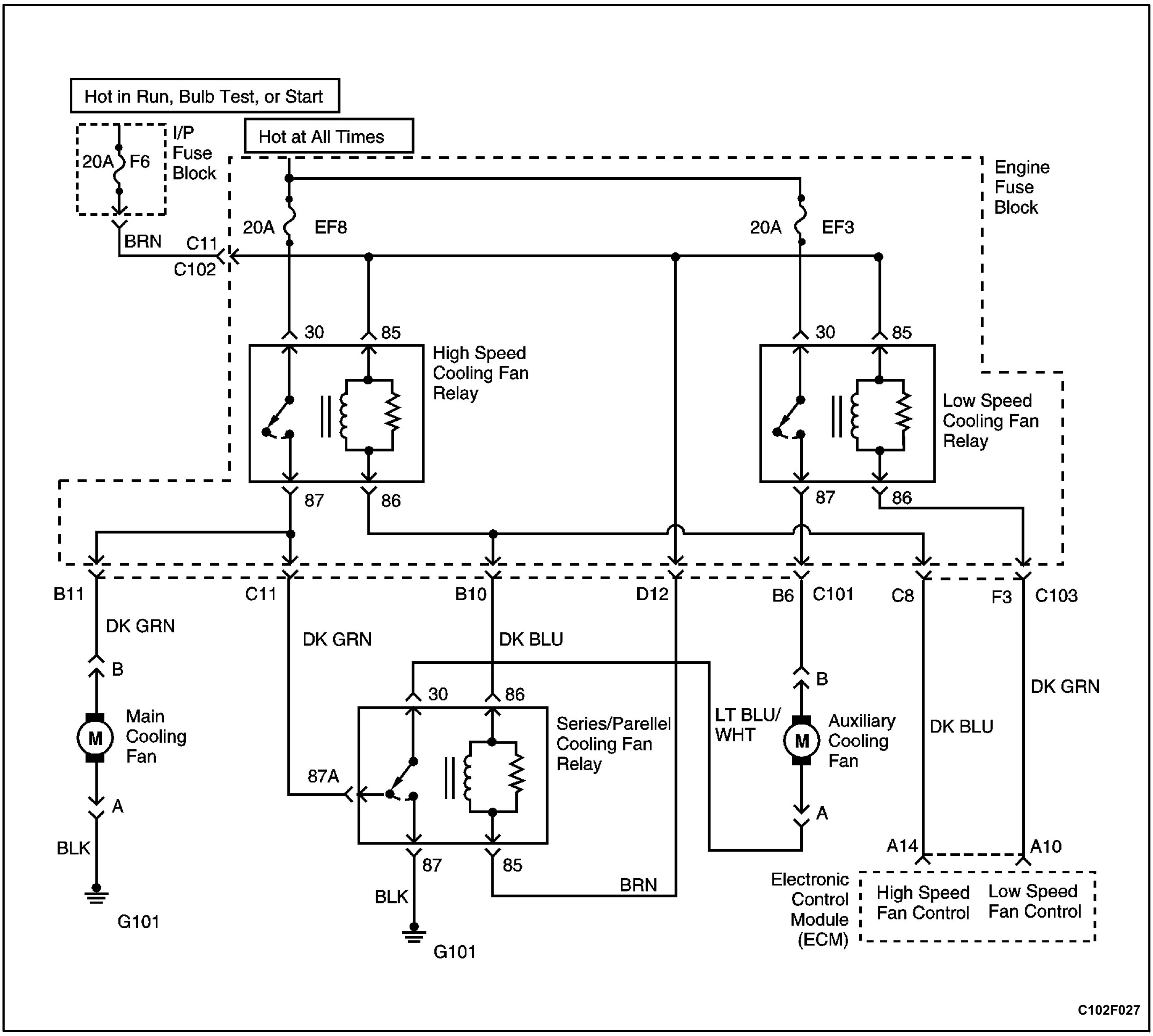


DIAGNOSTIC TROUBLE CODE (DTC) 4 FAN NUMBER TWO HIGH (2.0L DOHC)

Circuit Description

The high speed cooling fan relay is controlled by the electronic control module (ECM). The ECM applies a ground to the high speed cooling fan relay, while also applying ground to the low speed cooling fan relay, to achieve high speed cooling fan operation. The ECM determines when to activate the high speed cooling fan relay depending on the coolant temperature and the A/C system high side pressure.

DTC 4 Will Set When

✳ A short to battery voltage condition exists.

✳ This condition is present for more than 2 seconds.

Diagnostic Aids

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

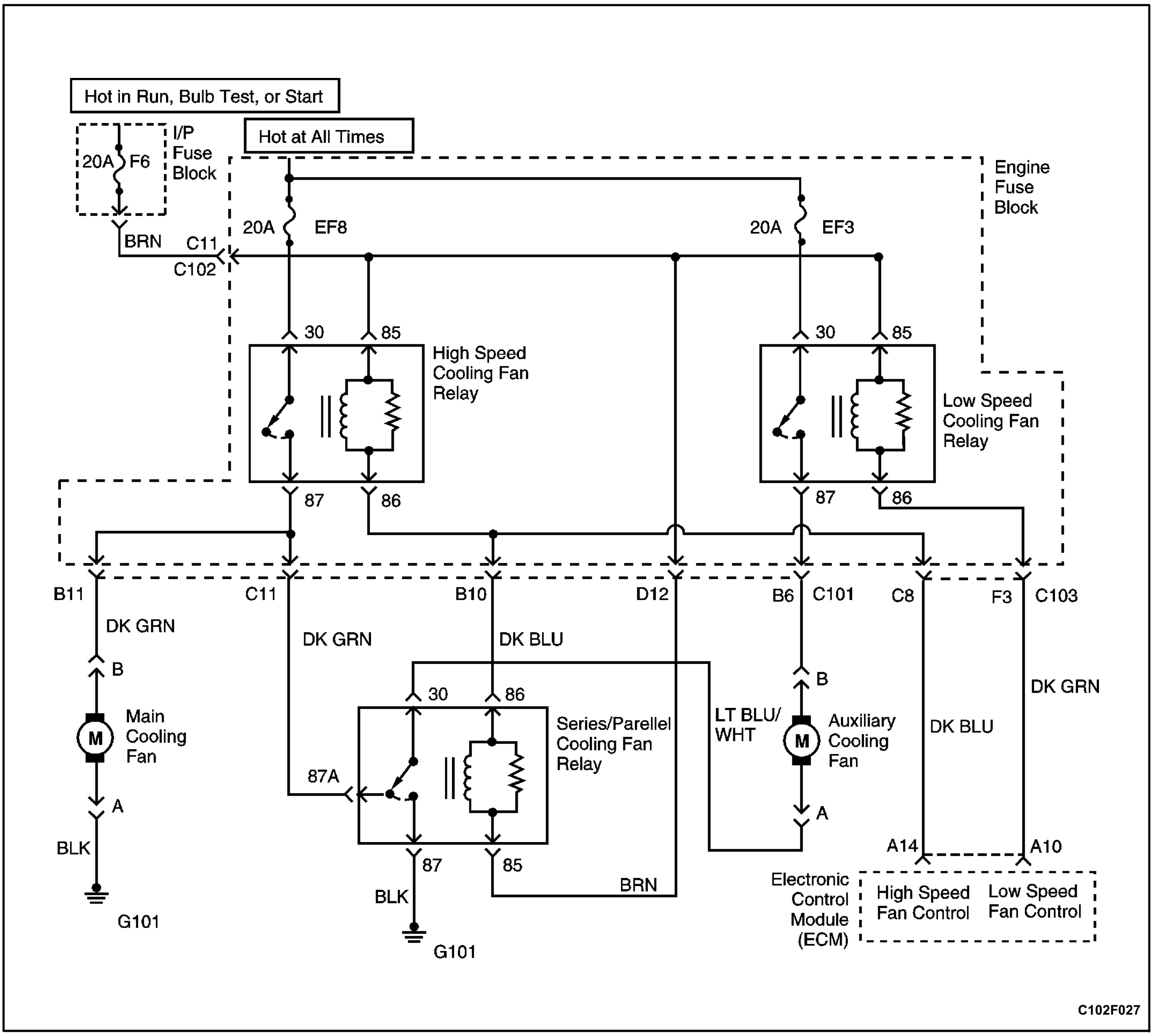
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. This step checks the wires for a short to battery voltage.
4. This step checks for a shorted relay.
6. This step checks for a shorted relay.

DTC 4 - Fan Number Two High (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the electronic control module (ECM) red connector. 2. Disconnect the high speed cooling fan relay and the series/parallel cooling fan relay. 3. Measure the voltage between the ECM connector terminal A14 and ground. Does the voltage measure within the value specified?	0 V	Go to *Step 4*	Go to *Step 3*
3	1. Repair the short to voltage between the high speed cooling fan relay or the series/parallel cooling fan relay connector terminal 86 and the ECM connector terminal A14. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
4	Measure the resistance between the high speed cooling fan relay terminals 85 and 86. Does the resistance measure near the value specified?	≈ 0 Ω	Go to *Step 5*	Go to *Step 6*
5	1. Replace the high speed cooling fan relay. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	Measure the resistance between the series/parallel cooling fan relay terminals 85 and 86. Does the resistance measure near the value specified?	≈ 0 Ω	Go to *Step 7*	Go to *Step 8*
7	1. Replace the series/parallel cooling fan relay. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	Inspect for a poor connection at the ECM connector terminal A14. Is the problem found?	-	Go to *Step 9*	Go to *Step 10*
9	1. Repair or replace the connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 5
FAN NUMBER ONE LOW (2.0L DOHC)

Circuit Description

The low speed cooling fan relay is controlled by the electronic control module (ECM). The ECM applies a ground to the low speed cooling fan relay to achieve low speed cooling fan operation. The ECM determines when to activate the low speed cooling fan relay depending on the coolant temperature and the A/C system high side pressure.

DTC 5 Will Set When

✳ A short to ground condition exists.

✳ This condition is present for more than 2 seconds.

Diagnostic Aids

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

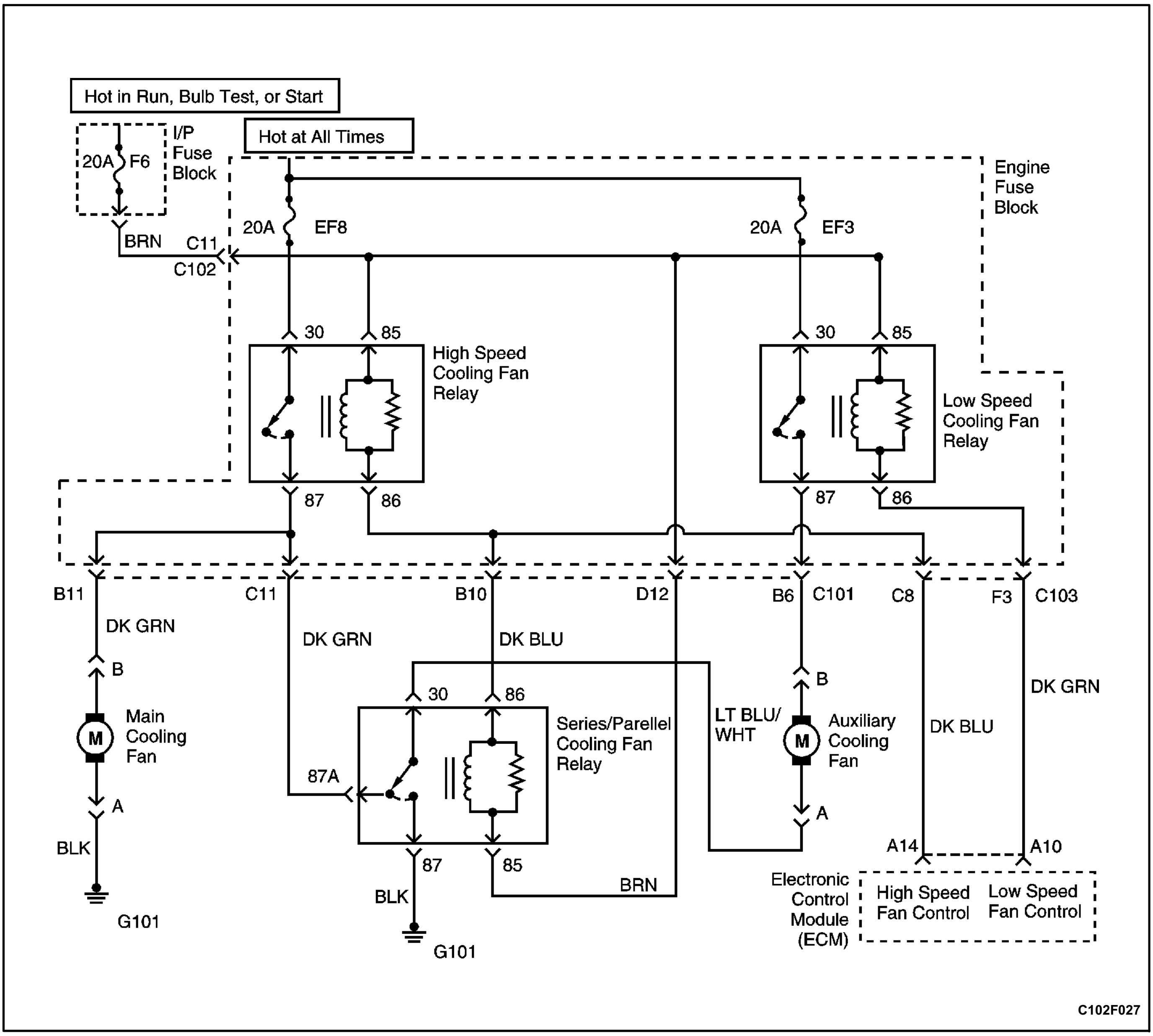
Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This step checks for a shorted relay.
8. This step checks for the ability of the ECM to ground the fan circuits.

DTC 5 - Fan Number One Low (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	Inspect the fuse F6. Is the fuse in good condition?	-	Go to *Step 4*	Go to *Step 3*
3	1. Replace the fuse. 2. Clear any diagnostic trouble codes (DTCs) from the electronic control module (ECM). 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
4	1. Disconnect the low speed cooling fan relay. 2. Measure the resistance between the low speed cooling fan relay terminals 85 and 86. Is the circuit shorted to ground?	-	Go to *Step 5*	Go to *Step 6*
5	1. Replace the low speed cooling fan relay. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	Check for a short to ground in the wiring between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A10. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	1. Repair the short to ground in the wiring. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	1. Turn the ignition OFF. 2. Connect the low speed cooling fan relay. 3. Connect the ECM red connector. 4. Jumper terminals A and B of the assembly line diagnostic link (ALDL) connector. 5. Turn the ignition ON. 6. With a test light connected to battery voltage, backprobe the ECM connector terminal A10. Is the test light on?	-	Go to "Diagnostic Aids"	Go to *Step 9*
9	1. Turn the ignition OFF. 2. Disconnect the ECM red connector. 3. Inspect for a poor connection at the ECM connector terminal A10. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
10	1. Repair or replace the connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 6
FAN NUMBER ONE HIGH (2.0L DOHC)

Circuit Description

The low speed cooling fan relay is controlled by the electronic control module (ECM). The ECM applies a ground to the low speed cooling fan relay to achieve low speed cooling fan operation. The ECM determines when to activate the low speed cooling fan relay depending on the coolant temperature and the A/C system high side pressure.

DTC 6 Will Set When

✳ A short to battery voltage condition exists.

✳ This condition is present for than 2 seconds.

Diagnostic Aids

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

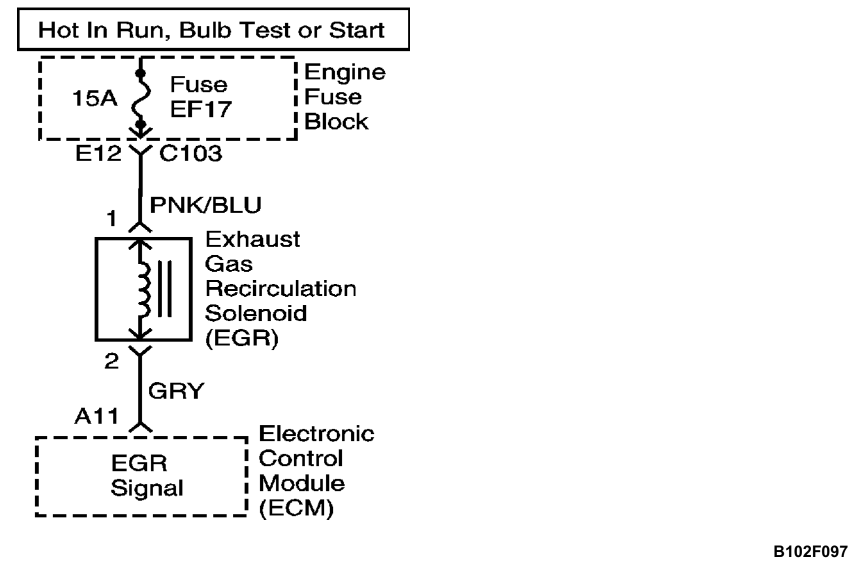
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. This step checks the wires for a short to battery voltage.
4. This step checks for a shorted relay.

DTC 6 - Fan Number Two High (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the electronic control module (ECM) red connector. 2. Disconnect the low speed cooling fan relay. 3. Measure the voltage between the ECM connector terminal A10 and ground. Does the voltage measure within the value specified?	0 V	Go to *Step 4*	Go to *Step 3*
3	1. Repair the short to voltage between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal A10. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
4	Measure the resistance between the low speed cooling fan relay terminals 85 and 86. Does the resistance measure near the value specified?	≈ 0 Ω	Go to *Step 5*	Go to *Step 6*
5	1. Replace the low speed cooling fan relay. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	Inspect for a poor connection at the ECM connector terminal A10. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	1. Repair or replace the connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 7 BACK PRESSURE EXHAUST GAS RECIRCULATION ON/OFF SOLENOID LOW (2.0L DOHC)

Circuit Description

The electronic control module (ECM) operates a solenoid to control the back pressure (BP) exhaust gas recirculation (EGR) valve. The solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid, which then allows vacuum to pass to the EGR valve.

The ECM monitors EGR effectiveness by de-energizing the EGR solenoid and shutting off vacuum to the EGR valve. With the EGR valve closed and the oxygen sensor fluctuating normally, short-term fuel trim counts will be greater than they were during normal operation.

DTC 7 Will Set When

✳ A short to ground condition exits.

Diagnostic Aids

✳ Inspect the ECM wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal-to-wire connection, or a damaged harness.

✳ If the connections and the wiring harness are in good condition, connect a test light between the controlled canister purge (CCP) solenoid connector terminal 2 and battery positive while moving related connectors. If the fault is induced, the test light will turn on. This may help to isolate the location of an intermittent problem.

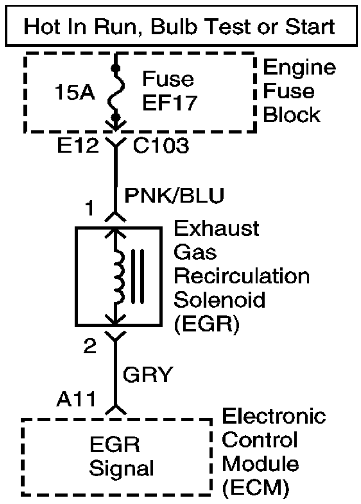
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. With the ignition OFF, the ECM should not be applyilng ground to the EGR solenoid.
3. If the test light is still on after disconnecting the ECM red connector, the wire between the EGR solenoid and the ECM is shorted to ground. IF the test light goes off, the ECM is at fault.

DTC 7 - Back Pressure Exhaust Gas Recirculation On/OFF Solenoid Law (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the exhaust gas recirculation (EGR) solenoid connector. 2. Connect a test light between the EGR solenoid connector terminal 2 and battery positive. Is the test light on?	-	Go to *Step 3*	Go to "Diagnostic System Check"
3	Disconnect the electronic control module (ECM) red connector. Is the test light on?	-	Go to *Step 4*	Go to *Step 5*
4	1. Repair the short to ground in the wire between the EGR solenoid connector terminal 2 and the ECM connector terminal A11. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
5	1. Replace the ECM. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



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DIAGNOSTIC TROUBLE CODE (DTC) 8 BACK PRESSURE EXHAUST GAS RECIRCULATION ON/OFF SOLENOID LOW (2.0L DOHC)

Circuit Description

The electronic control module (ECM) operates a solenoid to control the back pressure (BP) exhaust gas recirculation (EGR) valve. The solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid, which then allows vacuum to pass to the EGR valve.

The ECM monitors EGR effectiveness by de-energizing the EGR solenoid and shutting off vacuum to the EGR valve. With the EGR valve closed and the oxygen sensor fluctuating normally, short-term fuel trim counts will be greater than they were during normal operation.

DTC 8 Will Set When

✳ A short to battery voltage condition exits.

Diagnostic Aids

✳ Inspect the ECM wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal-to-wire connection, or a damaged harness.

✳ If the connections and the wiring harness are in good condition, connect a test light between the controlled canister purge (CCP) solenoid connector terminal 2 and battery positive while moving related connectors. If the fault is induced, the test light will turn on. This may help to isolate the location of an intermittent problem.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. If the test light is still on after disconnecting the ECM red connector, the wire between the CCP solenoid and the ECM is shorted to voltage. Ifr the test light goes off, the ECM is at fault.

DTC 8 - Back Pressure Exhaust Gas Recirculation On/OFF Solenoid Law (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the exhaust gas recirculation (EGR) solenoid connector. 2. Measure the resistance of the EGR solenoid. Does the resistance measure near the value specified?	≈ 0 Ω	Go to *Step 6*	Go to *Step 3*
3	1. Disconnect the EGR solenoid connector. 2. Connect a test light between the EGR solenoid connector terminal 2 and ground. Is the test light on?	-	Go to *Step 4*	Go to "Diagnostic Aids"
4	Disconnect the electronic control module (ECM) red connector. Is the test light on?	-	Go to *Step 5*	Go to *Step 7*
5	1. Repair the short to voltage in the wire between the EGR solenoid connector terminal 2 and the ECM connector terminal A11. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Replace the EGR. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
7	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

DIAGNOSTIC TROUBLE CODE (DTC) 12
NO PULSE REFERENCE, ENGINE NOT RUNNING
(2.0L SOHC IEFI6 AND 2.0L DOHC ITMS6F)

Circuit Description

This is a normal code that the electronic control module (ECM) stores.

DTC 12 Will Set When

✳ The ignition key is ON, but the engine is not running.

Diagnostic Aids

✳ This code indicates a normal condition with no malfunctions.

✳ This code indicates that the ECM has the ability to store codes.

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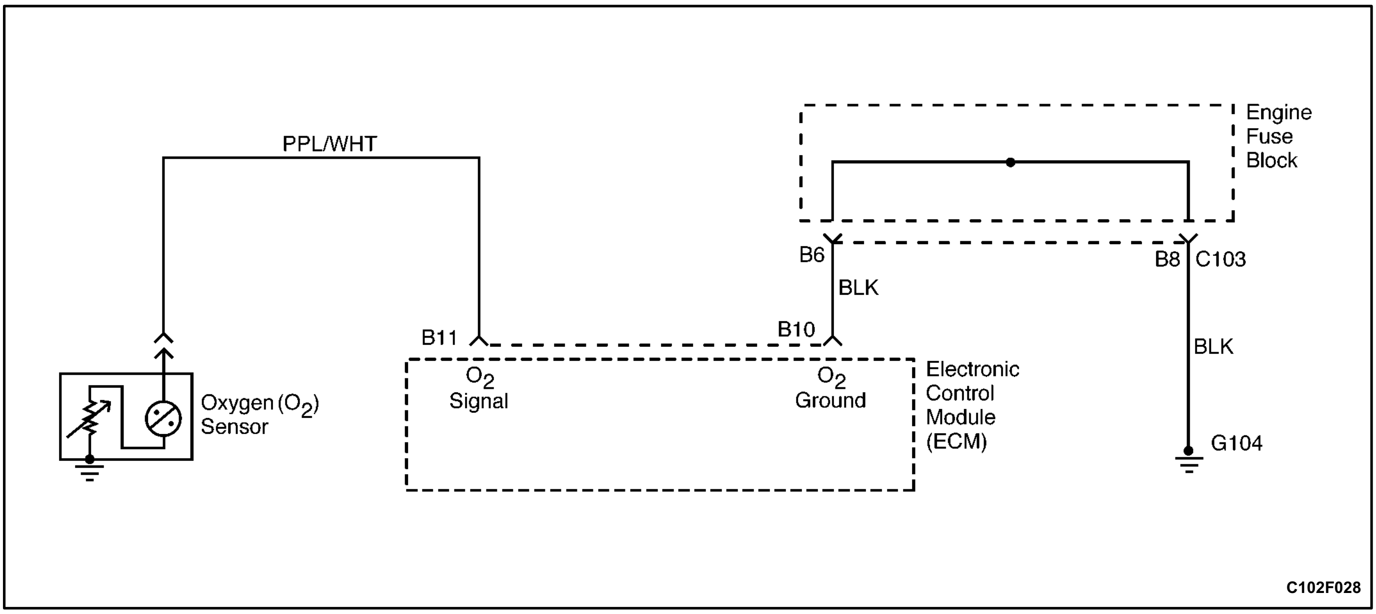

DIAGNOSTIC TROUBLE CODE (DTC) 13
OXYGEN SENSOR NOT TOGGLING (2.0L SOHC)

Circuit Description

The electronic control module (ECM) supplies a voltage of about 450 millivolts between the ECM terminals B11and B10. The oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down to about 100 millivolts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C (600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

DTC 13 Will Set When

✳ The engine has been running for at least 60 seconds.
✳ Diagnostic trouble code (DTC) 21 has not set.
✳ DTC 22 has not set.
✳ DTC 33 has not set.
✳ DTC 34 has not set.
✳ The throttle angle is above 5 percent.
✳ The coolant temperature is above 80°C (176°F).
✳ The oxygen (O_2) sensor is steady between 350 millivolts and 550 millivolts.
✳ These conditions are present for 30 seconds.

Diagnostic Aids

Normal scan tool voltage varies between 100 millivolts and 999 millivolts while in closed loop.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. If the conditions for the diagnostic trouble code (DTC) 13 are present, the engine controls system will not operate in closed loop.
5. By making a vacuum leak, a lean running condition should now be present. If the oxygen (O_2) sensor toggles below 450 millivolts, the O_2 sensor is sensing the lean running condition.
6. By making a slight vacuum leak at the manifold absolute pressure (MAP) sensor, a rich running condition should now be present. If the O_2 sensor toggles above 550 millivolts, the O_2 sensor is sensing the rich running condition.
10. An open or short to ground in the O_2 sensor circuit will not allow the ECM to operate in closed loop.

DTC 13 - Oxygen Sensor Not Toggling (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Start the engine. 3. Run the engine until it reaches operating temperature. 4. Check for closed loop operation. Does the electronic control module (ECM) go into closed loop?	-	Go to *Step 3*	Go to *Step 8*
3	1. Run the engine until it reaches operating temperature. 2. Check the oxygen (O_2) sensor reading at different throttle settings. Does the scan tool read the O_2 sensor input toggling between the values specified?	100900 mV	Go to *Step 7*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the O_2 sensor connector. 3. Check the O_2 sensor pigtail lead at the sensor. Is the lead properly attached to the sensor?	-	Go to *Step 5*	Go to *Step 9*
5	1. Reconnect the O_2 sensor connector. 2. Start the engine. 3. Run the engine until it reaches operating temperature. 4. Make a vacuum leak by disconnecting or partially disconnecting a vacuum hose. Do not disconnect the manifold absolute pressure (MAP) sensor. Does the O_2 sensor input stay fixed at or below the value specified?	300 mV	Go to *Step 6*	Go to *Step 8*
6	1. Run the engine until it reaches operating temperature. 2. Make a slight vacuum leak at the MAP sensor vacuum hose connection. Does the O_2 sensor input stay fixed at or above the value specified?	600 mV	Go to *Step 7*	Go to *Step 8*
7	1. Clear the intermittent diagnostic trouble code (DTC) 13 from the ECM. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Did DTC 13 reset in the ECM?	-	Go to *Step 2*	Go to "Diagnostic Aids"
8	1. Turn the ignition OFF. 2. Disconnect the O_2 sensor connector. 3. Turn the ignition ON. 4. Measure the voltage at the O_2 sensor connector (ECM side of connector). Is the voltage within the value specified?	300-600 mV	Go to *Step 9*	Go to *Step 10*
9	1. Replace the O_2 sensor. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

DTC 13 - Oxygen Sensor Not Toggling (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for an open or short to ground between the O_2 sensor connector and the ECM connector terminal B11. Is the problem found?	-	Go to *Step 11*	Go to *Step 12*
11	1. Repair the wire as needed. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
12	1. Replace the ECM. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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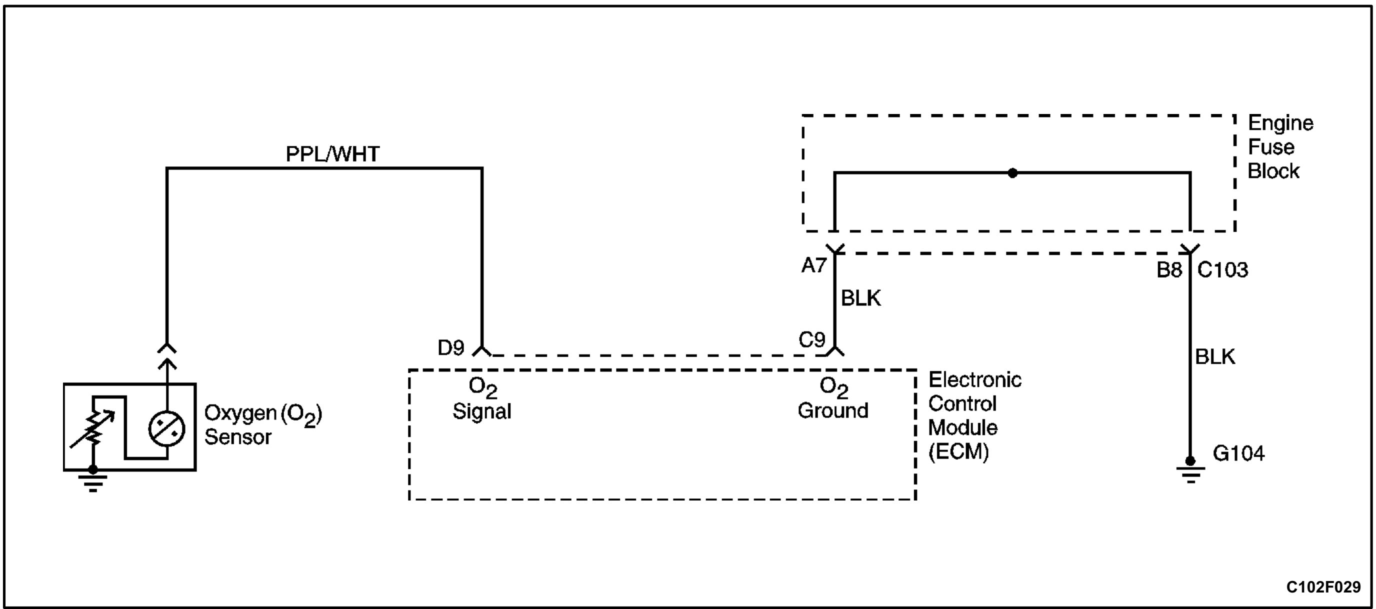

DIAGNOSTIC TROUBLE CODE (DTC) 13
OXYGEN SENSOR NOT TOGGLING (2.0L DOHC)

Circuit Description

The electronic control module (ECM) supplies a voltage of about 450 millivolts between the ECM terminals D9 and C9. The oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down to about 100 millivolts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C (600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

DTC 13 Will Set When

- ✳ The engine has been running for at least 60 seconds.
- ✳ Diagnostic trouble code (DTC) 21 has not set.
- ✳ DTC 22 has not set.
- ✳ DTC 33 has not set.
- ✳ DTC 34 has not set.
- ✳ The throttle angle is above 5 percent.
- ✳ The coolant temperature is above 70°C (158°F).
- ✳ The oxygen (O_2) sensor is steady between 340 millivolts and 540 millivolts.
- ✳ These conditions are present for 20 seconds.

Diagnostic Aids

Normal scan tool voltage varies between 100 millivolts and 999 millivolts while in closed loop.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. If the conditions for the diagnostic trouble code (DTC) 13 are present, the engine controls system will not operate in closed loop.
5. By making a vacuum leak, a lean running condition should now be present. If the oxygen (O_2) sensor toggles below 450 millivolts, the O_2 sensor is sensing the lean running condition.
6. By making a slight vacuum leak at the manifold absolute pressure (MAP) sensor, a rich running condition should now be present. If the O_2 sensor toggles above 550 millivolts, the O_2 sensor is sensing the rich running condition.
10. An open or short to ground in the O_2 sensor circuit will not allow the ECM to operate in closed loop.

DTC 13 - Oxygen Sensor Not Toggling (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Start the engine. 3. Run the engine until it reaches operating temperature. 4. Check for closed loop operation. Does the electronic control module (ECM) go into closed loop?	-	Go to *Step 3*	Go to *Step 8*
3	1. Run the engine until it reaches operating temperature. 2. Check the oxygen (O_2) sensor reading at different throttle settings. Does the scan tool read the O_2 sensor input toggling between the values specified?	100-900 mV	Go to *Step 7*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the O_2 sensor connector. 3. Check the O_2 sensor pigtail lead at the sensor. Is the lead properly attached to the sensor?	-	Go to *Step 5*	Go to *Step 9*
5	1. Reconnect the O_2 sensor connector. 2. Start the engine. 3. Run the engine until it reaches operating temperature. 4. Make a vacuum leak by disconnecting or partially disconnecting a vacuum hose. Do not disconnect the manifold absolute pressure (MAP) sensor. Does the O_2 sensor input stay fixed at or below the value specified?	300 mV	Go to *Step 6*	Go to *Step 8*
6	1. Run the engine until it reaches operating temperature. 2. Make a slight vacuum leak at the MAP sensor vacuum hose connection. Does the O_2 sensor input stay fixed at or above the value specified?	600 mV	Go to *Step 7*	Go to *Step 8*
7	1. Clear the intermittent diagnostic trouble code (DTC) 13 from the ECM. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Did DTC 13 reset in the ECM?	-	Go to *Step 2*	Go to "Diagnostic Aids"
8	1. Turn the ignition OFF. 2. Disconnect the O_2 sensor connector. 3. Turn the ignition ON. 4. Measure the voltage at the O_2 sensor connector (ECM side of connector). Is the voltage within the value specified?	300-600 mV	Go to *Step 9*	Go to *Step 10*
9	1. Replace the O_2 sensor. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

DTC 13 - Oxygen Sensor Not Toggling (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for an open or short to ground between the O_2 sensor connector and the ECM connector terminal D9. Is the problem found?	-	Go to *Step 11*	Go to *Step 12*
11	1. Repair the wire as needed. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
12	1. Replace the ECM. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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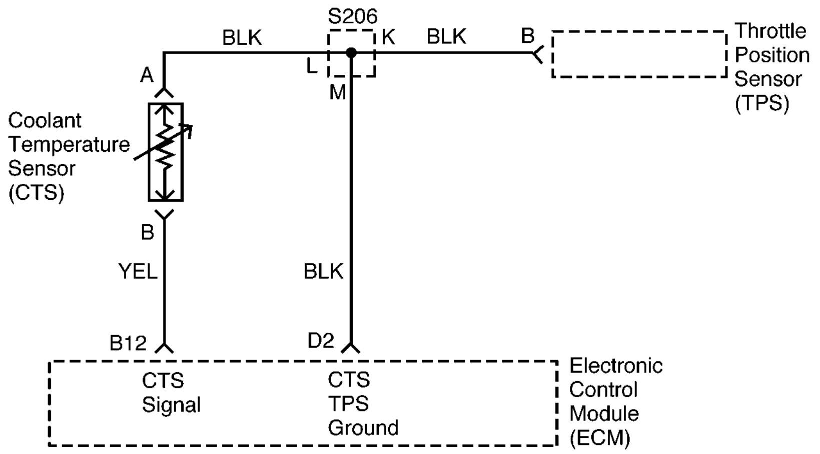

DIAGNOSTIC TROUBLE CODE (DTC) 14
COOLANT TEMPERATURE HIGH (2.0L SOHC)

Circuit Description

The coolant temperature sensor (CTS) uses a thermistor to control the signal voltage to the electronic control module (ECM). The ECM applies a voltage to the CTS. When the engine is cold, the CTS resistance is high. Therefore, the ECM will see a high signal voltage. As the engine warms, the CTS resistance becomes less, and the voltage drops. At normal engine operating temperature the CTS signal will measure about 1.5 to 2.0 volts.

DTC 14 Will Set When

✳ The engine has been running for more than 50 seconds.

✳ The coolant temperature sensor signal voltage indicates a coolant temperature above 145°C (293°F).

Diagnostic Aids

✳ If the connections are OK, monitor the coolant temperature while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.

✳ The "Temperature Vs. Resistance Values" scale may be used to test the coolant sensor at various temperatures to evaluate the possibility of a "shifted" or "mis-scaled" coolant temperature sensor which may result in driveability complaints.

COOLANT TEMPERATURE SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°C	°F	OHMS
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

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This test simulates the conditions for setting diagnostic trouble code 14. If the electronic control module (ECM) recognizes the low signal voltage (high temperature) and the scan tool displays 180°C (356°F), the ECM wiring is OK.
6. This step checks for voltage reference from the ECM.

DTC 14 - Coolant Temperature High (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. Does the scan tool display the engine coolant temperature within the value specified?	80-110°C (176-230°F)	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the coolant temperature sensor (CTS) connector. 3. Turn the ignition ON. Does the scan tool display the engine coolant temperature within the value specified?	Below –30°C (–22°F)	Go to *Step 4*	Go to *Step 6*
4	1. Jumper terminals A and B of the CTS connector. 2. Turn the ignition ON. Does the scan tool display the engine coolant temperature within the value specified?	Above 180°C (356°F)	Go to *Step 5*	Go to *Step 6*
5	1. Replace the coolant temperature sensor. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	Measure the voltage at the CTS connector terminal B. Is the voltage within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) white connector. 3. Inspect the ECM pins and connector for bent or damaged terminals. Repair or replace as needed. 4. Check the wire between the CTS connector terminal A and the ECM connector terminal D2 for a short to ECM reference voltage. Is the problem found?	-	Go to *Step 12*	Go to *Step 8*
8	1. Replace the electronic control module. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	Check the wire for a short to ground between the CTS connector terminal B and the ECM connector terminal B12. Is the problem found?	-	Go to *Step 13*	Go to *Step 10*

DTC 14 - Coolant Temperature High (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Disconnect the ECM red connector. 3. Inspect the ECM pins and connector for bent or damaged terminals or pins. Is the problem found?	-	Go to *Step 11*	Go to *Step 8*
11	1. Repair the connector terminals and straighten the ECM pins as needed. 2. If the ECM pins are broken, the ECM must be replaced. Have the terminals and pins been repaired?	-	Go to *Step 6*	-
12	1. Repair the short to voltage in the wire between the CTS connector terminal A and the ECM connector terminal D2. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
13	1. Repair the short to ground in the wire between the CTS connector terminal B and the ECM connector terminal B12. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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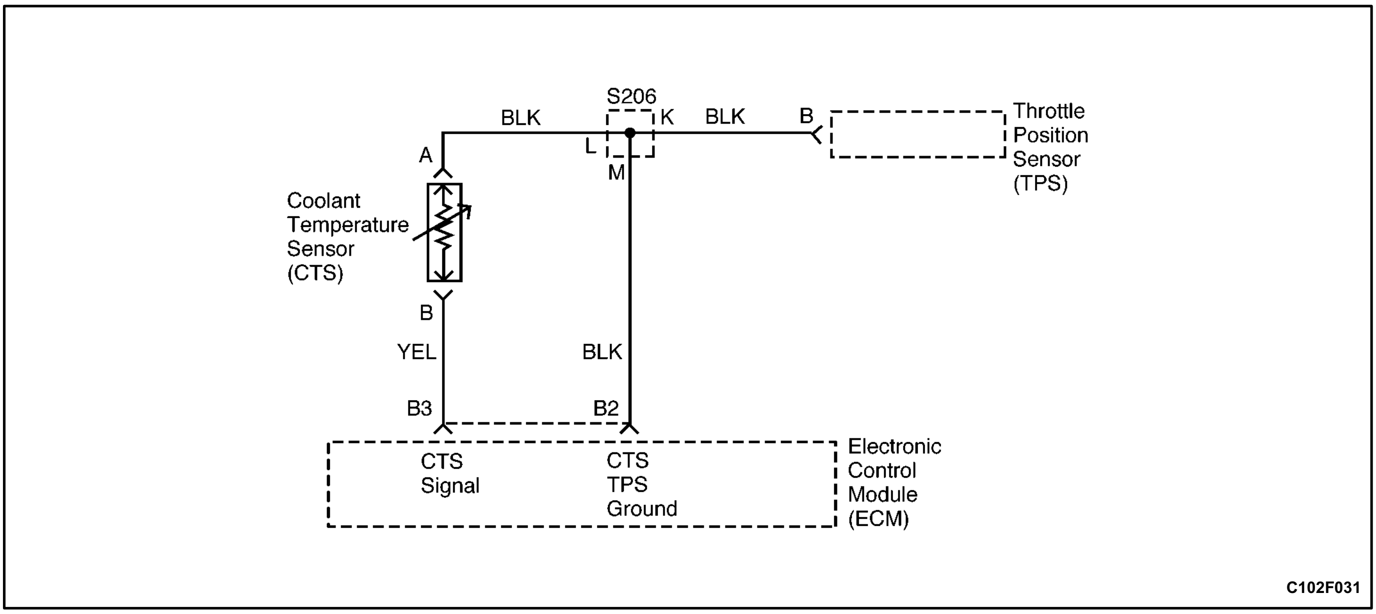

DIAGNOSTIC TROUBLE CODE (DTC) 14
COOLANT TEMPERATURE HIGH (2.0L DOHC)

Circuit Description

The coolant temperature sensor (CTS) uses a thermistor to control the signal voltage to the electronic control module (ECM). The ECM applies a voltage to the CTS. When the engine is cold, the CTS resistance is high. Therefore, the ECM will see a high signal voltage. As the engine warms, the CTS resistance becomes less, and the voltage drops. At normal engine operating temperature the CTS signal will measure about 1.5 to 2.0 volts.

DTC 14 Will Set When

- ✳ The engine has been running for more than 2 seconds.
- ✳ The coolant temperature sensor signal voltage indicates a coolant temperature above 146°C (294°F).

Diagnostic Aids

- ✳ If the connections are OK, monitor the coolant temperature while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.
- ✳ The "Temperature Vs. Resistance Values" scale may be used to test the coolant sensor at various temperatures to evaluate the possibility of a "shifted" or "mis-scaled" coolant temperature sensor which may result in driveability complaints.

COOLANT TEMPERATURE SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°C	°F	OHMS
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

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This test simulates the conditions for setting diagnostic trouble code 14. If the electronic control module (ECM) recognizes the low signal voltage (high temperature) and the scan tool displays 180°C (356°F), the ECM wiring is OK.
6. This step checks for voltage reference from the ECM.

DTC 14 - Coolant Temperature High (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. Does the scan tool display the engine coolant temperature within the value specified?	80-110°C (176-230°F)	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the coolant temperature sensor (CTS) connector. 3. Turn the ignition ON. Does the scan tool display the engine coolant temperature within the value specified?	Below –30°C (–22°F)	Go to *Step 4*	Go to *Step 6*
4	1. Jumper terminals A and B of the CTS connector. 2. Turn the ignition ON. Does the scan tool display the engine coolant temperature within the value specified?	Above 180°C (356°F)	Go to *Step 5*	Go to *Step 6*
5	1. Replace the coolant temperature sensor. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	Measure the voltage at the CTS connector terminal B. Is the voltage within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) red connector. 3. Inspect the ECM pins and connector for bent or damaged terminals. Repair or replace as needed. 4. Check the wire between the CTS connector terminal A and the ECM connector terminal B2 for a short to ECM reference voltage. Is the problem found?	-	Go to *Step 12*	Go to *Step 8*
8	1. Replace the electronic control module. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	Check the wire for a short to ground between the CTS connector terminal B and the ECM connector terminal B3. Is the problem found?	-	Go to *Step 13*	Go to *Step 10*

DTC 14 - Coolant Temperature High (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Disconnect the ECM red connector. 3. Inspect the ECM pins and connector for bent or damaged terminals or pins. Is the problem found?	-	Go to *Step 11*	Go to *Step 8*
11	1. Repair the connector terminals and straighten the ECM pins as needed. 2. If the ECM pins are broken, the ECM must be replaced. Have the terminals and pins been repaired?	-	Go to *Step 6*	-
12	1. Repair the short to voltage in the wire between the CTS connector terminal A and the ECM connector terminal B2. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
13	1. Repair the short to ground in the wire between the CTS connector terminal B and the ECM connector terminal B3. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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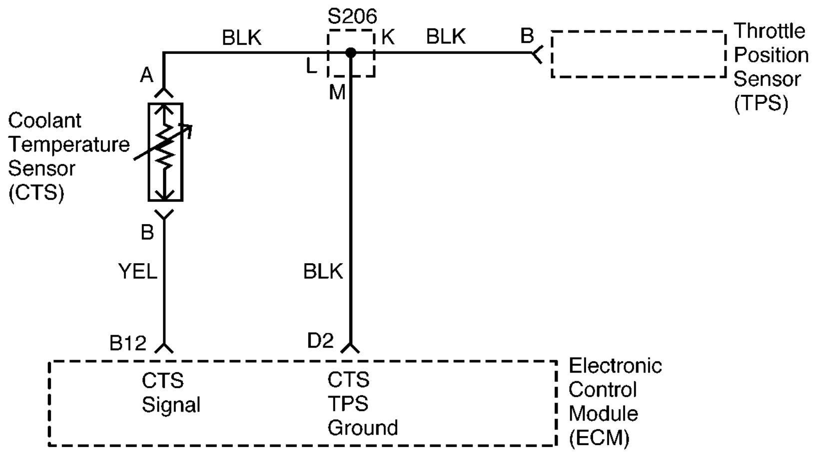

DIAGNOSTIC TROUBLE CODE (DTC) 15
COOLANT TEMPERATURE LOW (2.0L SOHC)

Circuit Description

The coolant temperature sensor (CTS) uses a thermistor to control the signal voltage to the electronic control module (ECM). The ECM applies a voltage to the CTS. When the engine is cold, the CTS resistance is high. Therefore, the ECM will see a high signal voltage. As the engine warms, the CTS resistance becomes less, and the voltage drops. At normal engine operating temperature the CTS signal will measure about 1.5 to 2.0 volts.

DTC 15 Will Set When

✳ The engine has been running for more than 4 seconds.

✳ The coolant temperature sensor signal voltage indicates a coolant temperature below –35°C (–31°F).

Diagnostic Aids

✳ If connections are OK, monitor the coolant temperature while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.

✳ The "Temperature Vs. Resistance Values" scale may be used to test the coolant sensor at various temperatures to evaluate the possibility of a "shifted" or "mis-scaled" coolant temperature sensor which may result in driveability complaints.

COOLANT TEMPERATURE SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°C	°F	OHMS
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

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This test simulates the conditions for setting diagnostic trouble code 14. If the electronic control module (ECM) recognizes the low signal voltage (high temperature) and the scan tool displays 180°C (356°F), the ECM wiring is OK.
6. This step checks for voltage reference from the ECM.

DTC 15 - Coolant Temperature Low (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. Does the scan tool display engine coolant temperature within the value specified?	80°-110°C (176-230°F)	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the coolant temperature sensor (CTS) connector. 3. Turn the ignition ON. Does the scan tool display engine coolant temperature below the value specified?	–30°C (–22°F)	Go to *Step 4*	Go to *Step 6*
4	Jumper terminals A and B of the CTS connector. Does the scan tool display engine coolant temperature above the value specified?	180°C (356°F)	Go to *Step 5*	Go to *Step 6*
5	1. Replace the coolant temperature sensor. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	Measure the voltage at the CTS connector terminal B. Is the voltage within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition OFF. 2. Disconnect the white connector. 3. Inspect the electronic control module (ECM) pins and connector for bent or damaged terminals. Repair or replace damaged terminals as needed. 4. Check the wire between the CTS connector terminal A and the ECM connector terminal D2 for an open or short to battery voltage. Is the problem found?	-	Go to *Step 12*	Go to *Step 8*
8	1. Replace the electronic control module. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	Check the wire between the CTS connector terminal B and the ECM connector terminal B12 for an open or short battery voltage. Is the problem found?	-	Go to *Step 13*	Go to *Step 10*

DTC 15 - Coolant Temperature Low (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Disconnect ECM red connector. 3. Check the ECM pins and the connector for bent or damaged terminals or pins. Is the problem found?	-	Go to *Step 11*	Go to *Step 8*
11	1. Repair the ECM connector terminals and straighten the ECM pins as needed. 2. If the ECM pins are broken, the ECM must be replaced. Have the terminals and pins been repaired?	-	Go to *Step 6*	-
12	1. Repair the open or short to voltage in the wire between the CTS connector terminal A and the ECM connector terminal D2. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
13	1. Repair the open or short to voltage in the wire between the CTS connector terminal B and the ECM connector terminal B12. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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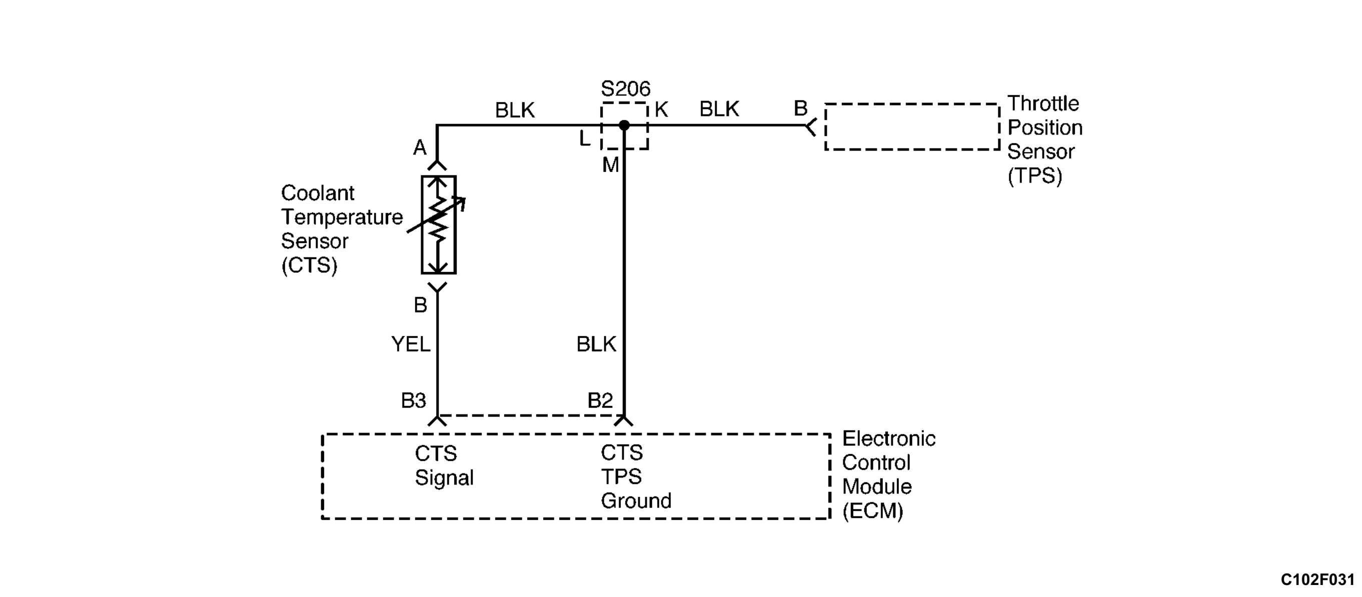

DIAGNOSTIC TROUBLE CODE (DTC) 15
COOLANT TEMPERATURE LOW (2.0L DOHC)

Circuit Description

The coolant temperature sensor (CTS) uses a thermistor to control the signal voltage to the electronic control module (ECM). The ECM applies a voltage to the CTS. When the engine is cold, the CTS resistance is high. Therefore, the ECM will see a high signal voltage. As the engine warms, the CTS resistance becomes less, and the voltage drops. At normal engine operating temperature the CTS signal will measure about 1.5 to 2.0 volts.

DTC 15 Will Set When

✳ The engine has been running for more than 2 seconds.

✳ The coolant temperature sensor signal voltage indicates a coolant temperature below −35°C (−31°F).

Diagnostic Aids

✳ If connections are OK, monitor the coolant temperature while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.

✳ The "Temperature Vs. Resistance Values" scale may be used to test the coolant sensor at various temperatures to evaluate the possibility of a "shifted" or "mis-scaled" coolant temperature sensor which may result in driveability complaints.

COOLANT TEMPERATURE SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°C	°F	OHMS
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

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This test simulates the conditions for setting diagnostic trouble code 14. If the electronic control module (ECM) recognizes the low signal voltage (high temperature) and the scan tool displays 180°C (356°F), the ECM wiring is OK.
6. This step checks for voltage reference from the ECM.

DTC 15 - Coolant Temperature Low (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. Does the scan tool display engine coolant temperature within the value specified?	80°-110°C (176-230°F)	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the coolant temperature sensor (CTS) connector. 3. Turn the ignition ON. Does the scan tool display engine coolant temperature below the value specified?	–30°C (–22°F)	Go to *Step 4*	Go to *Step 6*
4	Jumper terminals A and B of the CTS connector. Does the scan tool display engine coolant temperature above the value specified?	180°C (356°F)	Go to *Step 5*	Go to *Step 6*
5	1. Replace the coolant temperature sensor. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	Measure the voltage at the CTS connector terminal B. Is the voltage within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) red connector. 3. Inspect the ECM pins and connector for bent or damaged terminals. Repair or replace damaged terminals as needed. 4. Check the wire between the CTS connector terminal A and the ECM connector terminal B2 for an open or short to battery voltage. Is the problem found?	-	Go to *Step 12*	Go to *Step 8*
8	1. Replace the electronic control module. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	Check the wire between the CTS connector terminal B and the ECM connector terminal B3 for an open or short battery voltage. Is the problem found?	-	Go to *Step 13*	Go to *Step 10*

DTC 15 - Coolant Temperature Low (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Turn the ignition OFF. 2. Disconnect ECM red connector. 3. Check the ECM pins and the connector for bent or damaged terminals or pins. Is the problem found?	-	Go to *Step 11*	Go to *Step 8*
11	1. Repair the ECM connector terminals and straighten the ECM pins as needed. 2. If the ECM pins are broken, the ECM must be replaced. Have the terminals and pins been repaired?	-	Go to *Step 6*	-
12	1. Repair the open or short to voltage in the wire between the CTS connector terminal A and the ECM connector terminal B2. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
13	1. Repair the open or short to voltage in the wire between the CTS connector terminal B and the ECM connector terminal B3. 2. Run the engine until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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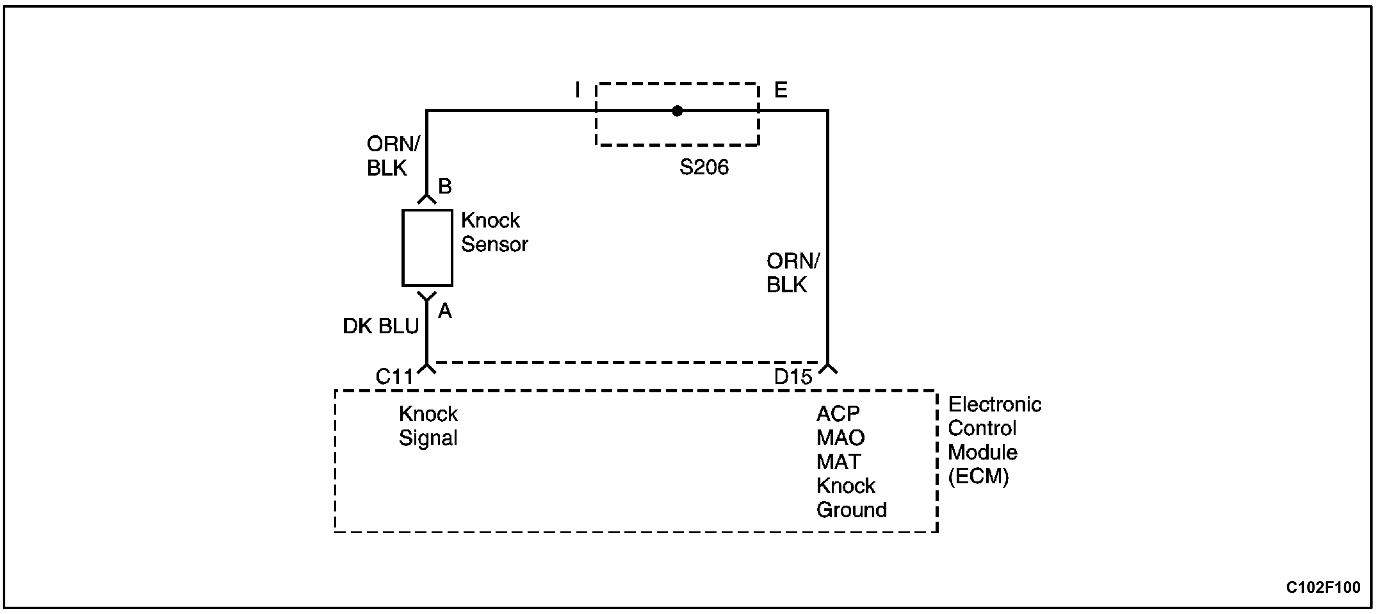


DIAGNOSTIC TROUBLE CODE (DTC) 16
KNOCK SENSOR FAILURE (2.0L DOHC)

Circuit Description

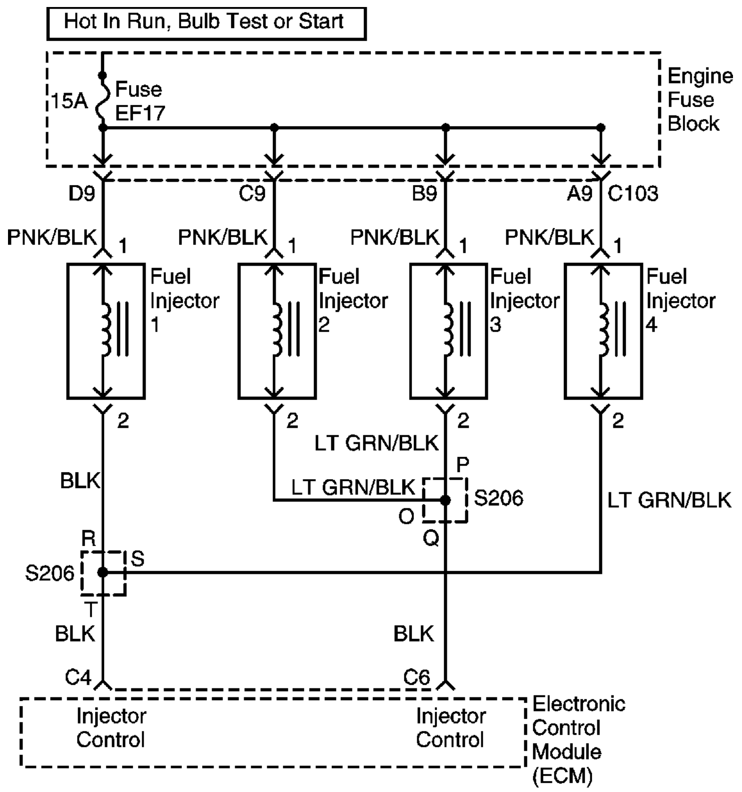
The knock sensor is used to detect engine detonation, allowing the electronic control module (ECM) to retard ignition control spark timing based on the knock sensor signal being received. The knock sensor produces an ac signal. The knock sensor signal's amplitude and frequency depend upon the amount of knock being experienced. The ECM contains a non replaceable knock filter module called a signal-to-noise enhancement filter module. This filter module in the ECM determines whether knock is occurring by comparing the signal level on the knock sensor circuit with the voltage level on the noise channel. The noise channel allows the ECM to reject any false knock signal by knowing the amount of normal engine mechanical noise present. Normal engine noise varies depending on engine speed and load. When the ECM determines that an abnormally low noise channel voltage level is being experienced, DTC 16 will set.

DTC 16 Will Set When

- The engine speed is above 2,000 rpm.
- Maximum integrated value is above 192.
- Minimum integrated value is below 20.
- The setup time is above 4 seconds.

DTC 16 - Knock Sensor Failure (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Diagnostic System Check. Is the Diagnostic System Check complete?	-	Go to *Step 2*	-
2	Replace the electronic control module (ECM). Is the repair complete?	-	Go to "Diagnostic System Check"	-



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DIAGNOSTIC TROUBLE CODE (DTC) 17
INJECTOR SHORTED TO GROUND/BATTERY (2.0L DOHC)

Circuit Description

When the ignition switch is turned to ON or START, the electronic control module (ECM) will energize and de-energize the fuel injector solenoid coil. With the solenoid coil energized, a plunger is activated, which allows pressurized fuel to be sprayed through the fuel injector into the combustion chamber where it is mixed with air from the intake manifold. This creates the proper air/fuel mixture needed for combustion.

DTC 17 Will Set When

- ✳ The fuel pump is running.
- ✳ Battery voltage is greater than 9 volts.
- ✳ A fuel injector fault has been detected over 3 times of successive 1 second intervals.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. This step checks for the presence of battery voltage to the fuel injectors.
3. If the fuel injector test light does not flash for one of the fuel injectors, there is an open fuel injector control wire to the electronic control module (ECM) or the ECM is faulty.
13. An open coil in a fuel injector will prevent the fuel injector from operating.

DTC 17 - Injector Shorted to Ground/Battery (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the fuel injector harness from all of the fuel injectors. 2. Turn the ignition ON. 3. Measure the voltage at all of the fuel injector harness terminals. Is battery voltage present on the 1 terminal only of each connector?	-	Go to *Step 3*	Go to *Step 8*
3	Connect a fuel injector test light to each of the fuel injector harness connector while cranking the engine. Does the test light blink on all connectors?	-	Go to *Step 13*	Go to *Step 4*
4	Does the fuel injector test light stay off for one or more of the fuel injector(s)?	-	Go to *Step 6*	Go to *Step 5*
5	Does the fuel injector test light stay on for one or more fuel injector(s)?	-	Go to *Step 11*	-
6	1. Check for a short to battery positive between the fuel injector harness connector terminal 2 and the electronic control module (ECM) connector terminal C4 for fuel injectors 1 and 4. 2. Check for a short to battery positive between the fuel injector harness connector terminal 2 and the ECM connector terminal C6 for fuel injectors 2 and 3. Is the problem found?	-	Go to *Step 7*	Go to *Step 15*
7	1. Repair the short to battery positive as needed. 2. Connect an injector test light to each injector harness connector while cranking the engine. Does the test light blink on all connectors?	-	Go to "Diagnostic System Check"	-
8	Is battery voltage not present at the 1 terminal of any injector harness connector?	-	Go to *Step 10*	Go to *Step 9*
9	Is battery voltage present at the 2 terminal of any injector harness connector?	-	Go to *Step 6*	-
10	1. Check for a short to ground in the fuel injector harness. 2. Check the fuel injector harness connectors for damaged terminals. 3. Perform repairs as needed. 4. Check for battery voltage at the 1 terminals of all of the fuel injector harness connectors. Is battery voltage present on the 1 terminal only of each connector?	-	Go to *Step 3*	-
11	1. Check for a short to ground between the fuel injector harness connector terminal 2 to ECM connector terminal C4 for injectors 1 and 4. 2. Check for a short to ground between the fuel injector harness connector terminal 2 to ECM connector terminal C6 for injectors 2 and 3. Is the problem found?	-	Go to *Step 12*	Go to *Step 15*

DTC 17 - Injector Shorted to Ground/Battery (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Repair the short to ground as needed. 2. Connect a fuel injector test light to each of the fuel injector harness connectors while cranking the engine. Does the test light blink on all connectors?	-	Go to *Step 13*	Go to *Step 4*
13	Measure the resistance of each fuel injector. Is the fuel injector resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6-12.4 Ω	System OK	Go to *Step 14*
14	1. Replace any of the fuel injectors with a resistance that is out of specification. 2. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
15	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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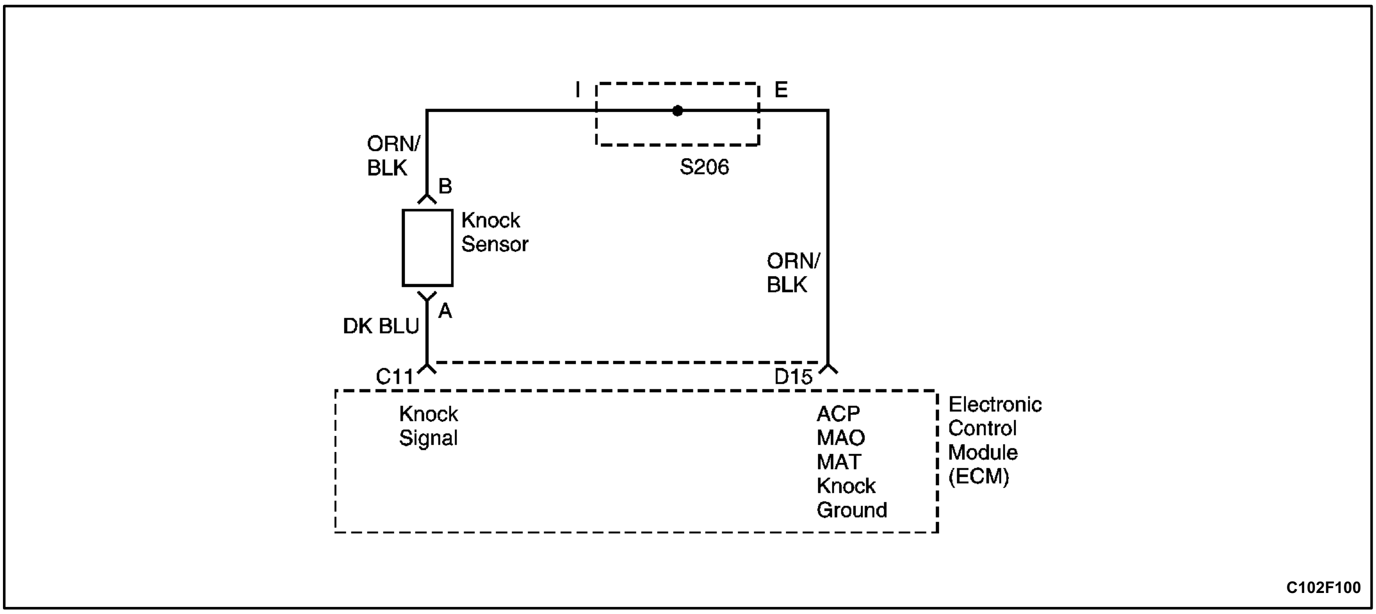


DIAGNOSTIC TROUBLE CODE (DTC) 18
KNOCK SENSOR ACTIVITY FAILURE (2.0L DOHC)

Circuit Description

The electronic control module (ECM) uses the knock sensor to detect engine detonation, allowing the ECM to retard ignition control spark timing based on the knock sensor signal being received. The knock sensor produces an ac signal. The signal amplitude and frequency are dependent upon the amount of knock being experienced.

DTC 18 Will Set When

- ✳ The engine speed is above 2,000 rpm.
- ✳ Maximum integrated value is above 110 for at least 2seconds.
- ✳ Minimum integrated value is below 1 for at least 2seconds.
- ✳ Diagnostic trouble code (DTC) 16 is not set.
- ✳ Noise value is above 40 counts for at least 4 seconds.
- ✳ Noise value is below 0 counts for at least 4 seconds.

Diagnostic Aids

- ✳ Repair any engine mechanical problem before proceeding with diagnostics.
- ✳ Make sure the correct fuel octane rating is used.

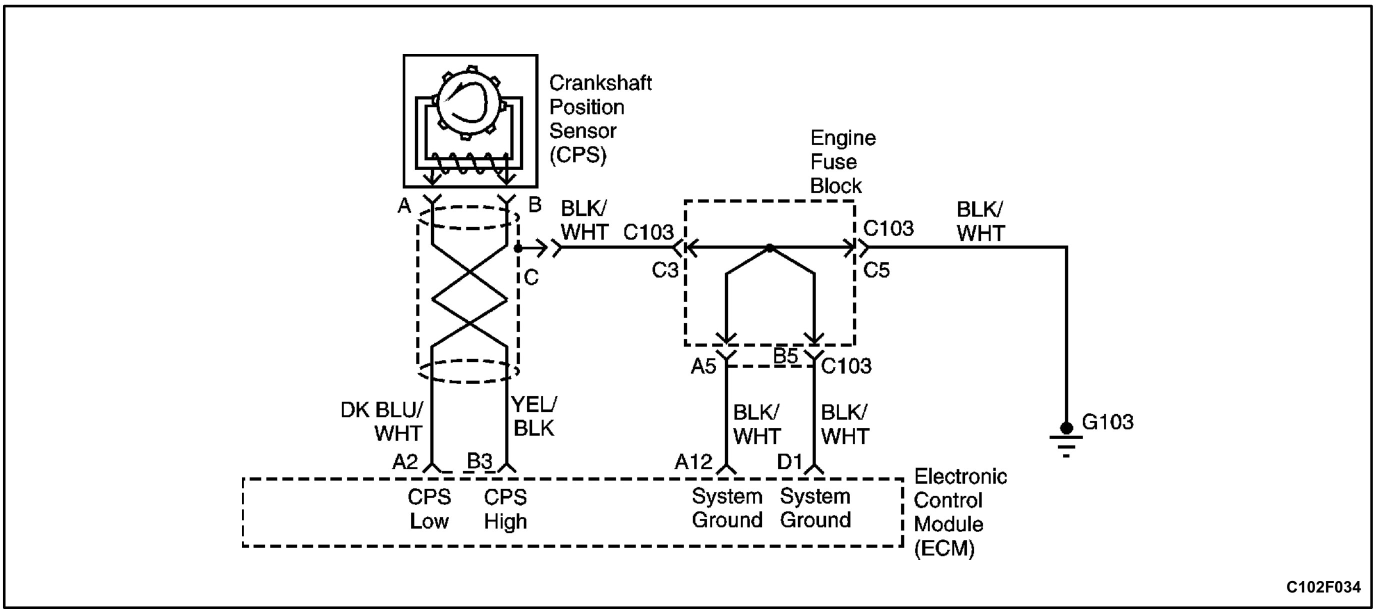
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. Checks the signal circuit and not sensor voltage.
6. Check the ground side of the circuit for an open, a short to ground, or a short to battery.

DTC 18 - DSNEF Activity Failure (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Diagnostic System Check. Is the Diagnostic System Check complete?	-	Go to *Step 2*	-
2	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the electronic control module (ECM). 3. Connect a digital voltmeter (DVM) to monitor ac voltage between between terminal C11 of the ECM connector and ground. 4. Tap on the engine with a extension near the knock sensor while observing the signal on the DVM. Is any signal indicated on the DVM while tapping on the engine?	-	Go to *Step 3*	Go to *Step 4*
3	1. Connect the electrical connector at the ECM. 2. Disconnect the electrical connector at the knock sensor. 3. Using a test light to battery positive probe terminal B on the ECM side of the knock sensor. Did the test light illuminate?	-	Go to Step 6	Go to Step 8
4	Check the wire from terminal C11 on the ECM to terminal A on the ECM side of the knock sensor for an open, a short to ground, or a short to battery. Does the wire indicate an open, a short to ground, or a short to battery?	-	Go to *Step 5*	Go to *Step 7*
5	Repair the wire from terminal C11 of the ECM to terminal A on the ECM side of the knock sensor. Is the repair complete?	-	Go to "Diagnostic System Check"	-
6	Replace the ECM. Is the repair complete?	-	Go to "Diagnostic System Check"	-
7	Replace the knock sensor. Is the repair complete?	-	Go to "Diagnostic System Check"	-
8	Repair the wire from terminal B of the knock sensor to terminal D15 of the ECM. Is the repair complete?	-	Go to "Diagnostic System Check"	-



DIAGNOSTIC TROUBLE CODE (DTC) 19
58X SIGNAL ERROR (A AND B) (2.0L SOHC)

Circuit Description

The crankshaft position sensor is a Hall effect sensor which senses a slotted wheel that is attached to the crankshaft pulley. The slotted wheel interrupts a magnetic field and produces a reference signal from the sensor.

DTC Will Set When

✳ The revolutions of the 58X signal are fewer than 65.

✳ There are consecutive missing pulses of 10 or more.

✳ Starting manifold absolute pressure is less than 0.6 kPa (0.178 inches Hg) for at least 3 seconds.

✳ Starting battery voltage drop is less than 0.5 volt for at least 3 seconds.

Diagnostic Aids

Check for poor connections at the electronic control module (ECM) and at the crankshaft position sensor (CPS).

Test Description

The number(s) below refer to step(s) on the diagnostic table.

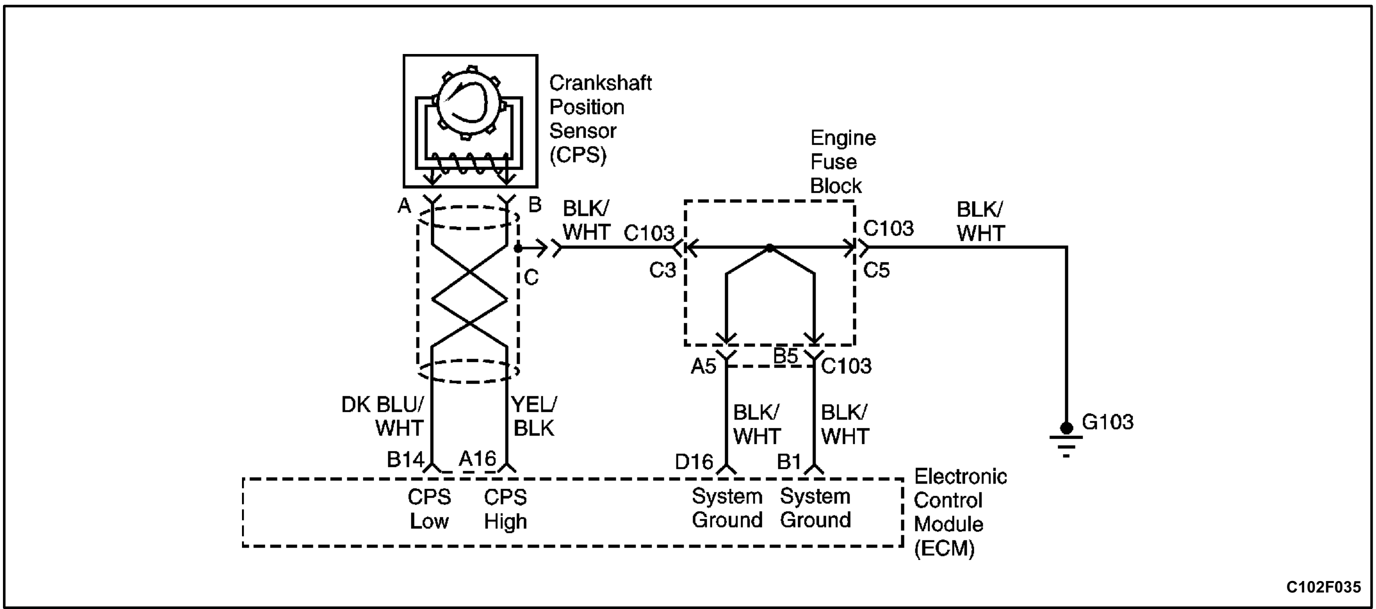
3. It is important to inspect all of the connector terminals to prevent inaccurate diagnosis.
6. The specified value during cranking is an average voltage produced as the sensor voltage oscillates.

DTC 19 - 58X Signal Error (A and B) (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	Start the engine and allow it to idle. Does the engine start?	-	Go to *Step 3*	Go to "Engine Cranks But Will Not Start"
3	1. Turn the ignition OFF. 2. Disconnect the crankshaft position sensor (CPS) connector. 3. Inspect the CPS terminals. Are any terminals damaged?	-	Go to *Step 13*	Go to *Step 4*
4	Inspect CPS connector terminals. Are any connector terminals damaged?	-	Go to *Step 5*	Go to *Step 6*

DTC 19 - 58X Signal Error (A and B) (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Repair or replace any damaged terminals. 2. Clear any diagnostic trouble code(s) (DTCs) from the electronic control module (ECM). 3. Road test the vehicle. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Connect the CPS connector. 2. Disconnect the direct ignition system (DIS) ignition coil connector to prevent the vehicle from starting. 3. Connect a voltmeter between ground and the ECM connector terminal A2 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with the ignition ON, 1.20 V during cranking	Go to *Step 7*	Go to *Step 9*
7	Connect a voltmeter between ground and the ECM connector terminal B3 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with the ignition ON, 1.20 v during cranking	Go to *Step 8*	Go to *Step 10*
8	1. Connect the DIS ignition coil connector 2. Replace the electronic control module. 3. Road test the vehicle. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	Check for an open or short in the wire between the CPS connector terminal A and the ECM connector terminal A2. Is the problem found?	-	Go to *Step 12*	Go to *Step 11*
10	Check for an open or short in the wire between the CPS connector terminal B and the ECM connector terminal B3. Is the problem found?	-	Go to *Step 12*	Go to *Step 11*
11	Check for an open or short in the wire between the CPS connector terminal C and ground. Is the problem found?	-	Go to *Step 12*	Go to *Step 13*
12	1. Connect the DIS ignition coil connector. 2. Repair the wiring needed. 3. Clear any DTCs from the ECM. 4. Road test the vehicle. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
13	1. Connect the DIS ignition coil connector. 2. Replace the crankshaft position sensor. 3. Clear any DTCs from the ECM. 4. Road test the vehicle. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 19 58X SIGNAL ERROR (A AND B) (2.0L DOHC)

Circuit Description

The crankshaft position sensor is a Hall‑effect sensor which senses a slotted wheel that is attached to the crankshaft. The slotted wheel interrupts a magnetic field and produces a reference signal from the sensor.

DTC Will Set When

✳ Starting manifold absolute pressure (MAP) drop is less than 0.6 kPa (0.178 inches Hg) for at least 3 seconds.

✳ Starting battery voltage drop is less than 0.8 volt for at least 3 seconds.

✳ There are consecutive missing pulses of 10 or more.

✳ The revolutions of the 58X signal are fewer than 65.

Diagnostic Aids

Check for poor connections at the electronic control module (ECM) and at the crankshaft position sensor (CPS).

Test Description

The number(s) below refer to step(s) on the diagnostic table.

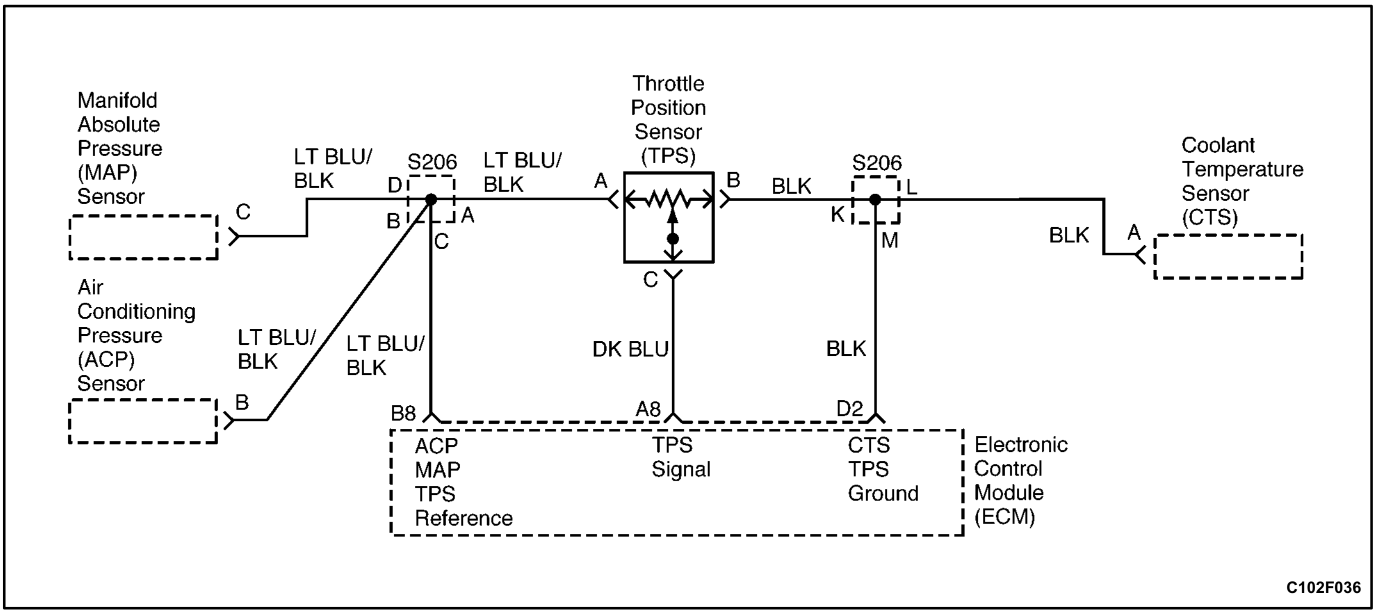
3. It is important to inspect all of the connector terminals to prevent inaccurate diagnosis.
6. The specified value during cranking is an average voltage produced as the sensor voltage oscillates.

DTC 19 - 58X Signal Error (A and B) (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	Start the engine and allow it to idle. Does the engine start?	-	Go to *Step 3*	Go to "Engine Cranks But Will Not Start"
3	1. Turn the ignition OFF. 2. Disconnect the crankshaft position sensor (CPS) connector. 3. Inspect the CPS terminals. Are any terminals damaged?	-	Go to *Step 13*	Go to *Step 4*

DTC 19 - 58X Signal Error (A and B) (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
4	Inspect CPS connector terminals. Are any connector terminals damaged?	-	Go to *Step 5*	Go to *Step 6*
5	1. Repair or replace any damaged terminals. 2. Clear any diagnostic trouble code(s) (DTCs) from the electronic control module (ECM). 3. Road test the vehicle. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Connect the CPS connector. 2. Disconnect the direct ignition system (DIS) ignition coil connector to prevent the vehicle from starting. 3. Connect a voltmeter between ground and the ECM connector terminal B14 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with the ignition ON, 1.20 V during cranking	Go to *Step 7*	Go to *Step 9*
7	Connect a voltmeter between ground and the ECM connector terminal A16 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with the ignition ON, 1.20 V during cranking	Go to *Step 8*	Go to *Step 10*
8	1. Connect the DIS ignition coil connector 2. Replace the electronic control module. 3. Road test the vehicle. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	Check for an open or short in the wire between the CPS connector terminal A and the ECM connector terminal B14. Is the problem found?	-	Go to *Step 12*	Go to *Step 11*
10	Check for an open or short in the wire between the CPS connector terminal B and the ECM connector terminal A16. Is the problem found?	-	Go to *Step 12*	Go to *Step 11*
11	Check for an open or short in the wire between the CPS connector terminal C and ground. Is the problem found?	-	Go to *Step 12*	Go to *Step 13*
12	1. Connect the DIS ignition coil connector. 2. Repair the wiring needed. 3. Clear any DTCs from the ECM. 4. Road test the vehicle. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
13	1. Connect the DIS ignition coil connector. 2. Replace the crankshaft position sensor. 3. Clear any DTCs from the ECM. 4. Road test the vehicle. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 21
THROTTLE POSITION SENSOR HIGH (2.0L SOHC)

Circuit Description

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about 0.4 to 0.8 volt at idle to nearly 5.0 volts at wide open throttle. The TPS is one of the most important inputs used by the electronic control module (ECM) for fuel control and other functions such as idle, wide open throttle, deceleration enleanment, and acceleration enrichment.

DTC 21 Will Set When

✳ The engine speed is less than 1,750 rpm.

✳ The manifold absolute pressure (MAP) reading is below 65kPa (19 inches Hg).

✳ The throttle position sensor reading is greater than 200 counts.

✳ Diagnostic trouble code (DTC) 34 has not set.

✳ All of the above conditions are present for 2 seconds.

Diagnostic Aids

✳ Inspect the electronic control module connector (ECM) terminals and the throttle position sensor (TPS) connector terminals for improper mating and poor terminal to wire connections.

✳ Observe the TPS voltage on a scan tool with the ignition ON and the engine stopped. Press the accelerator pedal while watching for smooth changes in the voltage readings of the TPS.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

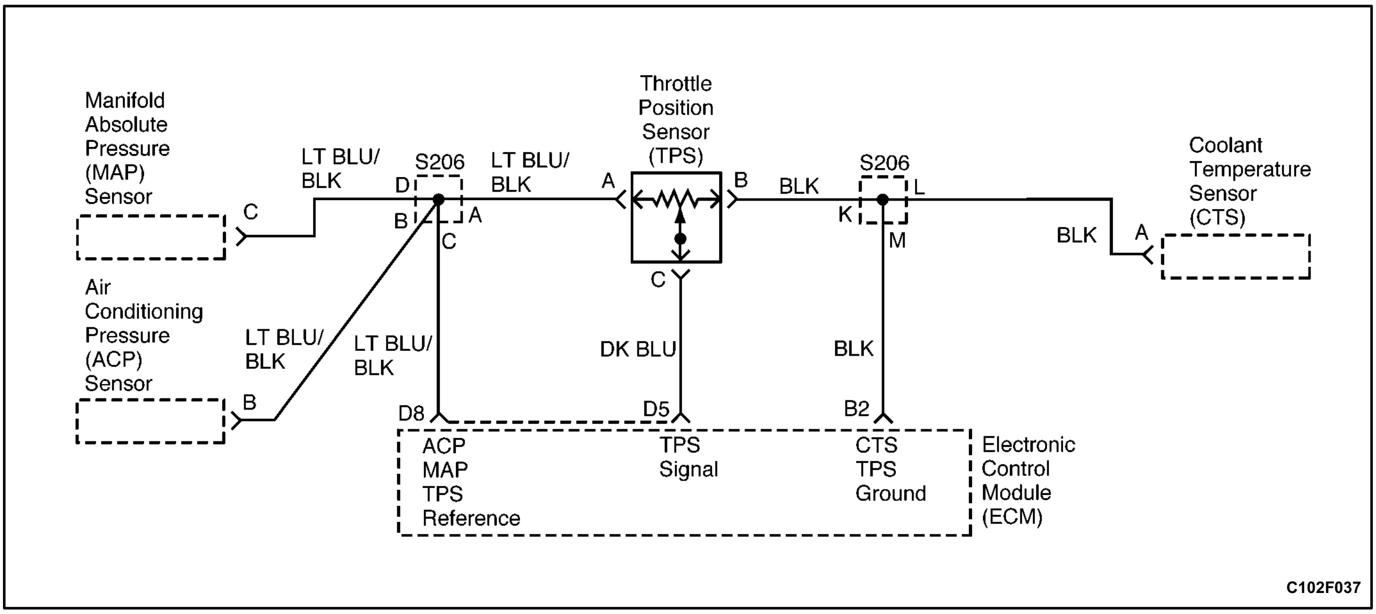
3. This step checks the voltage reference from the ECM and also the ground wire to the ECM.

4. This step checks the TPS signal wire. If the scan tool shows the TPS voltage above 4 volts, the signal wire is OK.

10. After checking the TPS wiring and confirming the ECM's ability to read a TPS signal, it can be determined that the TPS is at fault.

DTC 21 - Throttle Position Sensor High (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect a scan tool to the assembly line diagnostic link (ALDL). 2. Turn the ignition ON. 3. Operate the throttle lever from closed to open while watching the throttle position sensor (TPS) voltage on the scan tool. Does the scan tool show the TPS voltage change smoothly within the value specified?	0.10-0.90 V to 3.9-4.9 V	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the TPS connector. 3. Turn the ignition ON. 4. Measure the voltage between the TPS connector terminals A and B. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 4*	Go to *Step 5*
4	Jumper the TPS connector terminals A and C. Does the scan tool show the TPS voltage above the value specified?	4.0 V	Go to *Step 10*	Go to *Step 8*
5	Measure the voltage between the TPS connector terminal A and ground. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 6*	Go to *Step 7*
6	Check for a short to battery voltage in the wire between the TPS connector terminal B and the electronic control module (ECM) connector terminal D2. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
7	Check for a short to battery voltage in the wire between the TPS connector terminal A and the ECM connector terminal B8. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
8	Check for a short to voltage in the wire between the TPS connector terminal C and the ECM connector terminal A8. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Turn the ignition OFF. 2. Repair the wire or the connector terminal as needed. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the throttle position sensor. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Turn the ignition OFF. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 21
THROTTLE POSITION SENSOR HIGH (2.0L DOHC)

Circuit Description

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about 0.4 to 0.8 volt at idle to nearly 5.0 volts at wide open throttle. The TPS is one of the most important inputs used by the electronic control module (ECM) for fuel control and other functions such as idle, wide open throttle, deceleration enleanment, and acceleration enrichment.

DTC 21 Will Set When

✳ The engine speed is less than 3,000 rpm.

✳ The manifold absolute pressure reading (MAP) is below 85kPa (25 inches Hg).

✳ The throttle position sensor reading is greater than 240 counts.

✳ Diagnostic trouble code (DTC) 33 and 34 are not set.

✳ These conditions are present for 2 seconds.

Diagnostic Aids

✳ Inspect the electronic control module connector (ECM) terminals and the throttle position sensor (TPS) connector terminals for improper mating and poor terminal to wire connections.

✳ Observe the TPS voltage on a scan tool with the ignition ON and the engine stopped. Press the accelerator pedal while watching for smooth changes in the voltage readings of the TPS.

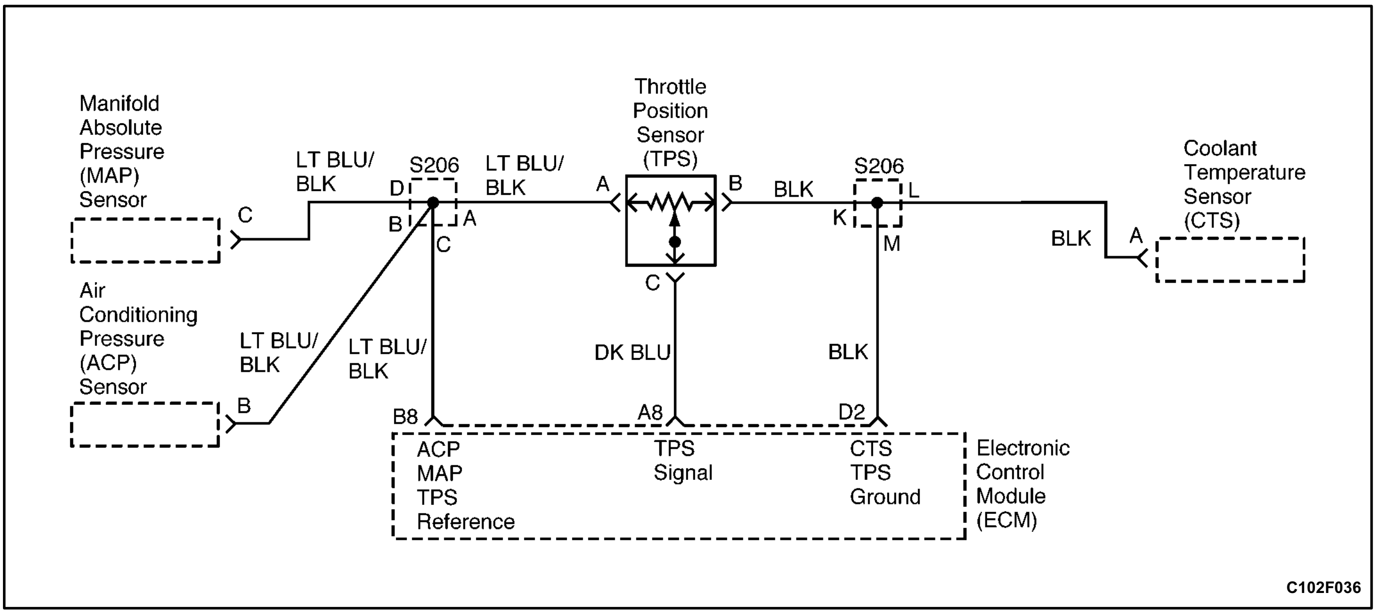
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks the voltage reference from the ECM and also the ground wire to the ECM.
4. This step checks the TPS signal wire. If the scan tool shows the TPS voltage above 4 volts, the signal wire is OK.
10. After checking the TPS wiring and confirming the ECM's ability to read a TPS signal, it can be determined that the TPS is at fault.

DTC 21 - Throttle Position Sensor High (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect a scan tool to the assembly line diagnostic link (ALDL). 2. Turn the ignition ON. 3. Operate the throttle lever from closed to open while watching the throttle position sensor (TPS) voltage on the scan tool. Does the scan tool show the TPS voltage change smoothly within the value specified?	0.10-0.90 V to 3.9-4.9 V	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the TPS connector. 3. Turn the ignition ON. 4. Measure the voltage between the TPS connector terminals A and B. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 4*	Go to *Step 5*
4	Jumper the TPS connector terminals A and C. Does the scan tool show the TPS voltage above the value specified?	4.0 V	Go to *Step 10*	Go to *Step 8*
5	Measure the voltage between the TPS connector terminal A and ground. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 6*	Go to *Step 7*
6	Check for a short to battery voltage in the wire between the TPS connector terminal B and the electronic control module (ECM) connector terminal B2. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
7	Check for a short to battery voltage in the wire between the TPS connector terminal A and the ECM connector terminal D8. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
8	Check for a short to voltage in the wire between the TPS connector terminal C and the ECM connector terminal D5. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Turn the ignition OFF. 2. Repair the wire or the connector terminal as needed. 3. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the throttle position sensor. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Turn the ignition OFF. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 22
THROTTLE POSITION SENSOR LOW (2.0L SOHC)

Circuit Description

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about 0.4 to 0.8 volt at idle to nearly 5.0 volts at wide open throttle. The TPS is one of the most important inputs used by the electronic control module (ECM) for fuel control and other functions such as idle, wide open throttle, deceleration enleanment, and acceleration enrichment.

DTC 22 Will Set When

✳ The throttle position sensor reading is less than 10 counts.

✳ These conditions are present for 5 seconds.

Diagnostic Aids

✳ Inspect the electronic control module connector (ECM) terminals and the throttle position sensor (TPS) connector terminals for improper mating and poor terminal to wire connections.

✳ Observe the TPS voltage on a scanner with the ignition ON and the engine stopped. Press the accelerator pedal while watching for smooth changes in the voltage readings of the TPS.

Test Description

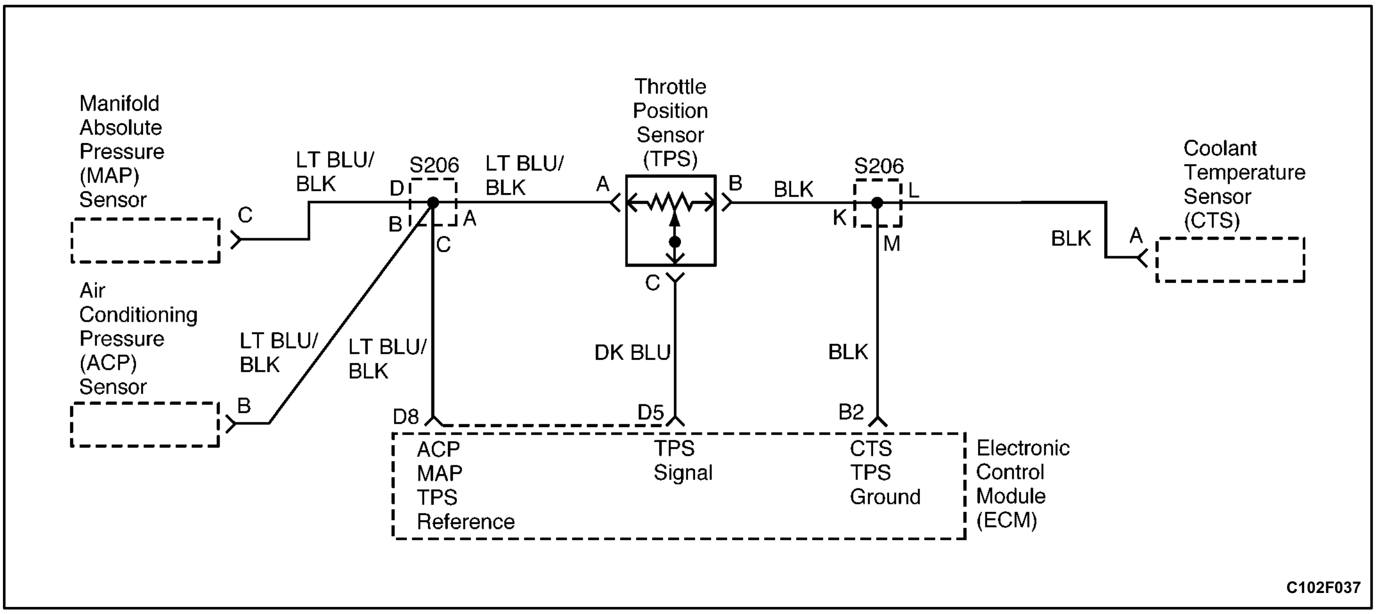
The number(s) below refer to step(s) on the diagnostic table.

1. When measuring the voltage between the throttle position sensor (TPS) terminals A and B, 4.5 to 5.5 volts confirms the 5 volt reference and ground from the electronic control module (ECM) are OK.

11. If there is a problem with the voltage reference or the ground from the ECM, confirm that the wiring is OK. If there is no problem present in the wiring, the ECM is at fault.

DTC 22 - Throttle Position Sensor Low (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Turn the ignition ON. 3. Operate the throttle lever from closed to open while watching the throttle position sensor (TPS) voltage on the scan tool. Does the scan tool show the TPS voltage change smoothly within the values specified?	0.10-0.90 V to 3.9-4.9 V	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the TPS connector. 3. Turn the ignition ON. 4. Measure the voltage between the TPS connector terminals A and B. Is the voltage within the value specified?	4.5-5.5 V	Go to *Step 4*	Go to *Step 5*
4	Connect a fused jumper between the TPS connector terminals A and C. Does the scan tool show the TPS voltage above the value specified?	4 v	Go to *Step 10*	Go to *Step 8*
5	Measure the voltage between the TPS connector terminal A and the ground. Is the voltage within the value specified?	4.5-5.5 V	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition OFF. 2. Check for an open in the wire between the TPS connector terminal B and the electronic control module (ECM) connector terminal D2. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
7	1. Turn the ignition OFF. 2. Check for an open or short to ground in the wire between the TPS connector terminal A and the ECM connector terminal B8. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
8	1. Turn the ignition OFF. 2. Check for an open or short to ground between the TPS connector terminal C and the ECM connector terminal A8. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair the wire or the connector terminal as needed. 2. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Replace the throttle position sensor. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Ignition OFF. 2. Replace the electronic control module. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 22
THROTTLE POSITION SENSOR LOW (2.0L DOHC)

Circuit Description

The throttle position sensor (TPS) provides a voltage signal that changes in relation to the throttle plate angle. The signal voltage will vary from about 0.4 to 0.8 volt at idle to nearly 5.0 volts at wide open throttle. The TPS is one of the most important inputs used by the electronic control module (ECM) for fuel control and other functions such as idle, wide open throttle, deceleration enleanment, and acceleration enrichment.

DTC 22 Will Set When

✳ The throttle position sensor reading is less than 11 counts.

✳ Diagnostic trouble code (DTC) 33 and 34 are not set.

Diagnostic Aids

✳ Inspect the electronic control module connector (ECM) terminals and the throttle position sensor (TPS) connector terminals for improper mating and poor terminal to wire connections.

✳ Observe the TPS voltage on a scanner with the ignition ON and the engine stopped. Press the accelerator pedal while watching for smooth changes in the voltage readings of the TPS.

Test Description

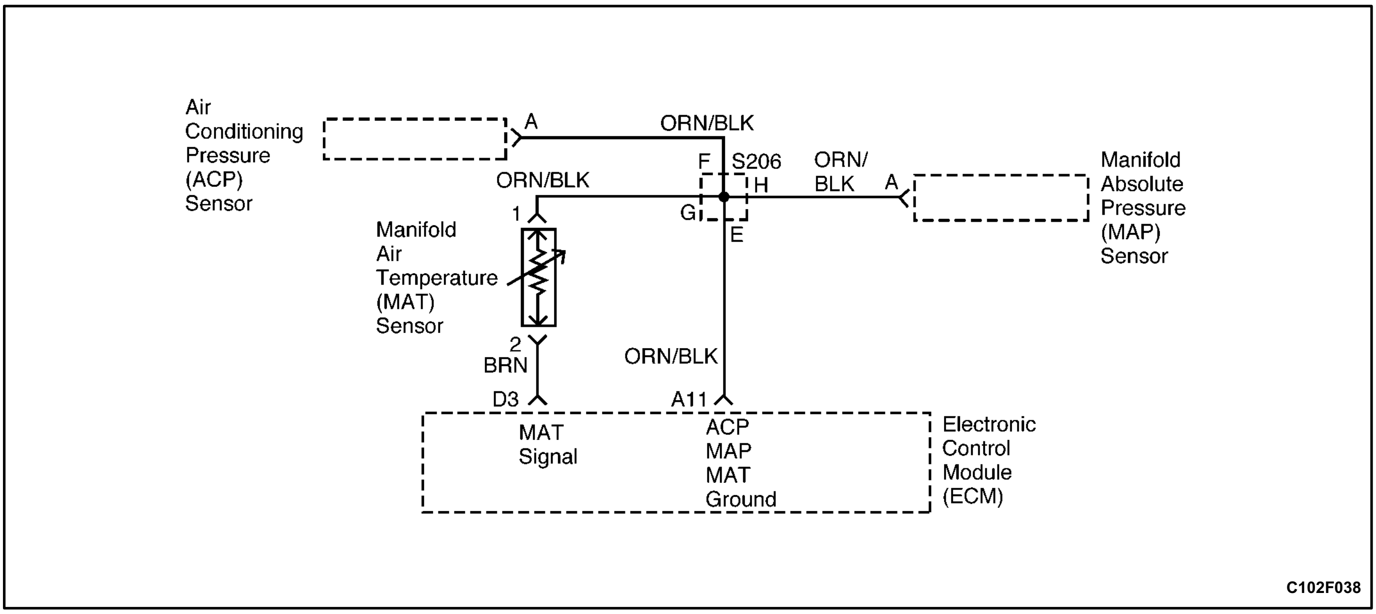
The number(s) below refer to step(s) on the diagnostic table.

1. When measuring the voltage between the throttle position sensor (TPS) terminals A and B, 4.5 to 5.5 volts confirms the 5 volt reference and ground from the electronic control module (ECM) are OK.

11. If there is a problem with the voltage reference or the ground from the ECM, confirm that the wiring is OK. If there is no problem present in the wiring, the ECM is at fault.

DTC 22 - Throttle Position Sensor Low (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Turn the ignition ON. 3. Operate the throttle lever from closed to open while watching the throttle position sensor (TPS) voltage on the scan tool. Does the scan tool show the TPS voltage change smoothly within the values specified?	0.10-0.90 V to 3.9-4.9 V	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the TPS connector. 3. Turn the ignition ON. 4. Measure the voltage between the TPS connector terminals A and B. Is the voltage within the value specified?	4.5-5.5 V	Go to *Step 4*	Go to *Step 5*
4	Connect a fused jumper between the TPS connector terminals A and C. Does the scan tool show the TPS voltage above the value specified?	4 V	Go to *Step 10*	Go to *Step 8*
5	Measure the voltage between the TPS connector terminal A and the ground. Is the voltage within the value specified?	4.5-5.5 V	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition OFF. 2. Check for an open in the wire between the TPS connector terminal B and the electronic control module (ECM) connector terminal B2. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
7	1. Turn the ignition OFF. 2. Check for an open or short to ground in the wire between the TPS connector terminal A and the ECM connector terminal D8. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
8	1. Turn the ignition OFF. 2. Check for an open or short to ground between the TPS connector terminal C and the ECM connector terminal D5. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair the wire or the connector terminal as needed. 2. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Replace the throttle position sensor. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Ignition OFF. 2. Replace the electronic control module. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 23
MANIFOLD AIR TEMPERATURE HIGH (2.0L SOHC)

Circuit Description

The manifold air temperature (MAT) sensor is a thermistor which measures the temperature of the air entering the engine. The electronic control module (ECM) applies 5 volts through a pullup resistor to the MAT sensor. When the temperature is cold, the MAT sensor resistance is high and the ECM will monitor a high signal voltage on the MAT circuit. If the intake air is warm, the sensor resistance is lower, causing the ECM to monitor a lower voltage.

DTC 23 Will Set When

- The engine has been running longer than 50 seconds.
- The manifold air temperature (MAT) sensor signal voltage indicates a temperature above 150°C (302°F).

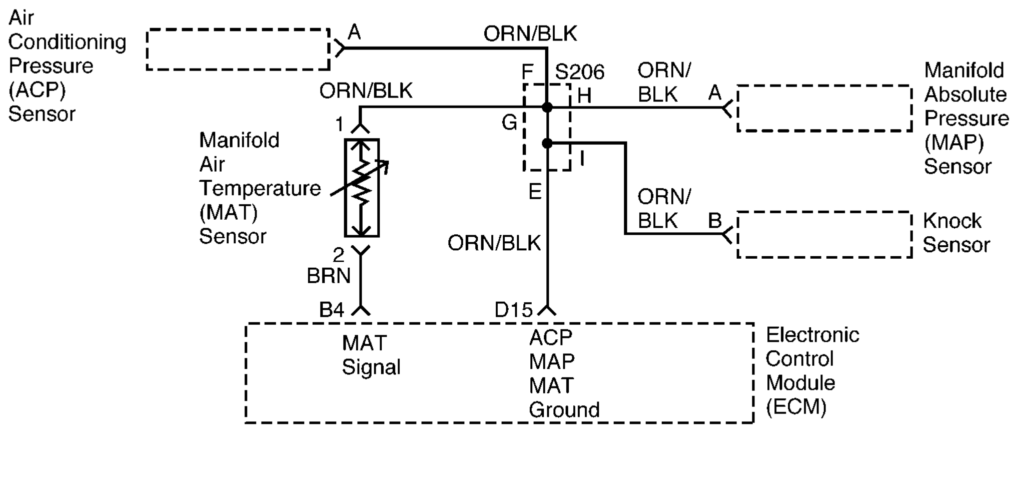
Diagnostic Aids

Inspect the wiring harness for damage. If the harness appears to be OK, observe the manifold air temperature (MAT) sensor display on the scan tool while moving the connectors and the wiring harnesses related to the MAT sensor. A change in the display will indicate the location of the fault.

MANIFOLD AIR TEMPERATURE SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°C	°F	OHMS
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

DTC 23 - Manifold Air Temperature Sensor High (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. Does the scan tool show the manifold air temperature (MAT) sensor reading within the value specified?	10°-80°C (50°-76°F)	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the MAT sensor connector. 3. Turn the ignition ON. Does the scan tool show the MAT sensor reading below the value specified?	Lower Than –35°C (–31°F)	Go to *Step 4*	Go to *Step 5*
4	Check for a faulty connector or terminals at the MAT sensor connector. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
5	Check the wire for a short to ground between the MAT connector terminal 2 and the electronic control module (ECM) connector terminal D3. Is the problem found?	-	Go to *Step 7*	Go to *Step 6*
6	Check the wire for a short to ECM reference voltage between the MAT connector terminal 1 and the ECM connector terminal A11. Is the problem found?	-	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition OFF. 2. Repair the wire or the connector terminal as needed. 3. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	Go to *Step 2*
8	1. Turn the ignition OFF. 2. Replace the manifold air temperature sensor. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	1. Turn the ignition OFF. 2. Replace the ECM. 3. Run the engine until it reaches operating temperature. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 23
MANIFOLD AIR TEMPERATURE HIGH (2.0L DOHC)

Circuit Description

The manifold air temperature (MAT) sensor is a thermistor which measures the temperature of the air entering the engine. The electronic control module (ECM) applies 5 volts through a pull-up resistor to the MAT sensor. When the temperature is cold, the MAT sensor resistance is high and the ECM will monitor a high signal voltage on the MAT circuit. If the intake air is warm, the sensor resistance is lower, causing the ECM to monitor a lower voltage.

DTC 23 Will Set When

- The engine has been running longer than 120 seconds.
- The manifold air temperature (MAT) sensor signal voltage indicates a temperature above 140°C (284°F).

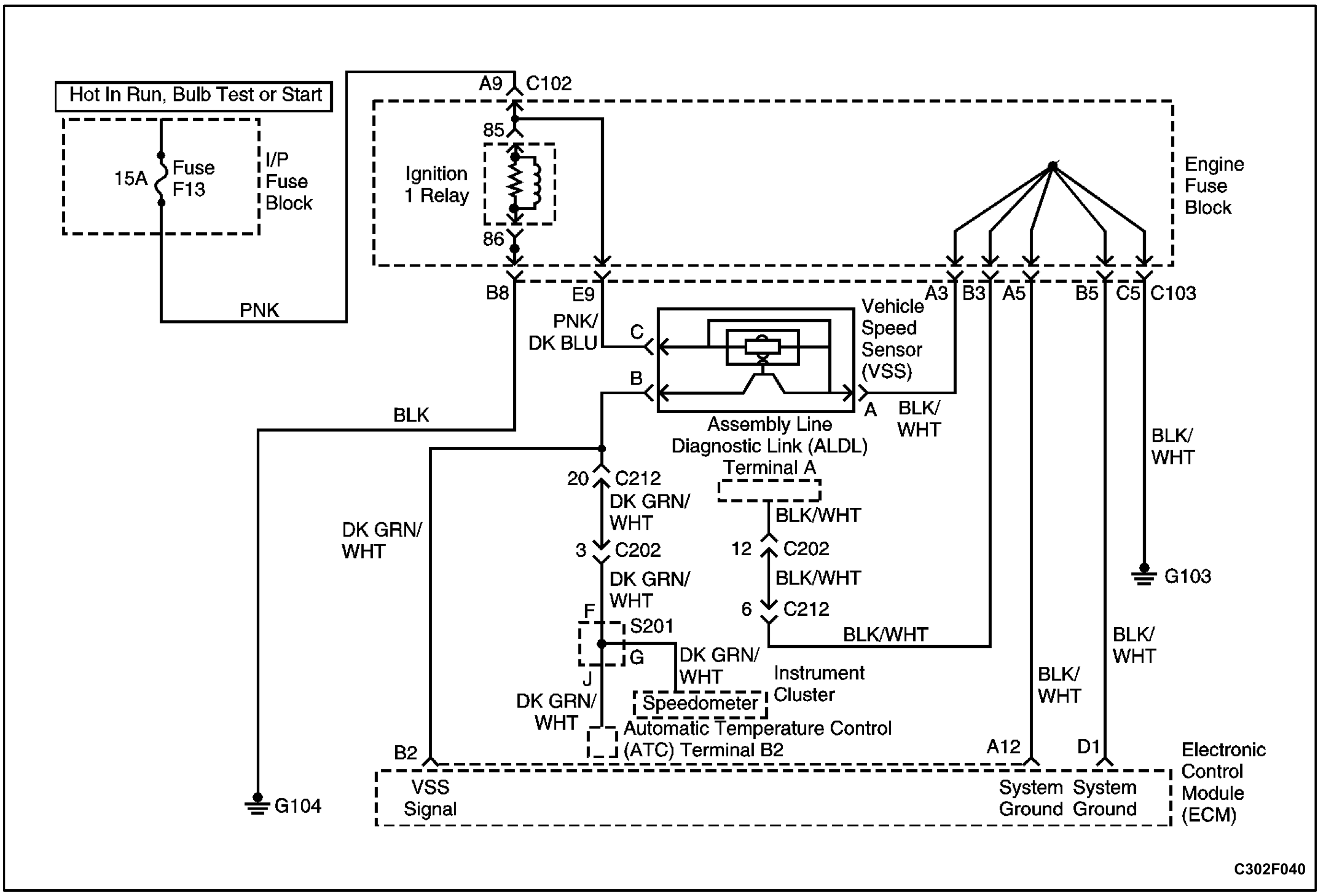
Diagnostic Aids

Inspect the wiring harness for damage. If the harness appears to be OK, observe the manifold air temperature (MAT) sensor display on the scan tool while moving the connectors and the wiring harnesses related to the MAT sensor. A change in the display will indicate the location of the fault.

MANIFOLD AIR TEMPERATURE SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°C	°F	OHMS
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

DTC 23 - Manifold Air Temperature Sensor High (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. Does the scan tool show the manifold air temperature (MAT) sensor reading within the value specified?	10°-80°C (50°-76°F)	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the MAT sensor connector. 3. Turn the ignition ON. Does the scan tool show the MAT sensor reading below the value specified?	Lower Than −35°C (−31°F)	Go to *Step 4*	Go to *Step 5*
4	Check for a faulty connector or terminals at the MAT sensor connector. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
5	Check the wire for a short to ground between the MAT connector terminal 2 and the electronic control module (ECM) connector terminal B4. Is the problem found?	-	Go to *Step 7*	Go to *Step 6*
6	Check the wire for a short to ECM reference voltage between the MAT connector terminal 1 and the ECM connector terminal D15. Is the problem found?	-	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition OFF. 2. Repair the wire or the connector terminal as needed. 3. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	Go to *Step 2*
8	1. Turn the ignition OFF. 2. Replace the manifold air temperature sensor. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	1. Turn the ignition OFF. 2. Replace the ECM. 3. Run the engine until it reaches operating temperature. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 24
VEHICLE SPEED SENSOR ERROR (2.0L SOHC)

Circuit Description

The electronic control module (ECM) applies and monitors 12 volts on the signal wire between the vehicle speed sensor (VSS) and the ECM. The signal wire connects to the vehicle speed sensor which alternately grounds the signal wire when the drive wheels are turning. This pulsing action takes place 2,289 times per kilometer (3,683 times per mile) and the ECM will calculate vehicle speed based on the time between the pulses. This information is also displayed by the vehicle speedometer.

DTC 24 Will Set When

- Diagnostic trouble code 34 is not set.
- The engine speed is between 1,600 rpm and 4,300 rpm.
- The vehicle speed sensor indicates a speed less than 8 km/h (5 mph).
- The manifold absolute pressure (MAP) sensor signal indicates less than 25 kPa (7.6 inches of Hg).
- These conditions are present for 5 seconds.

Diagnostic Aids

- Scan tool data should indicate a vehicle speed whenever the drive wheels are turning at more than 5 km/h (3 mph).

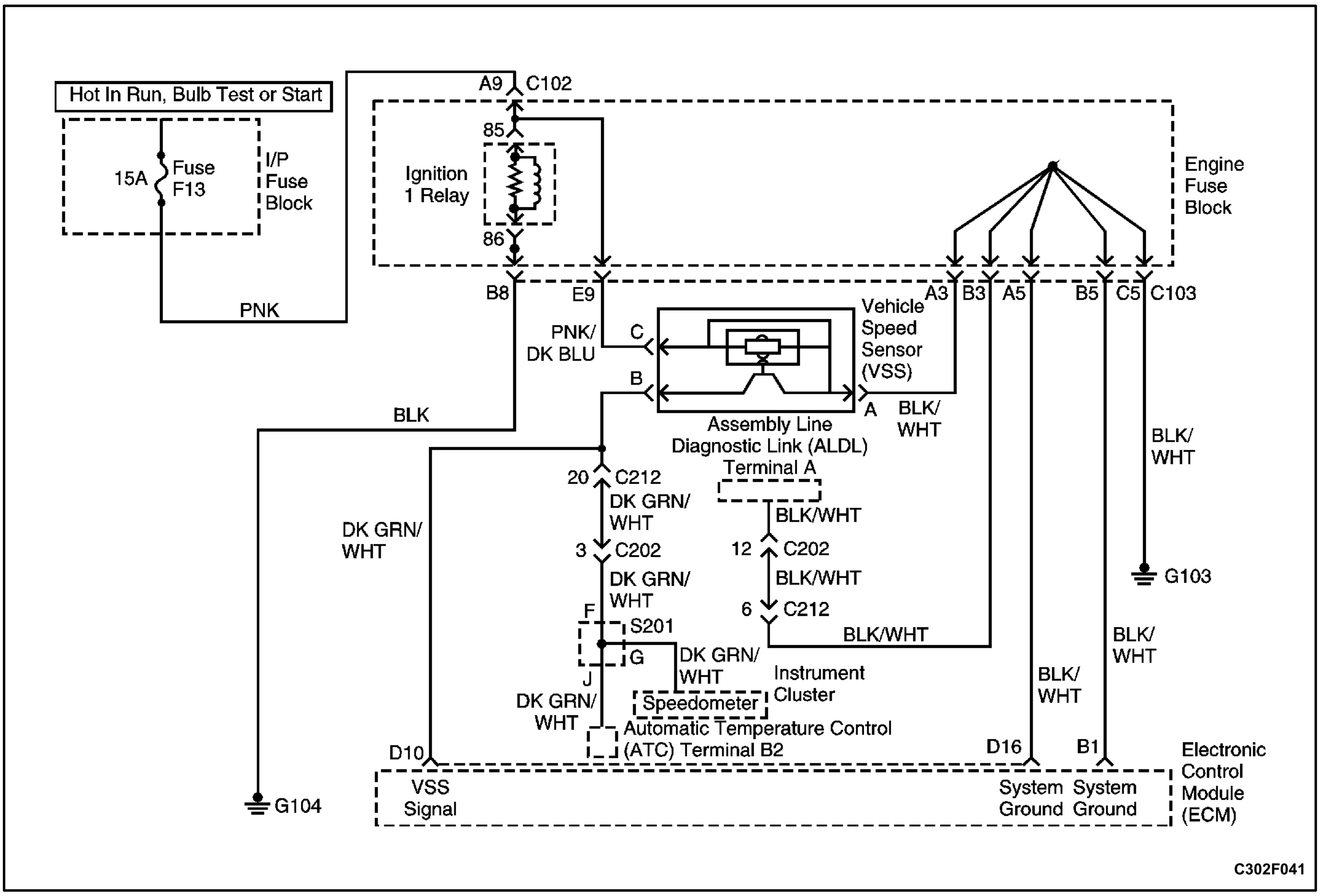
Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. By momentarily touching the vehicle speed sensor (VSS) connector terminal B several times a second, a simulated VSS signal is created. If voltage and ground are present at the VSS, the VSS is faulty.

DTC 24 - Vehicle Speed Sensor Error (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Road test the vehicle. Does the scan tool read vehicle speed?	-	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the vehicle speed sensor (VSS) connector. 3. Turn the ignition ON. 4. Connect a test light between the VSS connector terminal B and ground. Is the test light on?	-	Go to *Step 9*	Go to *Step 4*
4	With a test light connected to ground, momentarily touch the VSS connector terminal B several times a second. Does the scan tool read vehicle speed?	-	Go to *Step 5*	Go to *Step 11*
5	Connect a test light between the VSS connector terminal C and ground. Is the test light on?	-	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition OFF. 2. Connect a test light between the VSS connector terminal A and battery positive. Is the test light on?	-	Go to *Step 10*	Go to *Step 8*
7	Repair the open wire between the VSS connector terminal C and the ignition switch. Is the repair complete?	-	System OK	-
8	Repair the open wire between the VSS connector terminal A and ground. Is the repair complete?	-	System OK	-
9	Repair the short to voltage in the wire between the VSS connector terminal B and the electronic control module (ECM) connector terminal B2. Is the repair complete?	-	System OK	-
10	Replace the vehicle speed sensor. Is the repair complete?	-	System OK	-
11	1. Turn the ignition OFF. 2. Check for an open wire between the VSS connector terminal B and the ECM connector terminal B2. Is the problem found?	-	Go to *Step 12*	Go to *Step 13*
12	Repair the open wire between the VSS connector terminal B and the ECM connector terminal B2. Is the repair complete?	-	System OK	-
13	Replace the ECM. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 24
VEHICLE SPEED SENSOR ERROR (2.0L DOHC)

Circuit Description

The electronic control module (ECM) applies and monitors 12 volts on the signal wire between the vehicle speed sensor (VSS) and the ECM. The signal wire connects to the vehicle speed sensor which alternately grounds the signal wire when the drive wheels are turning. This pulsing action takes place 2,289 times per kilometer (3,683 times per mile) and the ECM will calculate vehicle speed based on the time between the pulses. This information is also displayed by the vehicle speedometer.

DTC 24 Will Set When

- Diagnostic trouble code (DTC) 21, 22, 33 and 34 are not set.
- The engine speed is between 2,000 rpm and 5,000 rpm.
- The vehicle speed sensor indicates a speed less than 6 km/h (4 mph).
- The manifold absolute pressure sensor signal indicates less than 24 kPa (7 inches of Hg).
- These conditions are present for 4 seconds.

Diagnostic Aids

- Scan tool data should indicate a vehicle speed whenever the drive wheels are turning at more than 5 km/h (3 mph).

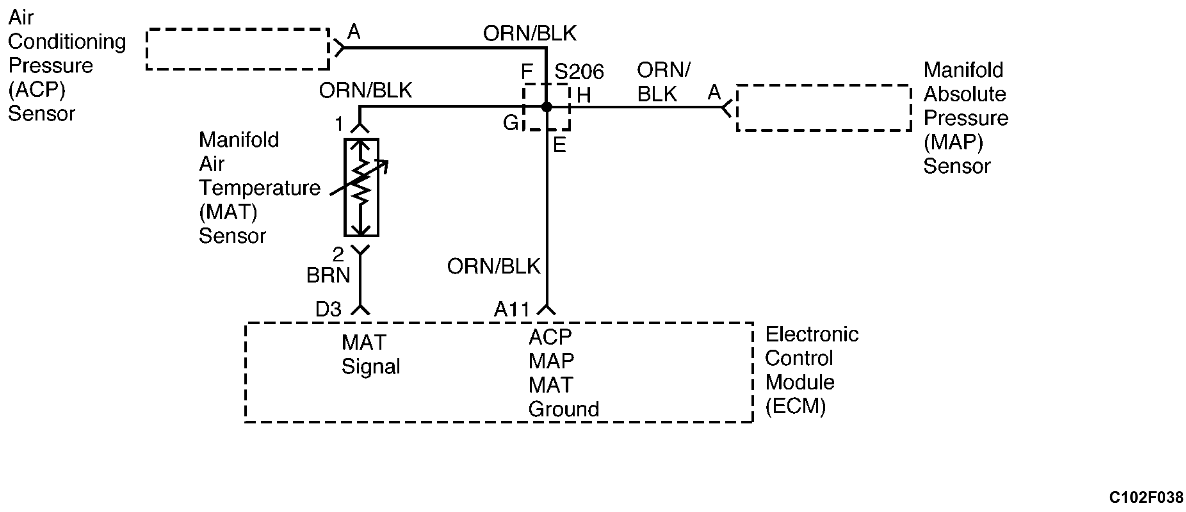
Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. By momentarily touching the vehicle speed sensor (VSS) connector terminal B several times a second, a simulated VSS signal is created. If voltage and ground are present at the VSS, the VSS is faulty.

DTC 24 - Vehicle Speed Sensor Error (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Road test the vehicle. Does the scan tool read vehicle speed?	-	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the vehicle speed sensor (VSS) connector. 3. Turn the ignition ON. 4. Connect a test light between the VSS connector terminal B and ground. Is the test light on?	-	Go to *Step 9*	Go to *Step 4*
4	With a test light connected to ground, momentarily touch the VSS connector terminal B several times a second. Does the scan tool read vehicle speed?	-	Go to *Step 5*	Go to *Step 11*
5	Connect a test light between the VSS connector terminal C and ground. Is the test light on?	-	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition OFF. 2. Connect a test light between the VSS connector terminal A and battery positive. Is the test light on?	-	Go to *Step 10*	Go to *Step 8*
7	Repair the open wire between the VSS connector terminal C and the ignition switch. Is the repair complete?	-	System OK	-
8	Repair the open wire between the VSS connector terminal A and ground. Is the repair complete?	-	System OK	-
9	Repair the short to voltage in the wire between the VSS connector terminal B and the electronic control module (ECM) connector terminal D10. Is the repair complete?	-	System OK	-
10	Replace the vehicle speed sensor. Is the repair complete?	-	System OK	-
11	1. Turn the ignition OFF. 2. Check for an open wire between the VSS connector terminal B and the ECM connector terminal D10. Is the problem found?	-	Go to *Step 12*	Go to *Step 13*
12	Repair the open wire between the VSS connector terminal B and the ECM connector terminal D10. Is the repair complete?	-	System OK	-
13	Replace the ECM. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 25 MANIFOLD AIR TEMPERATURE LOW (2.0L SOHC)

Circuit Description

The manifold air temperature (MAT) sensor is a thermistor which measures the temperature of the air entering the engine. The electronic control module (ECM) applies 5 volts through a pull-up resistor to the MAT sensor. When the temperature is cold, the MAT sensor resistance is high and the ECM will monitor a high signal voltage on the MAT circuit. If the intake air is warm, the sensor resistance is lower, causing the ECM to monitor a lower voltage.

DTC 25 Will Set When

- The engine has been running longer than 50 seconds.
- The manifold air temperature (MAT) sensor signal voltage indicates a temperature less than –35°C (–31°F).

Diagnostic Aids

Inspect the wiring harness for damage. If the harness appears to be OK, observe the manifold air temperature (MAT) sensor display on the scan tool while moving the connectors and the wiring harnesses related to the MAT sensor. A change in the display will indicate the location of the fault.

Test Description

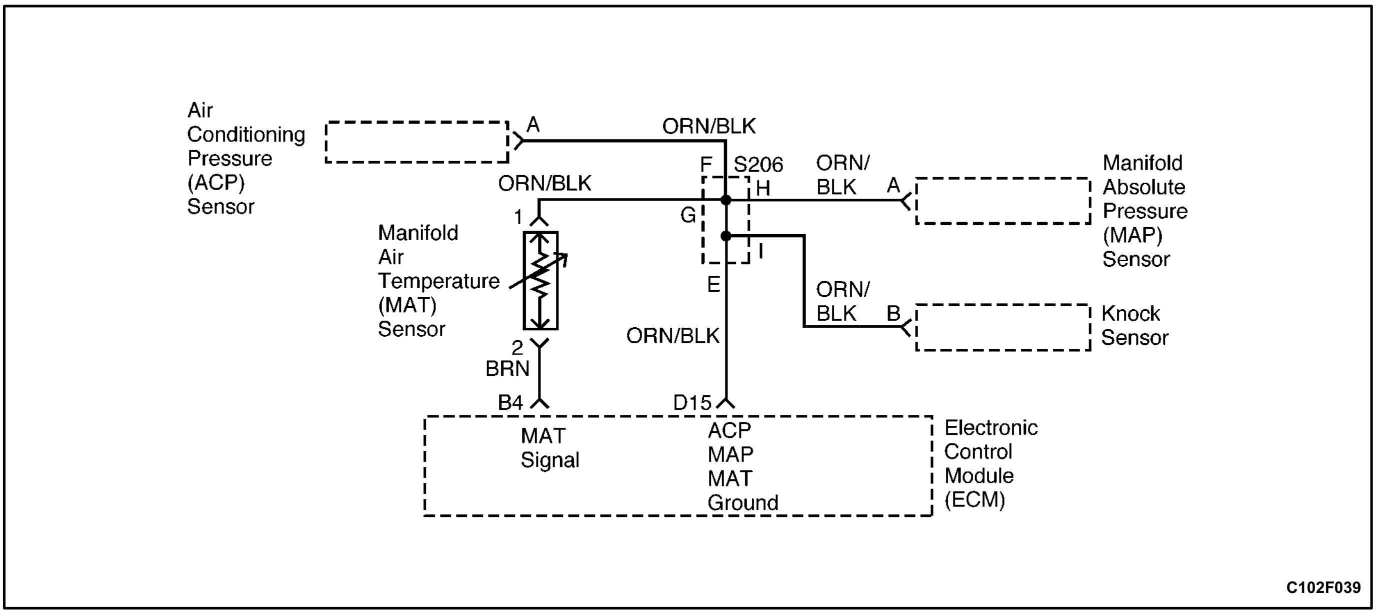
The number(s) below refer to step(s) on the diagnostic table.

6. This step checks for reference voltage and ground from the electronic control module (ECM).

MANIFOLD AIR TEMPERATURE SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°C	°F	OHMS
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

DTC 25 - Manifold Air Temperature Low (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. Does the scan tool show the manifold air temperature (MAT) sensor reading within the value specified?	10°-80°C (50°-176°F)	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the MAT sensor connector. 3. Jumper the MAT connector terminals. 4. Turn the ignition ON. Does the scan tool show the MAT sensor reading above the value specified?	180°C (356°F)	Go to *Step 4*	Go to *Step 5*
4	Check for a faulty connector or terminals at the MAT sensor connector. Is the problem found?	-	Go to *Step 10*	Go to *Step 9*
5	Measure the voltage between terminals 1 and 2 of the MAT connector. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 11*	Go to *Step 6*
6	Measure the voltage between the MAT terminal 2 and the battery ground (negative) post. Does the voltage measure within the value specified?	4.5-5.5 V	Go to Step 7	Go to Step 8
7	1. Turn the ignition OFF. 2. Check for an open or short to battery voltage in the wire between the MAT connector terminal 1 and the electronic control module (ECM) connector terminal A11. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
8	1. Turn the ignition OFF. 2. Check for an open or short to battery voltage in the wire between the MAT connector terminal 2 and the ECM connector terminal D3. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
9	1. Turn the ignition OFF. 2. Replace the manifold air temperature sensor. 3. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Repair the wire or the connector terminal as needed. 3. Clear any DTCs from the ECM. 4. Run the engine until It reaches operating temperature. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the ECM. 2. Run the vehicle until it reaches operating temperature. 3. Perform the Diagnostic System Check.10°-80°C Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 25
MANIFOLD AIR TEMPERATURE LOW (2.0L DOHC)

Circuit Description

The manifold air temperature (MAT) sensor is a thermistor which measures the temperature of the air entering the engine. The electronic control module (ECM) applies 5 volts through a pull-up resistor to the MAT sensor. When the temperature is cold, the MAT sensor resistance is high and the ECM will monitor a high signal voltage on the MAT circuit. If the intake air is warm, the sensor resistance is lower, causing the ECM to monitor a lower voltage.

DTC 25 Will Set When

- The engine has been running longer than 120 seconds.
- The manifold air temperature (MAT) sensor signal voltage indicates a temperature less than −38.5°C (−37°F).

Diagnostic Aids

Inspect the wiring harness for damage. If the harness appears to be OK, observe the manifold air temperature (MAT) sensor display on the scan tool while moving the connectors and the wiring harnesses related to the MAT sensor. A change in the display will indicate the location of the fault.

Test Description

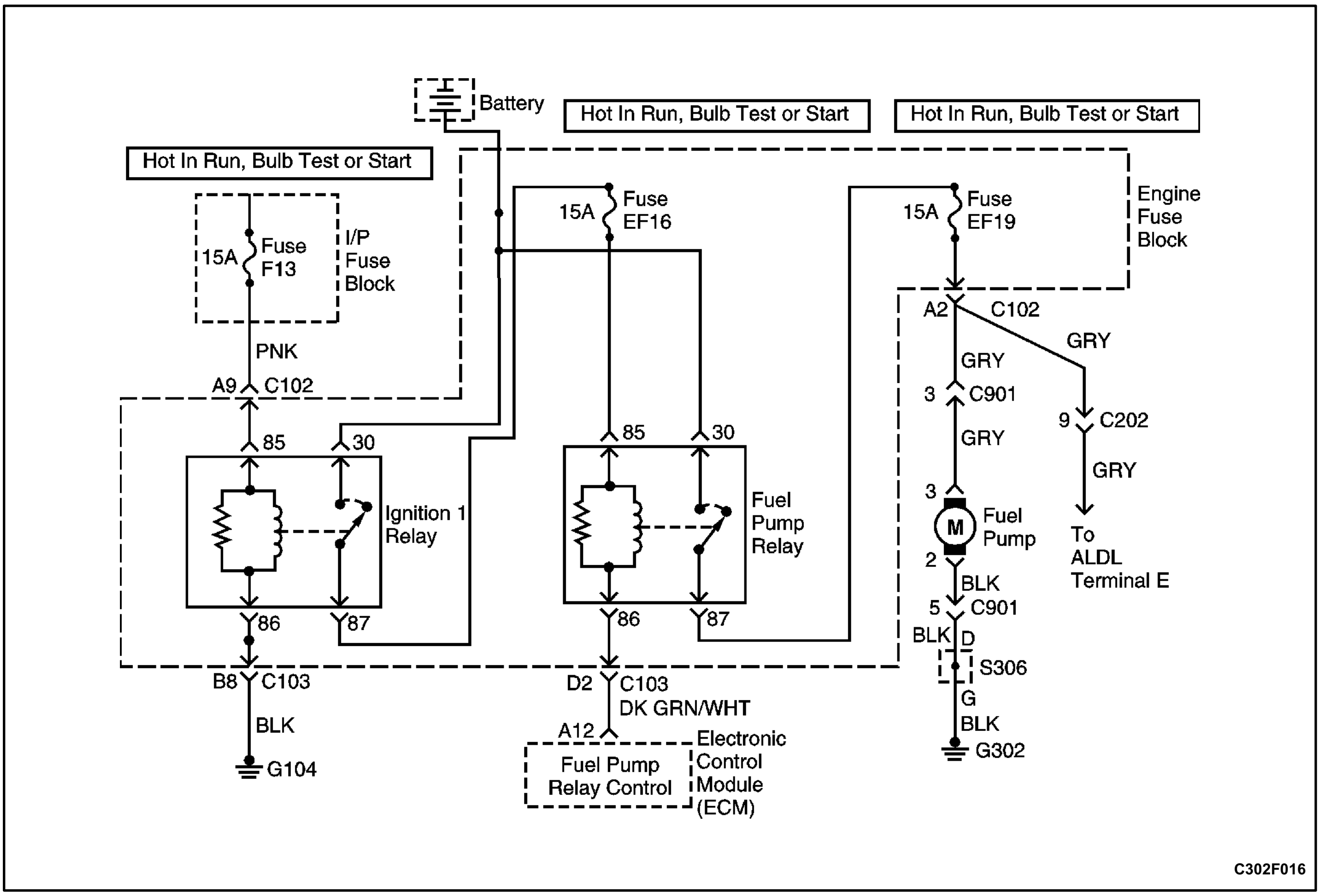
The number(s) below refer to step(s) on the diagnostic table.

6. This step checks for reference voltage and ground from the electronic control module (ECM).

MANIFOLD AIR TEMPERATURE SENSOR		
TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)		
°C	°F	OHMS
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

DTC 25 - Manifold Air Temperature Low (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. Does the scan tool show the manifold air temperature (MAT) sensor reading within the value specified?	10°-80°C (50°-176°F)	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the MAT sensor connector. 3. Jumper the MAT connector terminals. 4. Turn the ignition ON. Does the scan tool show the MAT sensor reading above the value specified?	180°C (356°F)	Go to *Step 4*	Go to *Step 5*
4	Check for a faulty connector or terminals at the MAT sensor connector. Is the problem found?	-	Go to *Step 10*	Go to *Step 9*
5	Measure the voltage between terminals 1 and 2 of the MAT connector. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 11*	Go to *Step 6*
6	Measure the voltage between the MAT terminal 2 and the battery ground (negative) post. Does the voltage measure within the value specified?	4.5-5.5 V	Go to Step 7	Go to Step 8
7	1. Turn the ignition OFF. 2. Check for an open or short to battery voltage in the wire between the MAT connector terminal 1 and the electronic control module (ECM) connector terminal D15. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
8	1. Turn the ignition OFF. 2. Check for an open or short to battery voltage in the wire between the MAT connector terminal 2 and the ECM connector terminal B4. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
9	1. Turn the ignition OFF. 2. Replace the manifold air temperature sensor. 3. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Repair the wire or the connector terminal as needed. 3. Clear any DTCs from the ECM. 4. Run the engine until It reaches operating temperature. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the ECM. 2. Run the vehicle until it reaches operating temperature. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 29
FUEL PUMP RELAY SHORTED TO GROUND (2.0L DOHC)

Circuit Description

When the ignition is turned ON, the electronic control module (ECM) applies ground to the fuel pump relay coil side. The ECM will apply this ground for 2 seconds or until reference pulses are received by the ECM from the crankshaft position sensor. This activates the fuel pump relay, applying battery voltage to the fuel pump.

DTC 29 Will Set When

- The fuel pump relay circuit is shorted to ground for at least 1.6 seconds.

Diagnostic Aids

- Inspect the ECM wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged harness.
- If the connections and the wiring harness are in good condition, connect a test light between the fuel pump relay connector terminal 85 and battery positive while moving related connectors. If the fault is induced, the test light will turn on. This may help to isolate the location of an intermittent problem.

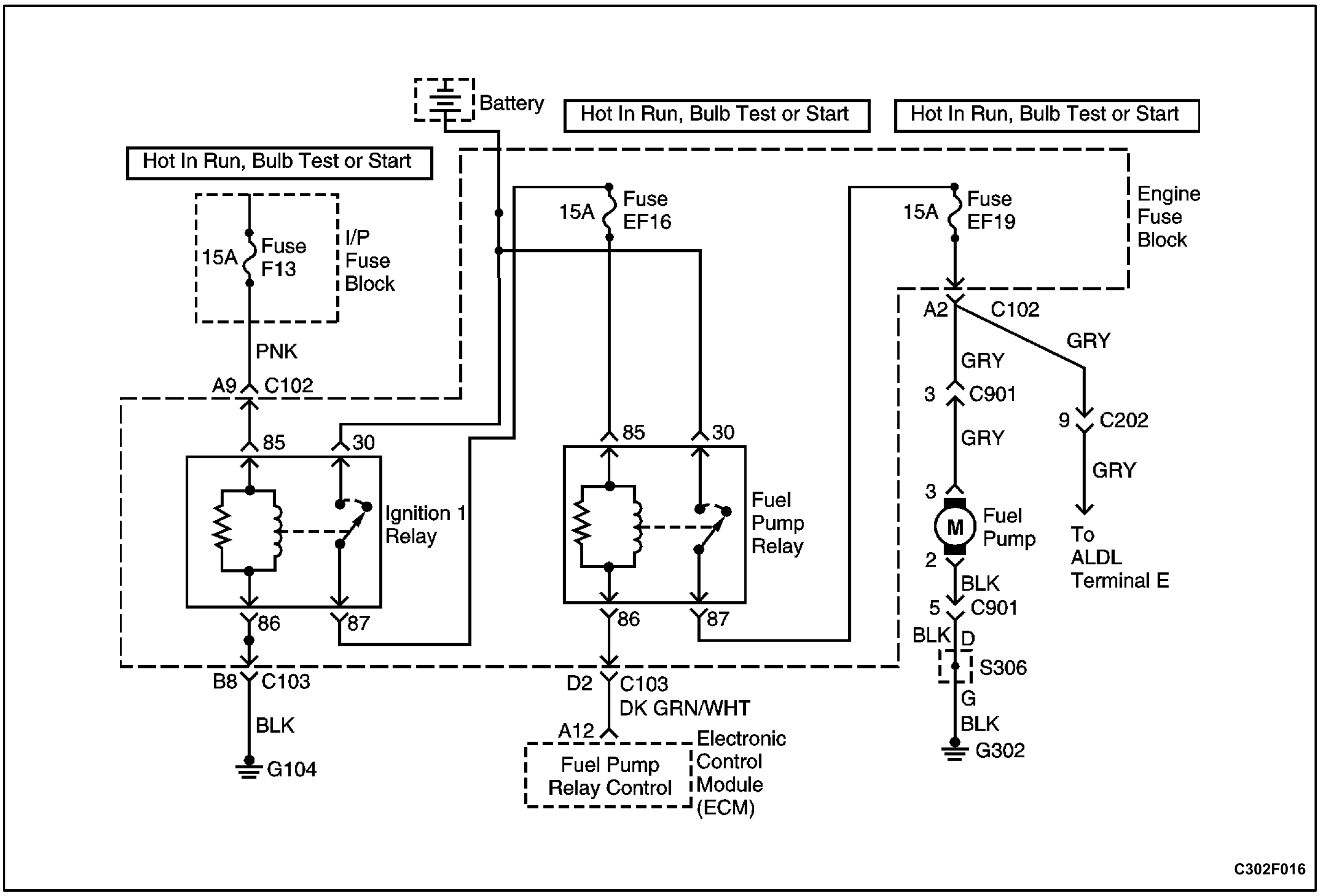
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. With the ignition OFF, the ECM should not be applying ground to the fuel pump relay.
3. If the test light is still on after disconnecting the ECM red connector, the wire between the fuel pump relay and the ECM is shorted to ground. If the test light goes off, the ECM is at fault.

DTC 29 - Fuel Pump Relay Shorted to Ground (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Diagnostic System Check. Is the Diagnostic System Check complete?	-	Go to *Step 2*	-
2	1. Disconnect the fuel pump relay. 2. Connect a test light between the fuel pump relay connector terminal 86 and battery positive. Is the test light on?	-	Go to *Step 3*	Go to "Diagnostic Aids"
3	Disconnect the electronic control module (ECM) red connector. Is the test light on?	-	Go to *Step 4*	Go to *Step 5*
4	1. Repair the short to ground in the wire between the fuel pump relay connector terminal 86 and the ECM connector terminal A12. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
5	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 32
FUEL PUMP RELAY SHORTED TO BATTERY (2.0L DOHC)

Circuit Description

When the ignition is turned ON, the electronic control module (ECM) applies ground to the fuel pump relay coil side. The ECM will apply this ground for 2 seconds or until reference pulses are received by the ECM from the crankshaft position sensor. This activates the fuel pump relay, applying battery voltage to the fuel pump.

DTC 32 Will Set When

- The fuel pump relay circuit is shorted to battery for at least 1.6 seconds.

Diagnostic Aids

- Inspect the ECM wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged harness.
- If the connections and the wiring harness are in good condition, connect a test light between the fuel pump relay connector terminal 85 and ground while moving related connectors. If the fault is induced, the test light will turn on. This may help to isolate the location of an intermittent problem.

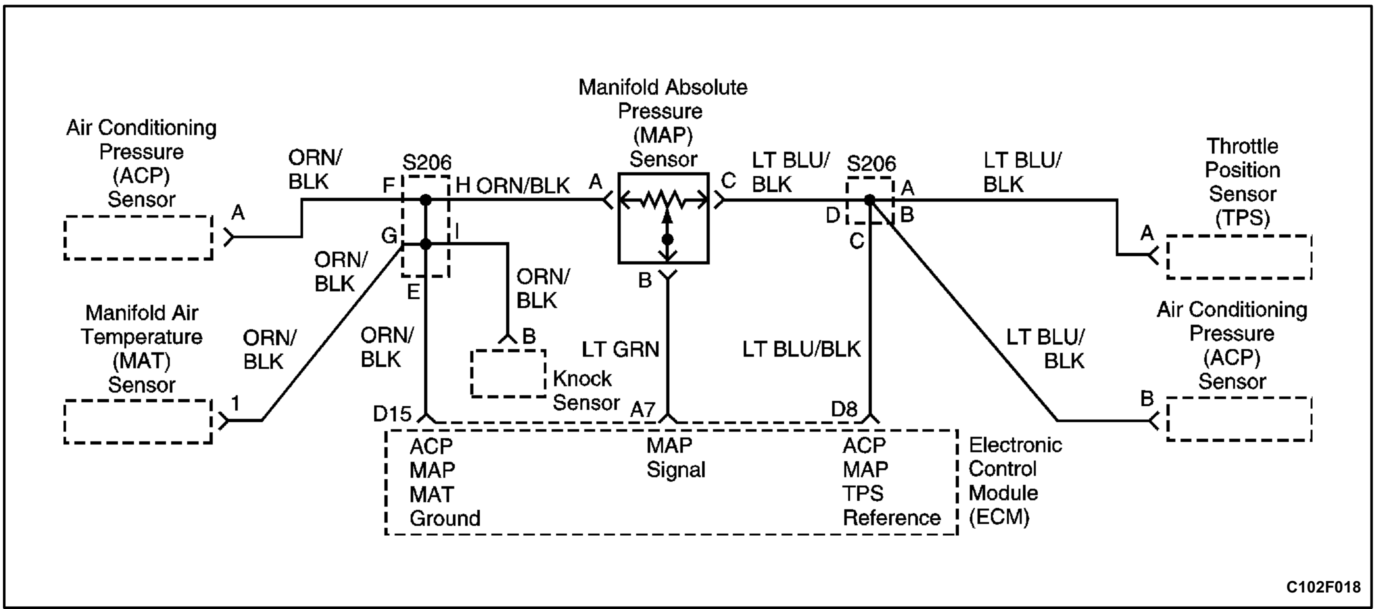
Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. If the test light is still on after disconnecting the ECM red connector, the wire between the fuel pump relay and the ECM is shorted to voltage. If the test light goes off, the ECM is at fault.

DTC 32 - Fuel Pump Relay Shorted to Battery (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Perform the Diagnostic System Check. Is the Diagnostic System Check complete?	-	Go to *Step 2*	-
2	1. Disconnect the fuel pump relay. 2. Measure the resistance between the fuel pump relay terminals 85 and 86. Does the resistance measure near the value specified?	≈0 Ω	Go to *Step 6*	Go to *Step 3*
3	Connect a test light between the fuel pump relay connector terminal 86 and ground. Is the test light on?	-	Go to *Step 4*	Go to "Diagnostic Aids"
4	Disconnect the electronic control module (ECM) red connector. Is the test light on?	-	Go to *Step 5*	Go to *Step 7*
5	1. Repair the short to voltage in the wire between the fuel pump relay connector terminal 86 and the ECM connector terminal A12. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Replace the fuel pump relay. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
7	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 33
MANIFOLD ABSOLUTE PRESSURE SENSOR HIGH
(2.0L SOHC)

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in the manifold vacuum. The electronic control module (ECM) receives this information as a signal voltage that will vary from about 1.0 to 1.5 volts at closed throttle (idle) to 4.5 to 5.0 volts at wide open throttle.

DTC 34 Will Set When

- Diagnostic trouble code (DTC) 21 is not set.
- DTC 22 is not set.
- The throttle angle is below 3 percent.
- The manifold absolute pressure (MAP) sensor signal indicates greater than 100 kPa (30.2 inches of Hg).
- These conditions are present for 3 seconds.

Diagnostic Aids

- If the connections are OK, monitor the manifold absolute pressure (MAP) sensor signal voltage while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.
- With the ignition ON and the engine OFF, the MAP sensor pressure is equal to the atmospheric pressure. This information is used by the electronic control module (ECM) as an indication of altitude. Comparison of these readings with a known good vehicle with the same MAP sensor is a good way to check the accuracy of a questionable MAP sensor. The readings should be the same within 0.4 volt.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. With the ignition ON and the engine OFF, the manifold absolute pressure (MAP) sensor is reading atmospheric or barometric pressure. If this reading is below 4 volts, the electronic control module (ECM) may prevent the engine from starting.
6. This step checks for a reference voltage and a ground from the ECM.
7. This step is checking the voltage reference and the signal return wire to the ECM. If the ECM recognizes the voltage reference and there is not a problem in the ground side of the circuit, the MAP sensor is faulty.

DTC 33 - Manifold Absolute Pressure Sensor High (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	Check the vacuum line from the manifold absolute pressure (MAP) sensor for cracks, leaks, or restrictions. Is the problem found?	-	Go to *Step 3*	Go to *Step 4*
3	1. Repair or replace the vacuum line as needed. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
4	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Turn the ignition ON. Does the scan tool show the MAP sensor voltage above the value specified?	4 V	Go to *Step 5*	Go to *Step 6*
5	1. Disconnect the vacuum line from the MAP sensor. 2. Apply 68 kPa (20 in. of Hg) of vacuum to the MAP sensor. Does the scan tool show the MAP sensor voltage within the value specified?	1.0-1.5 V	Go to "Diagnostic Aids"	Go to *Step 6*
6	1. Turn the ignition OFF. 2. Disconnect the MAP sensor connector. 3. Turn the ignition ON. 4. Measure the voltage between MAP sensor connector terminals A and C. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 8*
7	Connect a fused jumper between the MAP sensor connector terminals B and C. Does the scan tool show the MAP sensor voltage above the value specified?	4 V	Go to *Step 13*	Go to *Step 11*
8	Measure the voltage between the MAP sensor connector terminal C and ground. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 9*	Go to *Step 10*
9	Check for a short to battery voltage in the wire between the MAP sensor connector terminal A and the electronic control module (ECM) connector terminal A11. Is the problem found?	-	Go to *Step 12*	Go to *Step 11*
10	Check for a short to battery voltage in the wire between the MAP sensor connector terminal C and the electronic control module (ECM) connector terminal B8. Is the problem found?	-	Go to *Step 12*	Go to *Step 14*
11	Check for a short to voltage in the wire between the MAP sensor connector terminal B and the ECM connector terminal A7. Is the problem found?	-	Go to *Step 12*	Go to *Step 14*

DTC 33 - Manifold Absolute Pressure Sensor High (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Repair the wire or the connector terminal as needed. 2. Clear diagnostic trouble code(s) (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	Go to *Step 5*
13	1. Replace the manifold absolute pressure sensor. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
14	1. Turn the ignition OFF. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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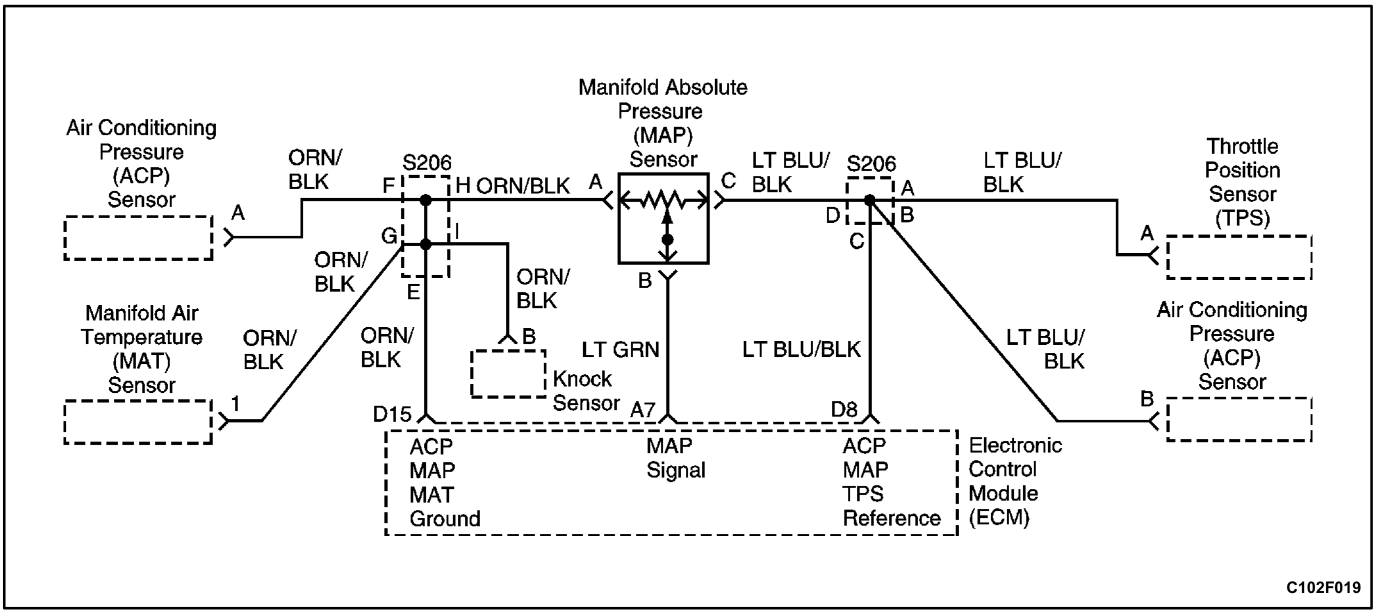

DIAGNOSTIC TROUBLE CODE (DTC) 33
MANIFOLD ABSOLUTE PRESSURE SENSOR HIGH (2.0L DOHC)

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in the manifold vacuum. The electronic control module (ECM) receives this information as a signal voltage that will vary from about 1.0 to 1.5 volts at closed throttle (idle) to 4.5 to 5.0 volts at wide open throttle.

DTC 34 Will Set When

- Diagnostic trouble code (DTC) 21 is not set.
- DTC 22 is not set.
- The throttle angle is below 5 percent.
- The manifold absolute pressure (MAP) sensor signal indicates greater than 95 kPa (28 inches of Hg).
- These conditions are present for 5 seconds.

Diagnostic Aids

- If the connections are OK, monitor the manifold absolute pressure (MAP) sensor signal voltage while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.
- With the ignition ON and the engine OFF, the MAP sensor pressure is equal to the atmospheric pressure. This information is used by the electronic control module (ECM) as an indication of altitude. Comparison of these readings with a known good vehicle with the same MAP sensor is a good way to check the accuracy of a questionable MAP sensor. The readings should be the same within 0.4 volt.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. With the ignition ON and the engine OFF, the manifold absolute pressure (MAP) sensor is reading atmospheric or barometric pressure. If this reading is below 4 volts, the electronic control module (ECM) may prevent the engine from starting.
6. This step checks for a reference voltage and a ground from the ECM.
7. This step is checking the voltage reference and the signal return wire to the ECM. If the ECM recognizes the voltage reference and there is not a problem in the ground side of the circuit, the MAP sensor is faulty.

DTC 33 - Manifold Absolute Pressure Sensor High (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	Check the vacuum line from the manifold absolute pressure (MAP) sensor for cracks, leaks, or restrictions. Is the problem found?	-	Go to *Step 3*	Go to *Step 4*
3	1. Repair or replace the vacuum line as needed. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
4	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Turn the ignition ON. Does the scan tool show the MAP sensor voltage above the value specified?	4 V	Go to *Step 5*	Go to *Step 6*
5	1. Disconnect the vacuum line from the MAP sensor. 2. Apply 68 kPa (20 in. of Hg) of vacuum to the MAP sensor. Does the scan tool show the MAP sensor voltage within the value specified?	1.0-1.5 V	Go to "Diagnostic Aids"	Go to *Step 6*
6	1. Turn the ignition OFF. 2. Disconnect the MAP sensor connector. 3. Turn the ignition ON. 4. Measure the voltage between MAP sensor connector terminals A and C. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 8*
7	Connect a fused jumper between the MAP sensor connector terminals B and C. Does the scan tool show the MAP sensor voltage above the value specified?	4 V	Go to *Step 13*	Go to *Step 11*
8	Measure the voltage between the MAP sensor connector terminal C and ground. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 9*	Go to *Step 10*
9	Check for a short to battery voltage in the wire between the MAP sensor connector terminal A and the electronic control module (ECM) connector terminal D15. Is the problem found?	-	Go to *Step 12*	Go to *Step 11*
10	Check for a short to battery voltage in the wire between the MAP sensor connector terminal C and the ECM connector terminal D8. Is the problem found?	-	Go to *Step 12*	Go to *Step 14*
11	Check for a short to voltage in the wire between the MAP sensor connector terminal B and the ECM connector terminal A7. Is the problem found?	-	Go to *Step 12*	Go to *Step 14*

DTC 33 - Manifold Absolute Pressure Sensor High (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Repair the wire or the connector terminal as needed. 2. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	Go to *Step 5*
13	1. Replace the manifold absolute pressure sensor. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
14	1. Turn the ignition OFF. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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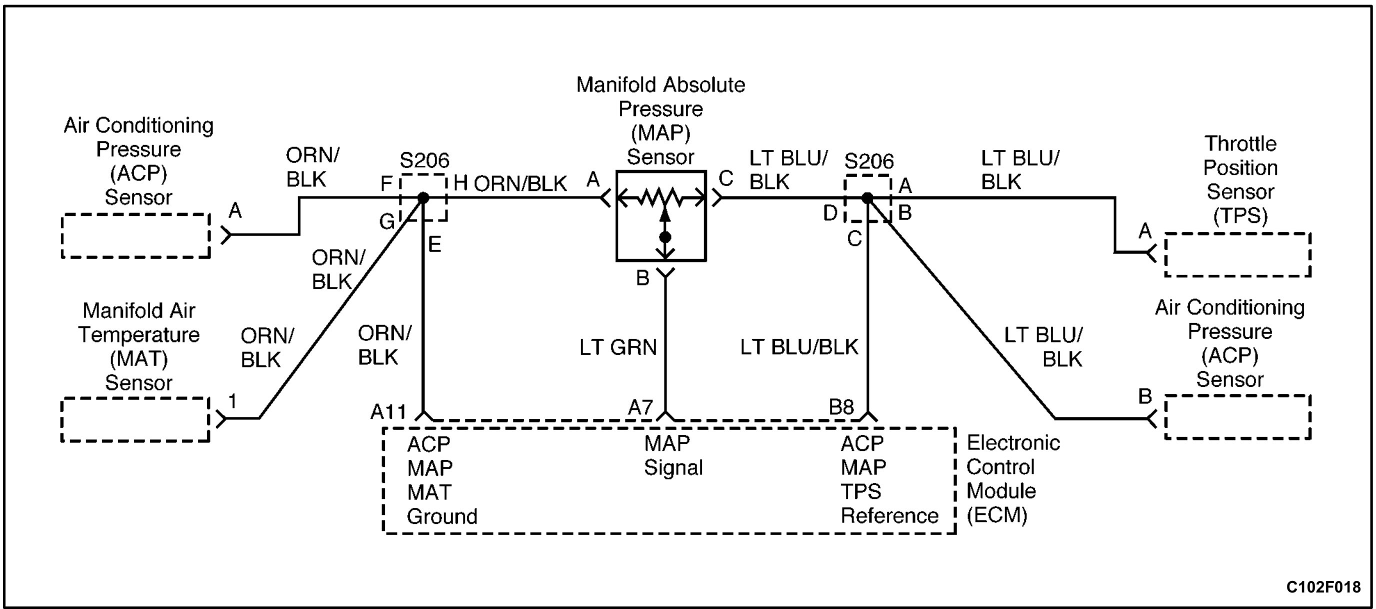

DIAGNOSTIC TROUBLE CODE (DTC) 34 MANIFOLD ABSOLUTE PRESSURE SENSOR LOW (2.0L SOHC)

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in the manifold vacuum. The electronic control module (ECM) receives this information as a signal voltage that will vary from about 1.0 to 1.5 volts at closed throttle (idle) to 4.5 to 5.0 volts at wide open throttle.

DTC 34 Will Set When

- Diagnostic trouble code (DTC) 21 is not set.
- DTC 22 is not set.
- The engine speed is less than 1,200 rpm or the engine speed is greater than 1,200 rpm and the throttle angle is greater than 15 percent.
- The manifold absolute pressure (MAP) sensor signal voltage indicates less the 15 kPa (4.5 inches of Hg).
- These conditions have been present for 0.1 second.

Diagnostic Aids

- If the connections are OK, monitor the manifold absolute pressure (MAP) sensor signal voltage while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.
- With the ignition ON and the engine OFF, the MAP sensor pressure is equal to the atmospheric pressure. This information is used by the electronic control module (ECM) as an indication of altitude. Comparison of these readings with a known good vehicle with the same MAP sensor is a good way to check the accuracy of a questionable MAP sensor. The readings should be the same within 0.4 volt.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. With the ignition ON and the engine OFF, the manifold absolute pressure (MAP) sensor is reading atmospheric or barometric pressure. If this reading is below 4 volts, the electronic control module (ECM) may prevent the engine from starting.
4. This step checks for a reference voltage and a ground from the ECM.
5. This step is checking the voltage reference and the signal return wire to the ECM. If the ECM recognizes the voltage reference and there is not a problem in the ground side of the circuit, the MAP sensor is faulty.

DTC 34 - Manifold Absolute Pressure Sensor Low (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Turn the ignition ON. Does the scan tool show the manifold absolute pressure (MAP) sensor voltage above the value specified?	4 V	Go to *Step 3*	Go to *Step 4*
3	1. Disconnect the vacuum line from the MAP sensor. 2. Apply 68 kPa (20 in. of Hg) of vacuum to the MAP sensor. Does the scan tool show the MAP sensor voltage within the value specified?	1.0-1.5 V	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the MAP sensor connector. 3. Turn the ignition ON. 4. Measure the voltage between the MAP sensor connector terminals A and C. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 5*	Go to *Step 6*
5	Connect a fused jumper between the MAP sensor connector terminals B and C. Does the scan tool show the MAP sensor voltage above the value specified?	4 V	Go to *Step 11*	Go to *Step 9*
6	Measure the voltage between the MAP sensor connector terminal C and ground. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition OFF. 2. Check for an open wire between the MAP sensor connector terminal A and the electronic control module (ECM) connector terminal A11. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
8	1. Turn the ignition OFF. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal C and the ECM connector terminal B8. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
9	1. Turn the ignition OFF. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal B and the ECM connector terminal A7. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
10	1. Repair the wire or the connector terminal as needed. 2. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

DTC 34 - Manifold Absolute Pressure Sensor Low (2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Replace the manifold absolute pressure sensor. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
12	1. Turn the ignition OFF. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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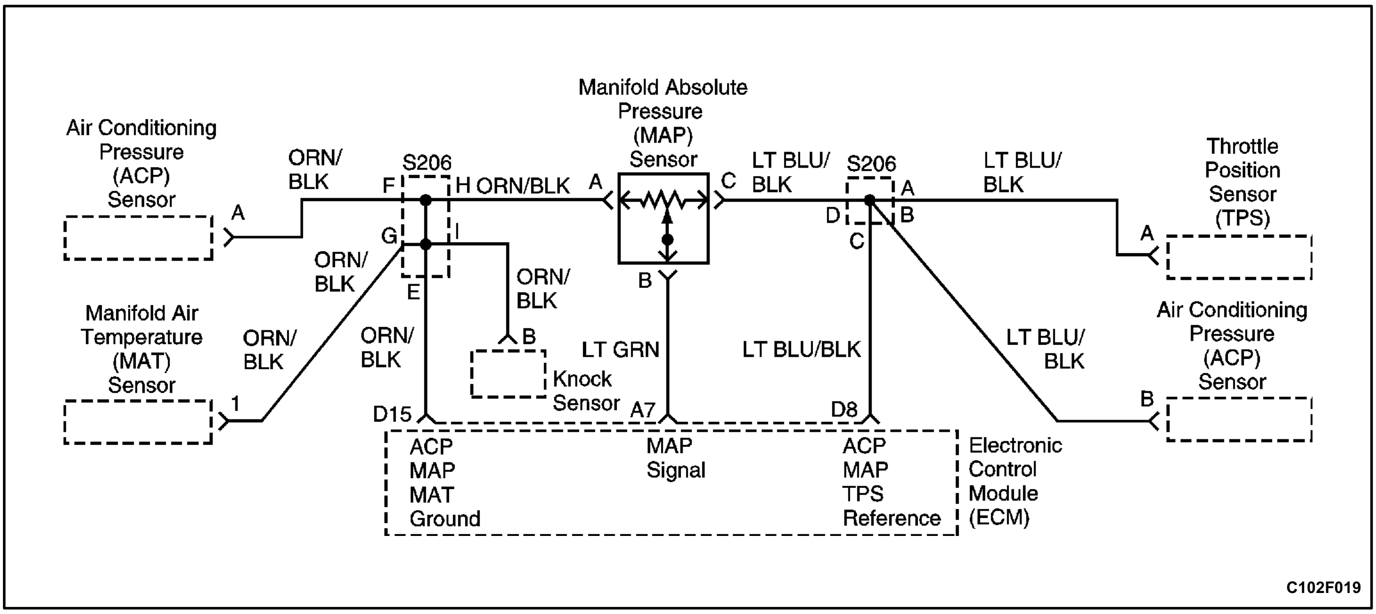

DIAGNOSTIC TROUBLE CODE (DTC) 34
MANIFOLD ABSOLUTE PRESSURE SENSOR LOW
(2.0L DOHC)

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in the manifold vacuum. The electronic control module (ECM) receives this information as a signal voltage that will vary from about 1.0 to 1.5 volts at closed throttle (idle) to 4.5 to 5.0 volts at wide open throttle.

DTC 34 Will Set When

- Diagnostic trouble code (DTC) 21 and 22 are not set.
- The engine speed is less than 1,050 rpm, or the engine speed is greater than 1,050 rpm and the throttle angle is greater than 18.8 percent.
- The manifold absolute pressure (MAP) sensor signal voltage indicates less than 14 kPa (4.0 inches of Hg).
- These conditions have been present for 1 second.

Diagnostic Aids

- If the connections are OK, monitor the manifold absolute pressure (MAP) sensor signal voltage while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.
- With the ignition ON and the engine OFF, the MAP sensor pressure is equal to the atmospheric pressure. This information is used by the electronic control module (ECM) as an indication of altitude. Comparison of these readings with a known good vehicle with the same MAP sensor is a good way to check the accuracy of a questionable MAP sensor. The readings should be the same within 0.4 volt.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. With the ignition ON and the engine OFF, the manifold absolute pressure (MAP) sensor is reading atmospheric or barometric pressure. If this reading is below 4 volts, the electronic control module (ECM) may prevent the engine from starting.
4. This step checks for a reference voltage and a ground from the ECM.
5. This step is checking the voltage reference and the signal return wire to the ECM. If the ECM recognizes the voltage reference and there is not a problem in the ground side of the circuit, the MAP sensor is faulty.

DTC 34 - Manifold Absolute Pressure Sensor Low (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Turn the ignition ON. Does the scan tool show the manifold absolute pressure (MAP) sensor voltage above the value specified?	4 V	Go to *Step 3*	Go to *Step 4*
3	1. Disconnect the vacuum line from the MAP sensor. 2. Apply 68 kPa (20 in. of Hg) of vacuum to the MAP sensor. Does the scan tool show the MAP sensor voltage within the value specified?	1.0-1.5 V	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the MAP sensor connector. 3. Turn the ignition ON. 4. Measure the voltage between the MAP sensor connector terminals A and C. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 5*	Go to *Step 6*
5	Connect a fused jumper between the MAP sensor connector terminals B and C. Does the scan tool show the MAP sensor voltage above the value specified?	4 V	Go to *Step 11*	Go to *Step 9*
6	Measure the voltage between the MAP sensor connector terminal C and ground. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition OFF. 2. Check for an open wire between the MAP sensor connector terminal A and the electronic control module (ECM) connector terminal D15. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
8	1. Turn the ignition OFF. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal C and the ECM connector terminal D8. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
9	1. Turn the ignition OFF. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal B and the ECM connector terminal A7. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
10	1. Repair the wire or the connector terminal as needed. 2. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

DTC 34 - Manifold Absolute Pressure Sensor Low (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Replace the manifold absolute pressure sensor. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
12	1. Turn the ignition OFF. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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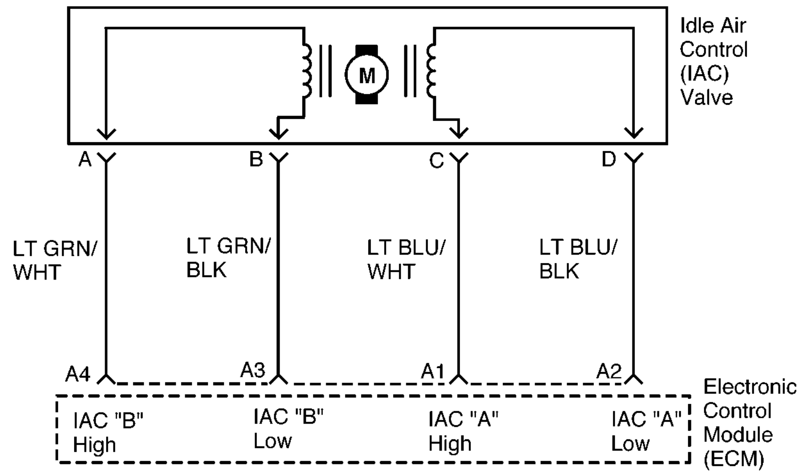

DIAGNOSTIC TROUBLE CODE (DTC) 35
IDLE AIR CONTROL ERROR (2.0L DOHC)

Circuit Description

The electronic control module (ECM) controls the idle speed to a calculated rpm based on inputs and the actual engine rpm. This is determined by the ignition reference pulses received by the ECM from the crankshaft position sensor. The ECM uses four circuits to move the idle air control (IAC) valve. The IAC valve allows varying amounts of air to flow into the intake manifold, controlling the idle speed.

DTC 35 Will Set When

- Diagnostic trouble code (DTC) 21 and 22 are not set.
- DTC 24 is not set.
- The throttle is closed.
- The engine speed is 175 rpm above or below the commanded idle speed for at least 20 seconds.

Diagnostic Aids

- Inspect for vacuum leaks, unconnected or brittle vacuum hoses, cuts, etc.
- Inspect the intake manifold and the throttle body gaskets for proper sealing.
- An idle air control (IAC) valve which does not respond to the electronic control module (ECM), an incorrect base idle adjustment, a damaged throttle body, or damage to the throttle body linkage could create the conditions for setting diagnostic trouble code 35.

DTC 35 - Idle Air Control Error (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Connect the scan tool to the assembly line diagnostic link (ALDL). 3. Monitor the engine rpm. 4. Disconnect the idle air control (IAC) valve connector. 5. Connect the IAC driver to the IAC valve. 6. Start the engine allow the engine to idle in P (PARK) (NEUTRAL for manual transaxle) with the A/C off and the parking brake applied. 7. Using the IAC driver, extend and retract the IAC valve. Does the rpm change as the IAC driver is cycled?	-	Go to *Step 5*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the IAC driver from the IAC valve. 3. Remove the IAC valve from the throttle body. 4. Inspect the IAC passages for restrictions. Are the IAC passages restricted?	-	Go to *Step 4*	Go to *Step 14*
4	1. Clean the IAC passages. 2. Clear any diagnostic trouble code(s) (DTCs) from the electronic control module (ECM). 3. Perform the IAC valve reset procedure. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
5	Cycle the IAC driver while monitoring the engine rpm. Does the rpm change smoothly within the value specified with each flash of the IAC driver?	700-1500 rpm	Go to *Step 6*	Go to *Step 3*
6	1. Turn the ignition OFF. 2. Connect the IAC node light to the IAC connector. 3. Start the engine and cycle the IAC driver. Do both lights of the IAC node light cycle red and green but never turn off as the rpm is changed using the IAC driver?	-	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition OFF. 2. Disconnect the IAC driver from the IAC valve. 3. Measure the resistance between IAC terminals A and B, then C and D. Is the resistance within the value specified?	40-80 Ω	Go to *Step 8*	Go to *Step 14*
8	Measure the resistance between IAC terminals B and C, then A and D. Does the resistance match the specified value?	∞	Go to "Diagnostic Aids"	Go to *Step 14*
9	1. Turn the ignition OFF. 2. Disconnect the IAC node light from the IAC valve connector. 3. Check for faulty connector terminals. Is the problem found?	-	Go to *Step 13*	Go to *Step 10*

DTC 35 - Idle Air Control Error (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check for any open circuits, including connections, between the IAC valve connector terminals and the ECM. Is the problem found?	-	Go to *Step 13*	Go to *Step 11*
11	Check for a short to ground between the IAC valve connector terminals and the ECM. Is the problem found?	-	Go to *Step 13*	Go to *Step 12*
12	1. Turn the ignition ON. 2. Check for a short to voltage between the IAC valve connector terminals and the ECM. Is the problem found?	-	Go to *Step 13*	Go to *Step 15*
13	1. Turn the ignition OFF. 2. Repair the wire or the connector terminal as needed. 3. Clear any DTCs from the ECM. 4. Perform the IAC valve reset procedure. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
14	1. Replace the idle air control valve. 2. Clear any DTCs from the ECM. 3. Perform the IAC valve reset procedure. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
15	1. Replace the ECM. 2. Clear any DTCs from the ECM. 3. Perform the IAC valve reset procedure. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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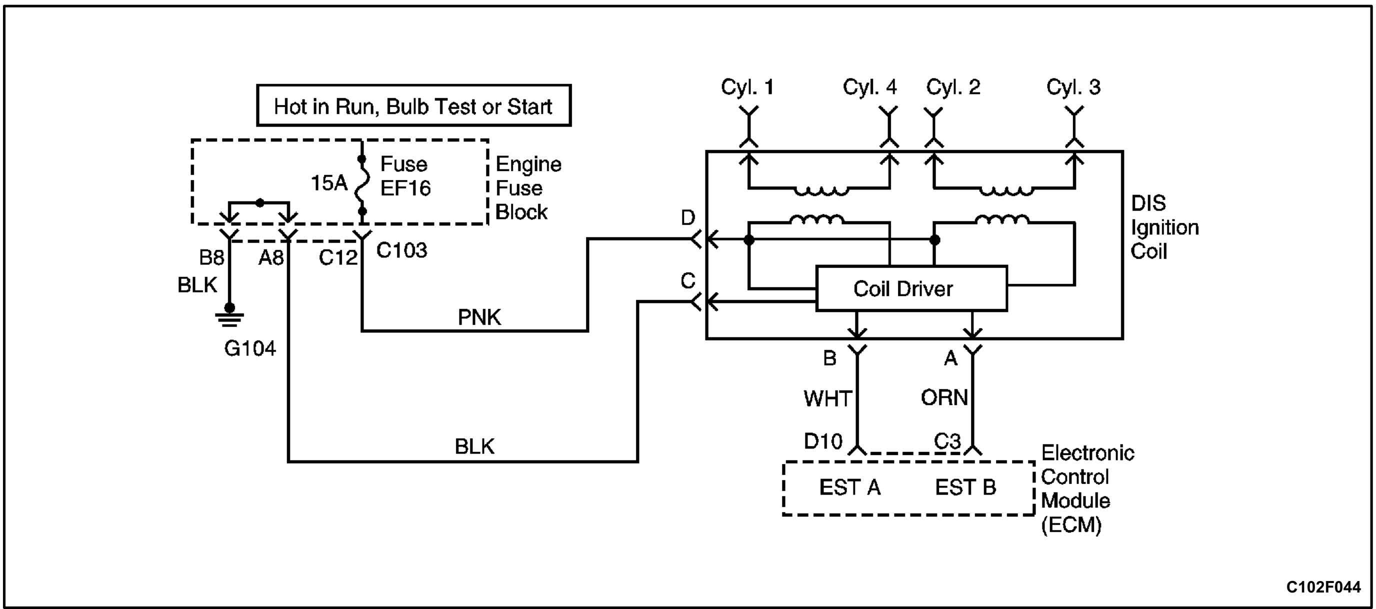


DIAGNOSTIC TROUBLE CODE (DTC) 41
ELECTRONIC SPARK TIMING "B" SHORTED TO BATTERY
(2.0L SOHC)

Circuit Description

The direct ignition system (DIS) ignition coil is supplied with battery voltage when the ignition is ON. The electronic control module (ECM) triggers the circuit for the DIS ignition coil. Voltage is then induced in the secondary portion of the DIS ignition coil. Control of the DIS ignition coil is monitored separately for the two electronic spark timing lines.

DTC 41 Will Set When

- The electronic control module (ECM) receives voltage greater than 12 volts through the electronic spark timing (EST) "B" line while reference pulses are received by the ECM from the crankshaft position sensor.
- This error occurs more than 6 times.

Diagnostic Aids

- Inspect the electronic control module (ECM) harness connectors for backed-out terminals, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged wiring harness.
- If the connections and the harness are OK, connect a digital voltmeter or an oscilloscope between the affected terminal and ground while moving the related connectors and the wiring harness. If the fault is induced, the voltage reading or the scope pattern will change.

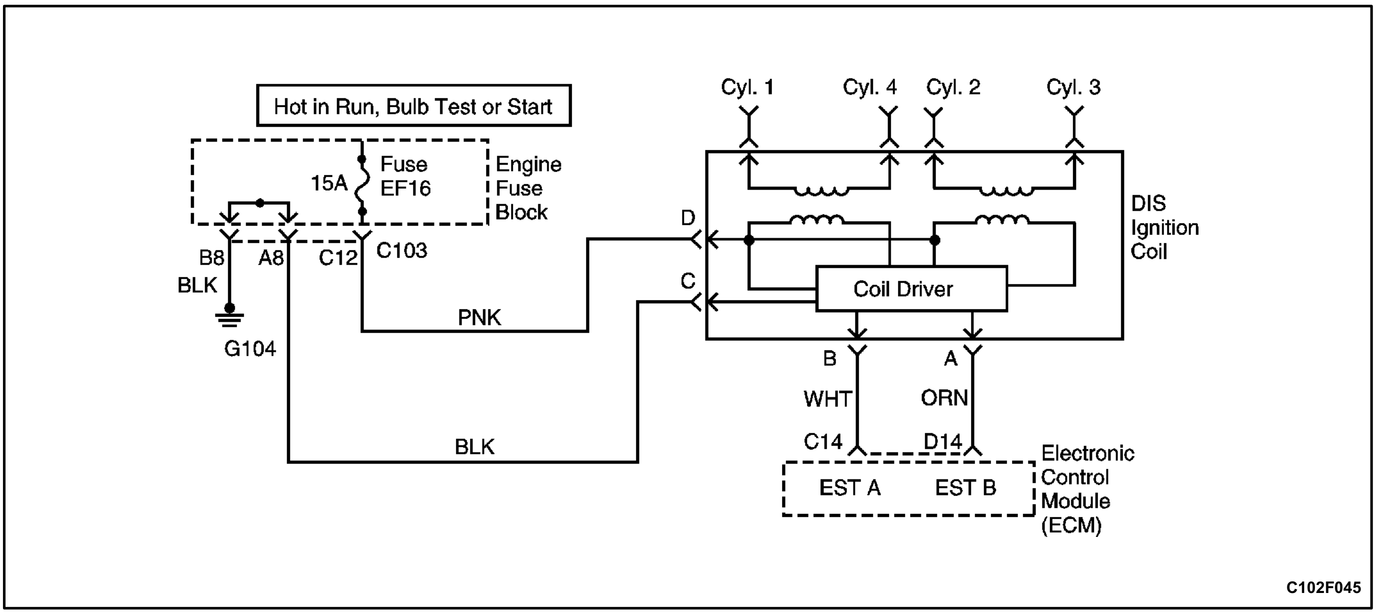
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks both the electronic spark timing (EST) "B" and the ground from the electronic control module (ECM).
6. A short to voltage that is intermittent may be at fault in the EST "B" wire from the ECM.
11. If there are not any problems in the wiring of the circuit, yet no output from the ECM, the ECM is faulty.

DTC 41 - Electronic Spark Timing "B" Shorted to Battery (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the direct ignition system (DIS) ignition coil connector. 2. Check the DIS ignition coil connector terminals to ensure that the terminals are correctly installed and none of them are touching. Is the problem found?	-	Go to *Step 9*	Go to *Step 3*
3	1. Measure the voltage between terminal A and terminal C of the DIS ignition coil connector. 2. Crank the engine. Does the voltage fluctuate within the value specified?	0.2-2.0 V	Go to *Step 10*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) white connector. 3. Check for any damaged pins or terminals at the ECM connector terminal C3 or near terminal C3. Is the problem found?	-	Go to *Step 9*	Go to *Step 5*
5	1. Turn the ignition ON. 2. Measure the voltage at the DIS ignition coil connector terminal A. Is any voltage present?	-	Go to *Step 7*	Go to *Step 6*
6	Measure the voltage at the DIS ignition coil connector terminal A while moving the connectors and the wiring harness of the ignition circuit. Is any voltage present?	-	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition OFF. 2. Repair the short to voltage between the DIS ignition coil connector terminal A and the ECM connector terminal C3. 3. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	1. Turn the ignition OFF. 2. Check the wires and harnesses of the ignition circuit for any damage that could cause an intermittent short to voltage. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair any wire or connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the direct ignition system ignition coil assembly. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 41 ELECTRONIC SPARK TIMING "B" SHORTED TO BATTERY (2.0L DOHC)

Circuit Description

The direct ignition system (DIS) ignition coil is supplied with battery voltage when the ignition is ON. The electronic control module (ECM) triggers the circuit for the DIS ignition coil. Voltage is then induced in the secondary portion of the DIS ignition coil. Control of the DIS ignition coil is monitored separately for the two electronic spark timing lines.

DTC 41 Will Set When

- The electronic control module (ECM) receives voltage greater than 12 volts through the electronic spark timing (EST) "B" line while reference pulses are received by the ECM from the crankshaft position sensor.
- This error occurs over 6 times.

Diagnostic Aids

- Inspect the electronic control module (ECM) harness connectors for backed-out terminals, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged wiring harness.
- If the connections and the harness are OK, connect a digital voltmeter or an oscilloscope between the affected terminal and ground while moving the related connectors and the wiring harness. If the fault is induced, the voltage reading or the scope pattern will change.

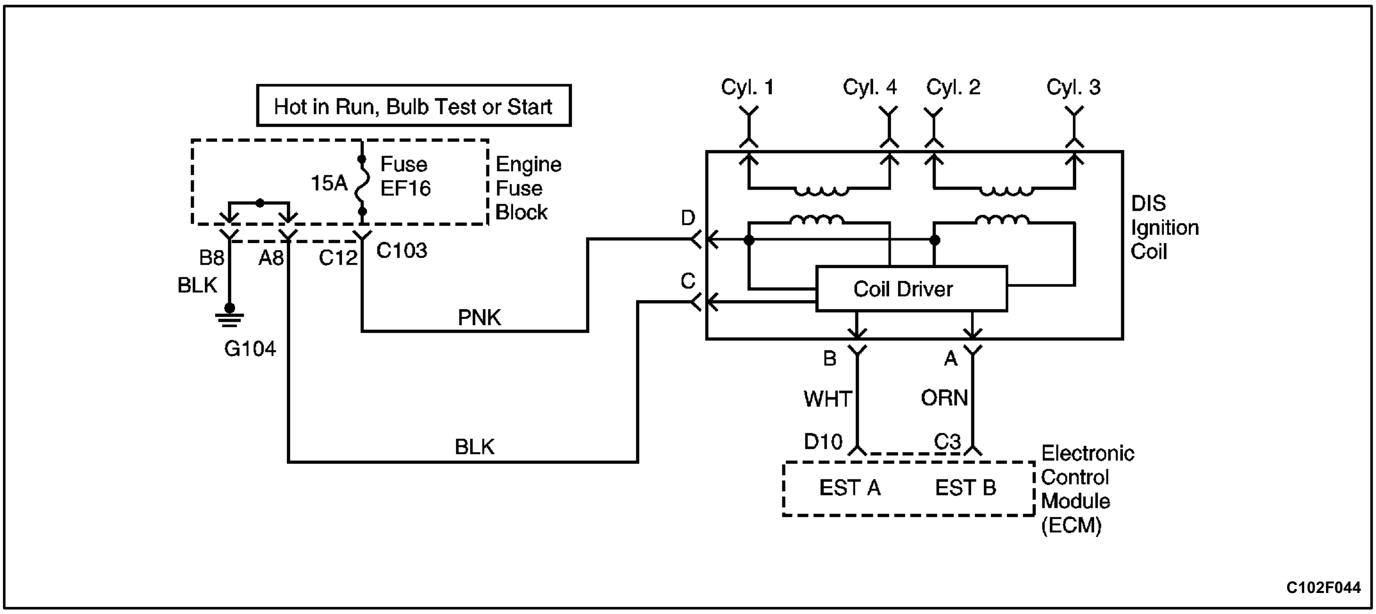
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks both the electronic spark timing (EST) "B" and the ground from the electronic control module (ECM).
6. A short to voltage that is intermittent may be at fault in the EST "B" wire from the ECM.
11. If there are not any problems in the wiring of the circuit, yet no output from the ECM, the ECM is faulty.

DTC 41 - Electronic Spark Timing "B" Shorted to Battery (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the direct ignition system (DIS) ignition coil connector. 2. Check the DIS ignition coil connector terminals to ensure that the terminals are correctly installed and none of them are touching. Is the problem found?	-	Go to *Step 9*	Go to *Step 3*
3	1. Measure the voltage between terminal A and terminal C of the DIS ignition coil connector. 2. Crank the engine. Does the voltage fluctuate within the value specified?	0.2-2.0 V	Go to *Step 10*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) white connector. 3. Check for any damaged pins or terminals at the ECM connector terminal D14 or near terminal D14. Is the problem found?	-	Go to *Step 9*	Go to *Step 5*
5	1. Turn the ignition ON. 2. Measure the voltage at the DIS ignition coil connector terminal A. Is any voltage present?	-	Go to *Step 7*	Go to *Step 6*
6	Measure the voltage at the DIS ignition coil connector terminal A while moving the connectors and the wiring harness of the ignition circuit. Is any voltage present?	-	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition OFF. 2. Repair the short to voltage between the DIS ignition coil connector terminal A and the ECM connector terminal D14. 3. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	1. Turn the ignition OFF. 2. Check the wires and harnesses of the ignition circuit for any damage that could cause an intermittent short to voltage. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair any wire or connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the direct ignition system ignition coil assembly. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 42
ELECTRONIC SPARK TIMING "A" SHORTED TO BATTERY
(2.0L SOHC)

Circuit Description

The direct ignition system (DIS) ignition coil is supplied with battery voltage when the ignition is ON. The electronic control module (ECM) triggers the circuit for the DIS ignition coil. Voltage is then induced in the secondary portion of the DIS ignition coil. Control of the DIS ignition coil is monitored separately for the two electronic spark timing lines.

DTC 42 Will Set When

- The electronic control module (ECM) receives voltage greater than 12 volts through the electronic spark timing (EST) "A" line while reference pulses are received by the ECM from the crankshaft position sensor.
- This error occurs more than 6 times.

Diagnostic Aids

- Inspect the electronic control module (ECM) harness connectors for backed-out terminals, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged wiring harness.
- If the connections and the harness are OK, connect a digital voltmeter or an oscilloscope between the affected terminal and ground while moving the related connectors and the wiring harness. If the fault is induced, the voltage reading or the scope pattern will change.

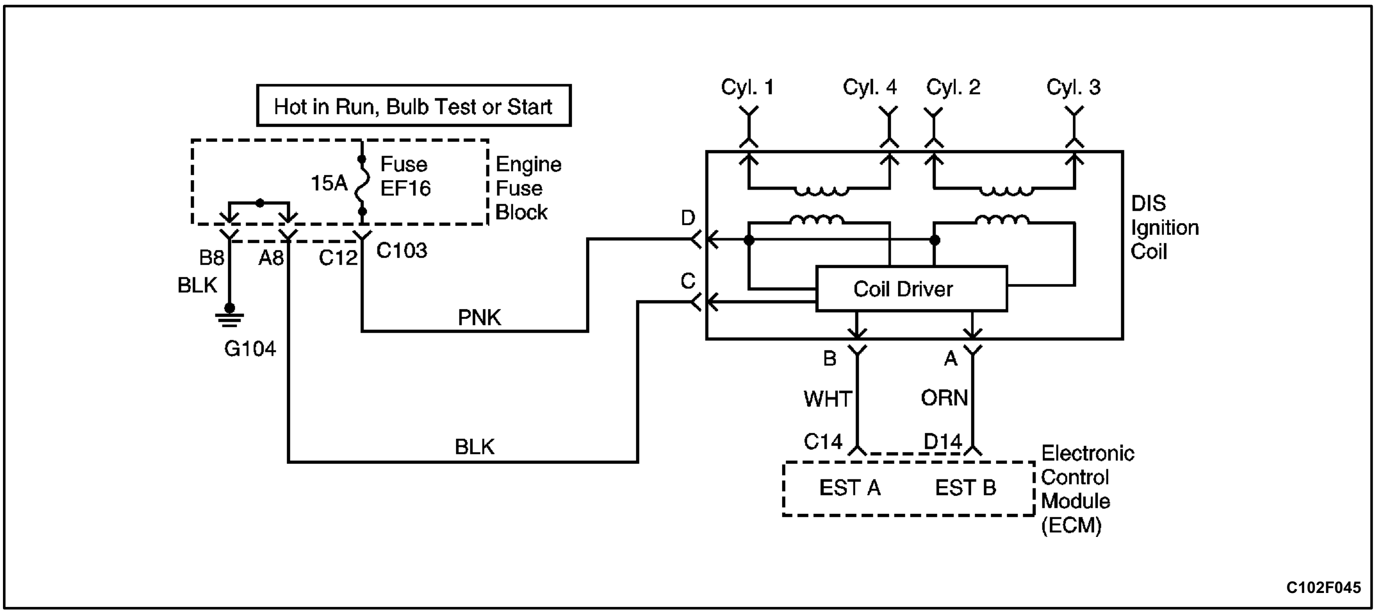
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks both the electronic spark timing (EST) "A" and the ground from the electronic control module (ECM).
6. A short to voltage that is intermittent may be at fault in the EST "A" wire from the ECM.
11. If there are not any problems in the wiring of the circuit, yet no output from the ECM, the ECM is faulty.

DTC 42 - Electronic Spark Timing "A" Shorted to Battery (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the direct ignition system (DIS) ignition coil connector. 2. Check the DIS ignition coil connector terminals to ensure that the terminals are correctly installed and none of them are touching. Is the problem found?	-	Go to *Step 9*	Go to *Step 3*
3	1. Measure the voltage between terminal B and terminal C of the DIS ignition coil connector. 2. Crank the engine. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 10*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) white connector. 3. Check for any damaged pins or terminals at the ECM connector terminal D10 or near terminal D10. Is the problem found?	-	Go to *Step 9*	Go to *Step 5*
5	1. Turn the ignition ON. 2. Measure the voltage at the DIS ignition coil connector terminal B. Is any voltage present?	-	Go to *Step 7*	Go to *Step 6*
6	Measure the voltage at the DIS ignition coil connector terminal B while moving the connectors and the wiring harness of the ignition circuit. Is any voltage present?	-	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition OFF. 2. Repair the short to voltage between the DIS ignition coil connector terminal B and the ECM connector terminal D10. 3. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	1. Turn the ignition OFF. 2. Check the wires and the harnesses of the ignition circuit for any damage that could cause an intermittent short to voltage. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair any wire or connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the direct ignition system ignition coil assembly. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 42
ELECTRONIC SPARK TIMING "A" SHORTED TO BATTERY
(2.0L DOHC)

Circuit Description

The direct ignition system (DIS) ignition coil is supplied with battery voltage when the ignition is ON. The electronic control module (ECM) triggers the circuit for the DIS ignition coil. Voltage is then induced in the secondary portion of the DIS ignition coil. Control of the DIS ignition coil is monitored separately for the two electronic spark timing lines.

DTC 42 Will Set When

- The electronic control module (ECM) receives voltage greater than 12 volts through the electronic spark timing (EST) "A" line while reference pulses are received by the ECM from the crankshaft position sensor.
- This error occurs over 6 times.

Diagnostic Aids

- Inspect the electronic control module (ECM) harness connectors for backed-out terminals, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged wiring harness.
- If the connections and the harness are OK, connect a digital voltmeter or an oscilloscope between the affected terminal and ground while moving the related connectors and the wiring harness. If the fault is induced, the voltage reading or the scope pattern will change.

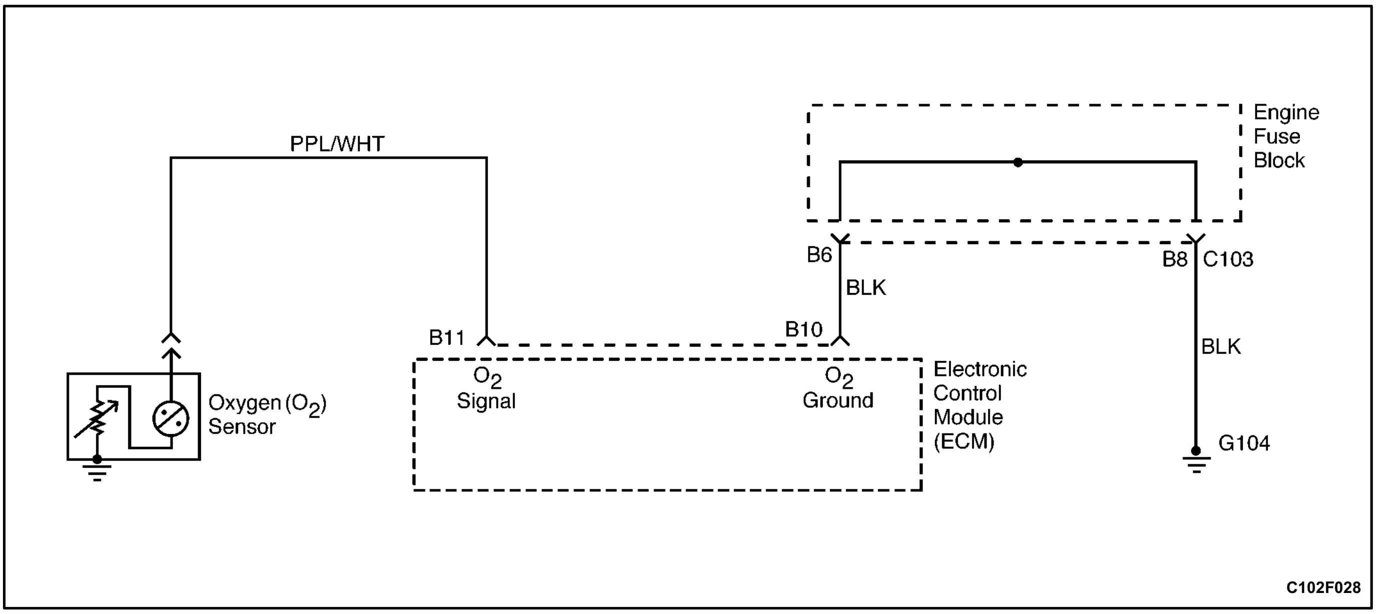
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks both the electronic spark timing (EST) "A" and the ground from the electronic control module (ECM).
6. A short to voltage that is intermittent may be at fault in the EST "A" wire from the ECM.
11. If there are not any problems in the wiring of the circuit, yet no output from the ECM, the ECM is faulty.

DTC 42 - Electronic Spark Timing "A" Shorted to Battery (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the direct ignition system (DIS) ignition coil connector. 2. Check the DIS ignition coil connector terminals to ensure that the terminals are correctly installed and none of them are touching. Is the problem found?	-	Go to *Step 9*	Go to *Step 3*
3	1. Measure the voltage between terminal B and terminal C of the DIS ignition coil connector. 2. Crank the engine. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 10*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) white connector. 3. Check for any damaged pins or terminals at the ECM connector terminal C14 or near terminal C14. Is the problem found?	-	Go to *Step 9*	Go to *Step 5*
5	1. Turn the ignition ON. 2. Measure the voltage at the DIS ignition coil connector terminal B. Is any voltage present?	-	Go to *Step 7*	Go to *Step 6*
6	Measure the voltage at the DIS ignition coil connector terminal B while moving the connectors and the wiring harness of the ignition circuit. Is any voltage present?	-	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition OFF. 2. Repair the short to voltage between the DIS ignition coil connector terminal B and the ECM connector terminal C14. 3. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	1. Turn the ignition OFF. 2. Check the wires and the harnesses of the ignition circuit for any damage that could cause an intermittent short to voltage. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair any wire or connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the direct ignition system ignition coil assembly. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 44
OXYGEN SENSOR LEAN (2.0L SOHC)

Circuit Description

The electronic control module (ECM) supplies a voltage of about 450 millivolts between the ECM terminals B11 and B10. The oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down to about 100 millivolts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C (600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

DTC 44 Will Set When

- The engine has been running for at least 50 seconds.
- Diagnostic trouble code (DTC) 21 has not set.
- DTC 22 has not set.
- DTC 33 has not set.
- DTC 34 has not set.
- The throttle angle is above 5 percent.
- The coolant temperature is above 80°C (176°F).
- The engine controls system is in closed loop.
- The oxygen sensor voltage is below 200 millivolts.
- These conditions are present for 30 seconds.

Diagnostic Aids

- Normal scan tool voltage varies between 100 millivolts and 999 millivolts while in closed loop.
- Inspect the oxygen (O_2) sensor wire. The O_2 sensor pigtail may be positioned incorrectly and contacting the exhaust manifold.
- Check for an intermittent ground in the wire between the O_2 sensor and the electronic control module.
- Perform an injector balance test to determine if a restricted fuel injector may be causing the lean running condition.
- Vacuum or crankcase leaks will cause a lean running condition.
- An exhaust manifold gasket leak or a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

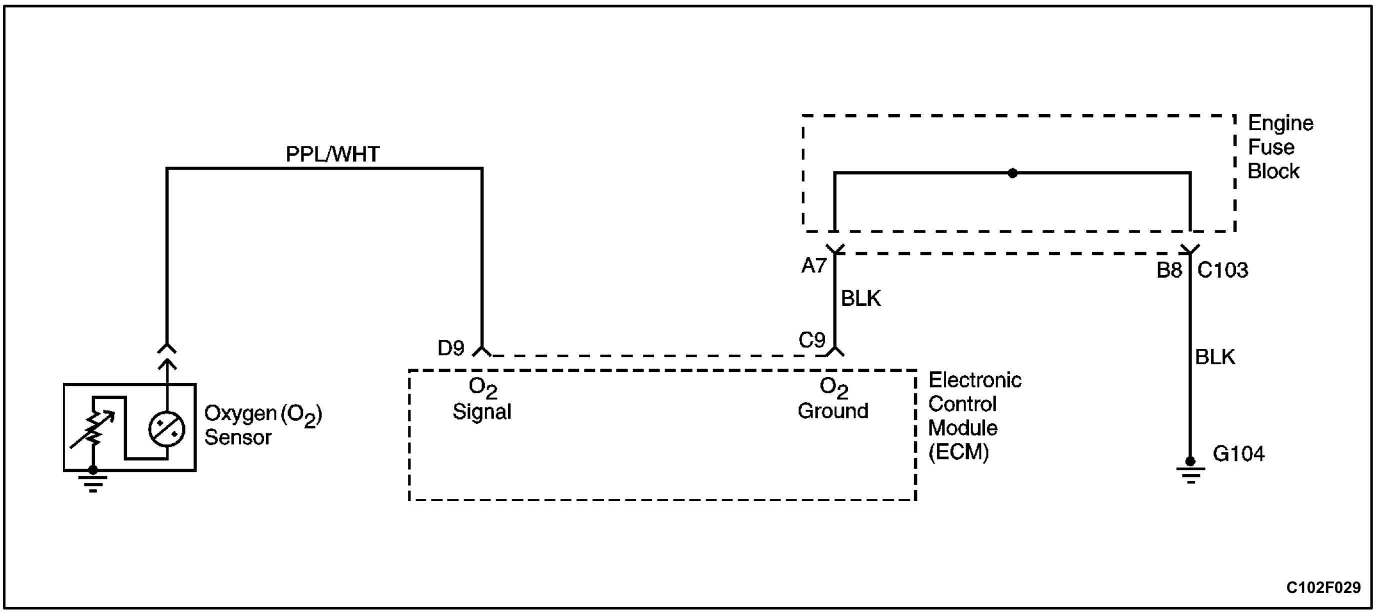
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. Running the engine at 1,200 rpm keeps the oxygen (O_2) sensor hot so an accurate display voltage can be maintained.
4. If the O_2 sensor voltage stays fixed below 350 millivolts after disconnecting the O_2 sensor, there is either a short to ground in the O_2 sensor wire to the electronic control module (ECM) or a faulty ECM.

DTC 44 - Oxygen Sensor Lean (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. 3. Run the engine at 1,200 rpm. Does the scan tool read the oxygen (O_2) sensor voltage fixed below the value specified?	220 mV	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Disconnect the O_2 sensor connector. 2. Run the warm engine at idle. Does the scan tool read O_2 sensor voltage within the value specified?	350-550 mV	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Check the O_2 sensor signal wire between the O_2 sensor and electronic control module (ECM) connector terminal B11 for a short to ground. Is the problem found?	-	Go to *Step 5*	Go to *Step 6*
5	1. Repair the wire or the connector terminal as needed. 2. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 3. Road test the vehicle. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Replace the ECM. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 44
OXYGEN SENSOR LEAN (2.0L DOHC)

Circuit Description

The electronic control module (ECM) supplies a voltage of about 450 millivolts between the ECM terminals D9 and C9. The oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down to about 100 millivolts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C (600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

DTC 44 Will Set When

- The engine controls system is in closed loop.
- The oxygen sensor voltage is below 274 millivolts.
- The engine has been running for at least 60 seconds.
- Diagnostic trouble code (DTC) 21 has not set.
- DTC 22 has not set.
- DTC 33 has not set.
- DTC 34 has not set.
- The throttle angle is above 5 percent.
- The coolant temperature is above 70°C (158°F).
- These conditions are present for at least 40 seconds.

Diagnostic Aids

- Normal scan tool voltage varies between 100 millivolts and 999 millivolts while in closed loop.
- Inspect the oxygen (O_2) sensor wire. The O_2 sensor pigtail may be positioned incorrectly and contacting the exhaust manifold.
- Check for an intermittent ground in the wire between the O_2 sensor and the electronic control module.
- Perform an injector balance test to determine if a restricted fuel injector may be causing the lean running condition.
- Vacuum or crankcase leaks will cause a lean running condition.
- An exhaust manifold gasket leak or a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

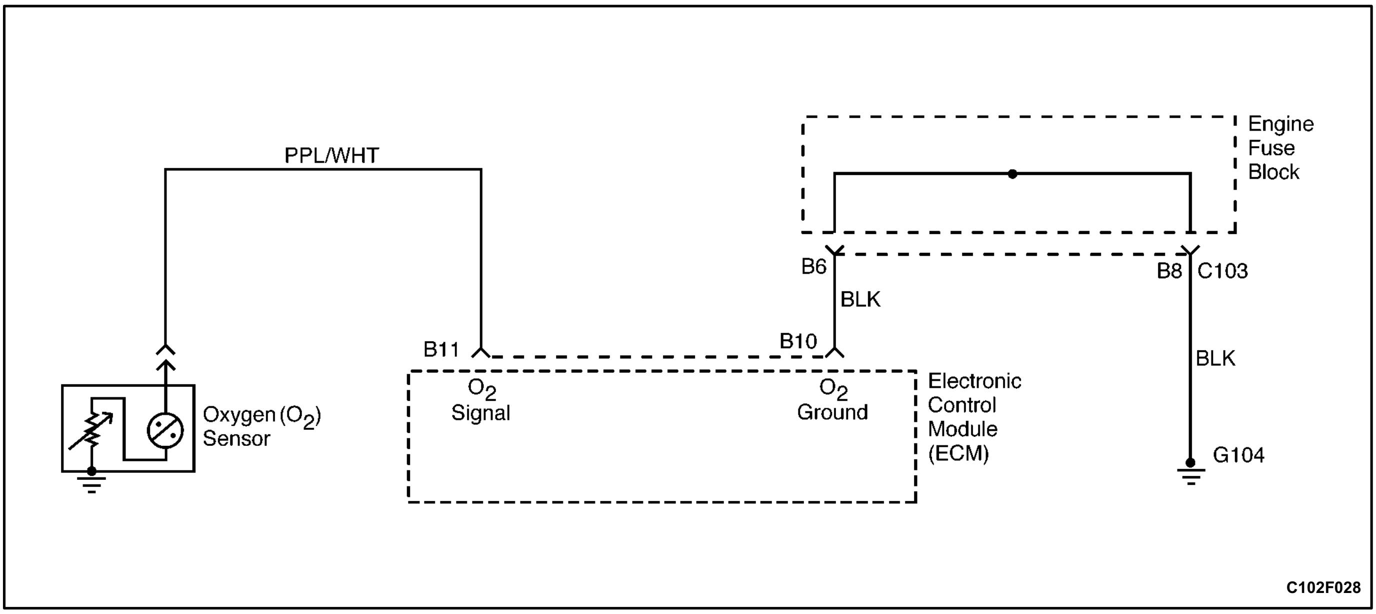
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. Running the engine at 1,200 rpm keeps the oxygen (O_2) sensor hot so an accurate display voltage can be maintained.
4. If the O_2 sensor voltage stays fixed below 350 millivolts after disconnecting the O_2 sensor, there is either a short to ground in the O_2 sensor wire to the electronic control module (ECM) or a faulty ECM.

DTC 44 - Oxygen Sensor Lean (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. 3. Run the engine at 1,200 rpm. Does the scan tool read the oxygen (O_2) sensor voltage fixed below the value specified?	274 mV	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Disconnect the O_2 sensor connector. 2. Run the warm engine at idle. Does the scan tool read O_2 sensor voltage within the value specified?	350-550 mV	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Check the O_2 sensor signal wire between the O_2 sensor and electronic control module (ECM) connector terminal D9 for a short to ground. Is the problem found?	-	Go to *Step 5*	Go to *Step 6*
5	1. Repair the wire or the connector terminal as needed. 2. Clear any diagnostic trouble code(s) (DTCs) from the ECM. 3. Road test the vehicle. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Replace the ECM. 2. Road test the vehicle. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 45
OXYGEN SENSOR RICH (2.0L SOHC)

Circuit Description

The electronic control module (ECM) supplies a voltage of about 450 millivolts between the ECM terminals B11 and B10. The oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down to about 100 millivolts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C (600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

DTC 45 Will Set When

- The engine has been running for at least 50 seconds.
- Diagnostic trouble code (DTC) 21 has not set.
- The DTC 22 has not set.
- The DTC 33 has not set.
- The DTC 34 has not set.
- The throttle angle is above 5 percent.
- The coolant temperature is above 80°C (176°F).
- The engine controls system is in closed loop.
- The oxygen sensor voltage is above 800 millivolts.
- These conditions are present for at least 30 seconds.

Diagnostic Aids

- Normal scan tool voltage varies between 100 millivolts and 999 millivolts while in closed loop.
- Fuel pressure that is too high may cause a rich running condition.
- A leaking fuel pressure regulator diaphragm will cause a rich running condition.
- Check for leaking fuel injectors by performing a fuel injector balance test.
- An intermittent throttle position sensor output will cause a rich running condition due to a false indication of the engine accelerating.
- A false rich indication due to silicone contamination of the oxygen (O_2) sensor. This will be indicated by the presence of the diagnostic trouble code 45 accompanied by lean driveability conditions and a powdery white deposit on the O_2 sensor.

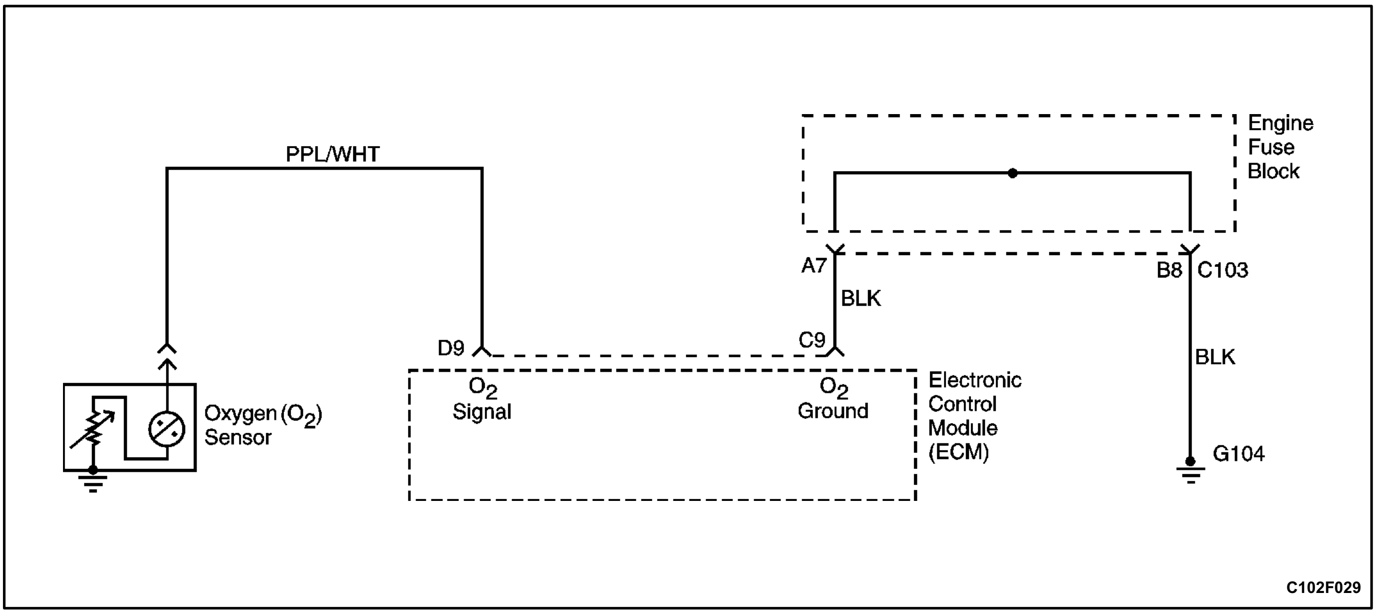
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. Running the engine at 1,200 rpm keeps the oxygen (O_2) sensor hot so an accurate display voltage can be maintained.
3. This step checks for the electronic control module ability to read a simulated lean O_2 sensor signal.

DTC 45 - Oxygen Sensor Rich (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. 3. Run the engine at 1,200 rpm. Does the scan tool read the oxygen (O_2) sensor voltage fixed above the value specified?	800 mV	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Disconnect the O_2 sensor connector and jumper the connector terminal to ground on the electronic control module (ECM) side. 2. Run the warm engine at idle. Does the scan tool read the O_2 sensor voltage below the value specified?	350 mV	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Replace the ECM. 3. Road test the vehicle. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 45 OXYGEN SENSOR RICH (2.0L DOHC)

Circuit Description

The electronic control module (ECM) supplies a voltage of about 450 millivolts between the ECM terminals D9 and C9. The oxygen (O_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down to about 100 millivolts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C (600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

DTC 45 Will Set When

- The engine has been running for at least 60 seconds.
- Diagnostic trouble code (DTC) 21 has not set.
- DTC 22 has not set.
- DTC 33 has not set.
- DTC 34 has not set.
- The throttle angle is above 5 percent.
- The coolant temperature is above 70°C (158°F).
- The engine controls system is in closed loop.
- The oxygen sensor voltage is above 865 millivolts.
- These conditions are present for at least 10 seconds.

Diagnostic Aids

- Normal scan tool voltage varies between 100 millivolts and 999 millivolts while in closed loop.
- Fuel pressure that is too high may cause a rich running condition.
- A leaking fuel pressure regulator diaphragm will cause a rich running condition.
- Check for leaking fuel injectors by performing a fuel injector balance test.
- An intermittent throttle position sensor output will cause a rich running condition due to a false indication of the engine accelerating.
- A false rich indication due to silicone contamination of the oxygen (O_2) sensor. This will be indicated by the presence of the diagnostic trouble code 45 accompanied by lean driveability conditions and a powdery white deposit on the O_2 sensor.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. Running the engine at 1,200 rpm keeps the oxygen (O_2) sensor hot so an accurate display voltage can be maintained.
3. This step checks for the electronic control module ability to read a simulated lean O_2 sensor signal.

DTC 45 - Oxygen Sensor Rich (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Run the engine until it reaches operating temperature. 3. Run the engine at 1,200 rpm. Does the scan tool read the oxygen (O_2) sensor voltage fixed above the value specified?	800 mV	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Disconnect the O_2 sensor connector and jumper the connector terminal to ground on the electronic control module (ECM) side. 2. Run the warm engine at idle. Does the scan tool read the O_2 sensor voltage below the value specified?	350 mV	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Replace the ECM. 3. Road test the vehicle. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

DIAGNOSTIC TROUBLE CODE (DTC) 49
BATTERY VOLTAGE TOO HIGH (2.0L DOHC)

Circuit Description

The electronic control module (ECM) monitors the battery voltage at the ECM connector terminal C16. If the ECM detects voltage above the tolerance, the diagnostic trouble code (DTC) 49 will be set.

DTC 49 Will Set When

- The battery voltage is greater than 17.2 volts for more than 2 seconds.

Diagnostic Aids

- Charging the battery with a battery charger and starting the engine may set the diagnostic trouble code (DTC) 49.
- Inspect the electronic control module (ECM) wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and a damaged harness.
- If the connections and the wiring harness check OK, monitor the battery voltage display on the scan tool while moving related connectors. If the fault is induced, the battery voltage will abruptly change. This may help to isolate the location of the problem.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. If the scan tool is showing incorrect battery voltage, the electronic control module (ECM) is at fault.

DTC 49 - Battery Voltage Too High (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL). 2. Start the engine and raise the engine speed to 1,200 rpm. 3. Monitor the battery voltage on the scan tool. Is the voltage at or above the value specified?	17.2 V	Go to *Step 3*	Go to *Step 4*
3	Measure the voltage across the battery. Is the voltage at or above the value specified?	17.2 V	Go to *Step 5*	Go to *Step 6*
4	1. Turn the headlamps ON. 2. Turn the A/C ON. 3. Turn the blower switch to HIGH. 4. Raise the engine speed to 2,000 rpm. 5. Monitor the battery voltage on the scan tool. Is the voltage at or above the value specified?	17.2 V	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Turn the ignition OFF. 2. Repair the generator or generator circuit as needed. 3. Clear any diagnostic trouble code(s) (DTCs) from the electronic control module (ECM). 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Turn the ignition OFF. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

DIAGNOSTIC TROUBLE CODE (DTC) 51
CHECKSUM OR KKPGMID ERROR (2.0L SOHC AND 2.0L DOHC)

DTC Will Set When

- KKPGMID is not set into A7 for SOHC or the calculated CHECKSUM is not consistent with the KKSUM.

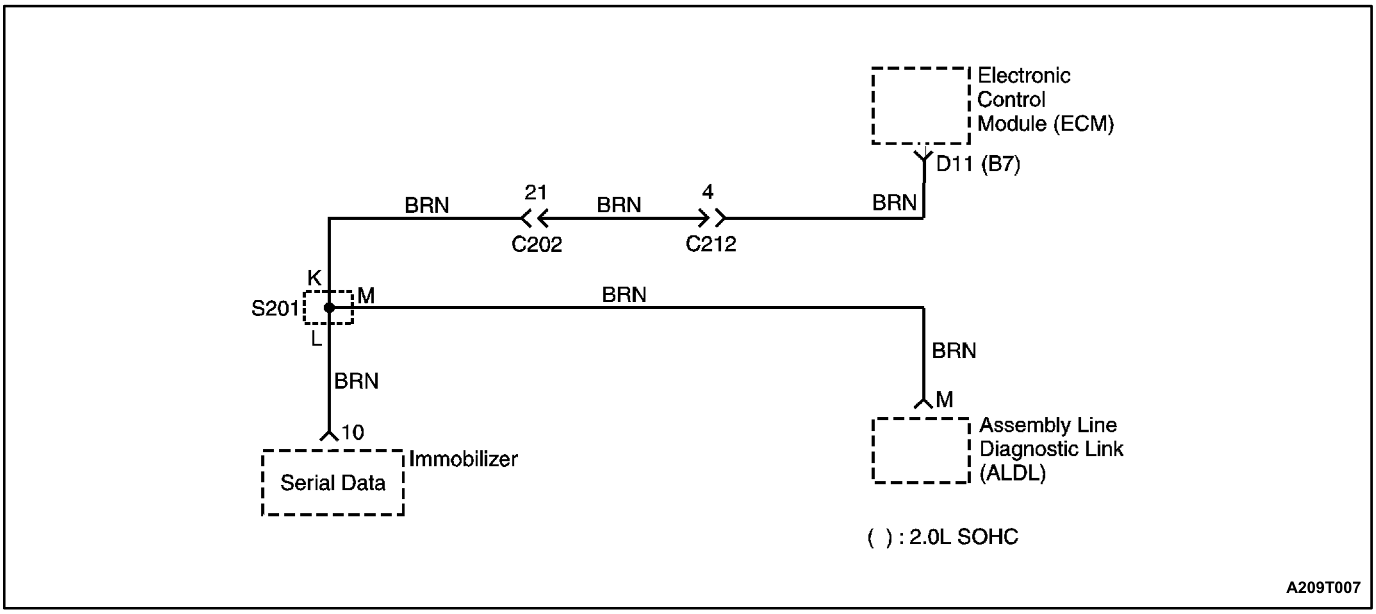
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. A PROM that is incorrectly installed will set the diagnostic trouble code (DTC) 51.

DTC 51 - CHECKSUM or KKPGMID Error (2.0L SOHC and 2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	Check that all of the programmable read-only memory (PROM) pins are fully inserted in the socket. Is the problem found?	-	Go to *Step 3*	Go to *Step 4*
3	1. Install the PROM correctly in the socket. 2. Clear any diagnostic trouble code(s) (DTCs) from the electronic control module (ECM). 3. Check for the presence of any DTCs. Did the DTC 51 reappear?	-	Go to *Step 4*	Go to "Diagnostic System Check"
4	1. Replace the PROM. 2. Clear any DTCs from the ECM. 3. Check for the presence of any DTCs. Did the DTC 51 reappear?	-	Go to *Step 5*	Go to "Diagnostic System Check"
5	1. Replace the ECM. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 53
ECM IMMOBILIZER ERROR (2.0L SOHC AND 2.0L DOHC)

Circuit Description

When the ignition is turned ON, the key is tested by the immobilizer anti-theft system. While the key code is being read by the immobilizer control unit, the engine can start and run with any key that will turn the lock cylinder. The key code is read and compared with key codes that have been stored in the memory of the immobilizer control unit. If a valid key is detected, the immobilizer control unit sends a serial data release message to the electronic control module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM have been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following actions:

- Disables the fuel injector circuit.
- Disables the fuel pump circuit.
- Disables the ignition coil.

DTC 53 Will Set When

- The ECM does not receive the signal from the immobilizer control module within 0.9 seconds when the vehicle is stationary, or within 1.8 seconds when the vehicle is moving.
- The ECM receives an incorrect release message from the immobilizer control unit more than five times.

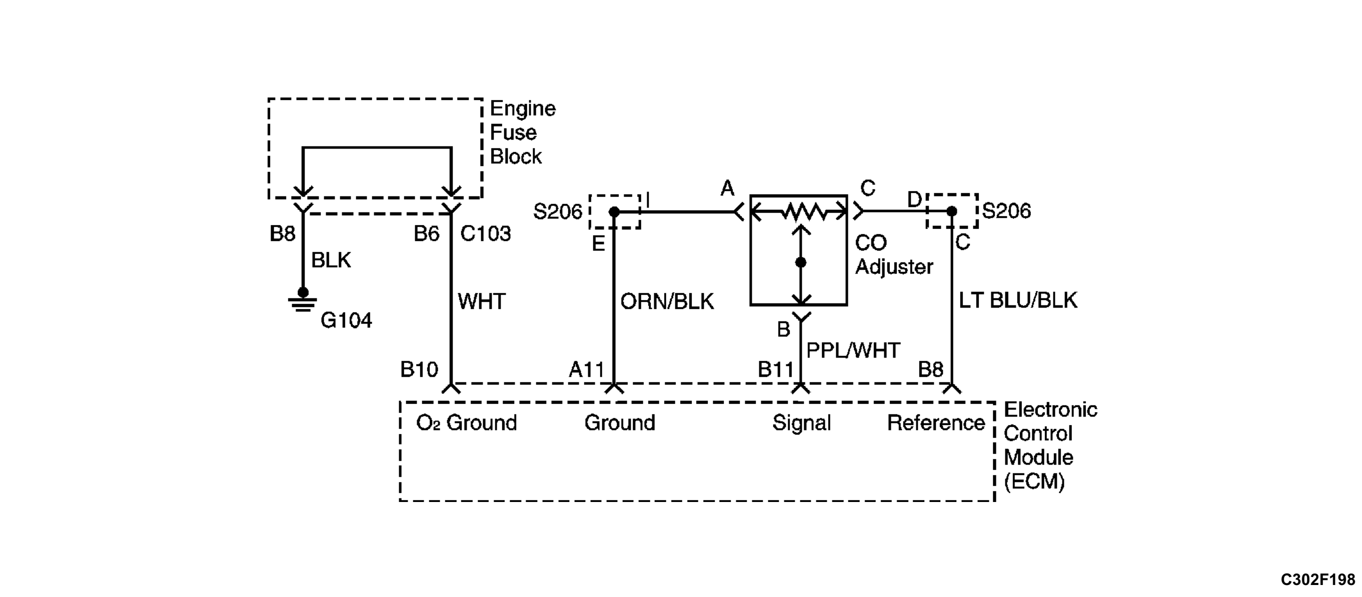
The above conditions will be maintained until the ignition is switched OFF.

DTC 53 Will Clear When

The ignition switch is turned OFF, or the scan tool CLEAR CODES command is issued.

DTC 53 - ECM Immobilizer Error (2.0L SOHC and 2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Connect the scan tool using the following procedure: 1. Insert the immobilizer data cartridge into the scan tool. 2. Turn the ignition switch OFF. 3. Connect the scan tool to the assembly line diagnostic link (ALDL). 4. Connect the scan tool's power cord to the cigar lighter socket. 5. Turn the ignition ON, but do not start the engine. Is communication established between the scan tool and the immobilizer control unit?	-	Go to *Step 2*	Go to "Communication Between Immobilizer and Test Equipment"
2	Select SYSTEM DIAGNOSIS from the scan tool menu. Does the KEY STATUS message indicate POS NR (position number) 00?	-	Go to "Key Status Errors"	Go to *Step 3*
3	1. Select SYSTEM DIAGNOSIS from the scan tool menu. 2. Read the IMMO & ECM ID CODE message. Does the message ID CODE DIFFERENT appear?	-	Go to "Identification (ID) Code Reprogramming"	Go to *Step 4*
4	Check for an open serial data wire between the immobilizer control unit and the electronic control module (ECM). Is the circuit open?	-	Go to *Step 5*	Go to *Step 6*
5	Repair the open serial data wire between the ECM and the immobilizer control unit. Is the repair complete?	-	System OK	-
6	1. Replace the ECM. 2. Reprogram the identification (ID)code. Refer to *Section 9T, Immobilizer Anti-Theft System.* Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 54
CO ADJUST ERROR (2.0L SOHC - LEADED FUEL ONLY)

Circuit Description

The CO adjuster is only used on vehicles that use leaded fuel. The CO adjuster is used in place of the O_2 sensor.

DTC 54 Will Set When

- The engine control system is in open loop.
- CO potentiometer high limit > 254 counts or CO potentiometer low limit < 4.9 counts.

Diagnostic Aids

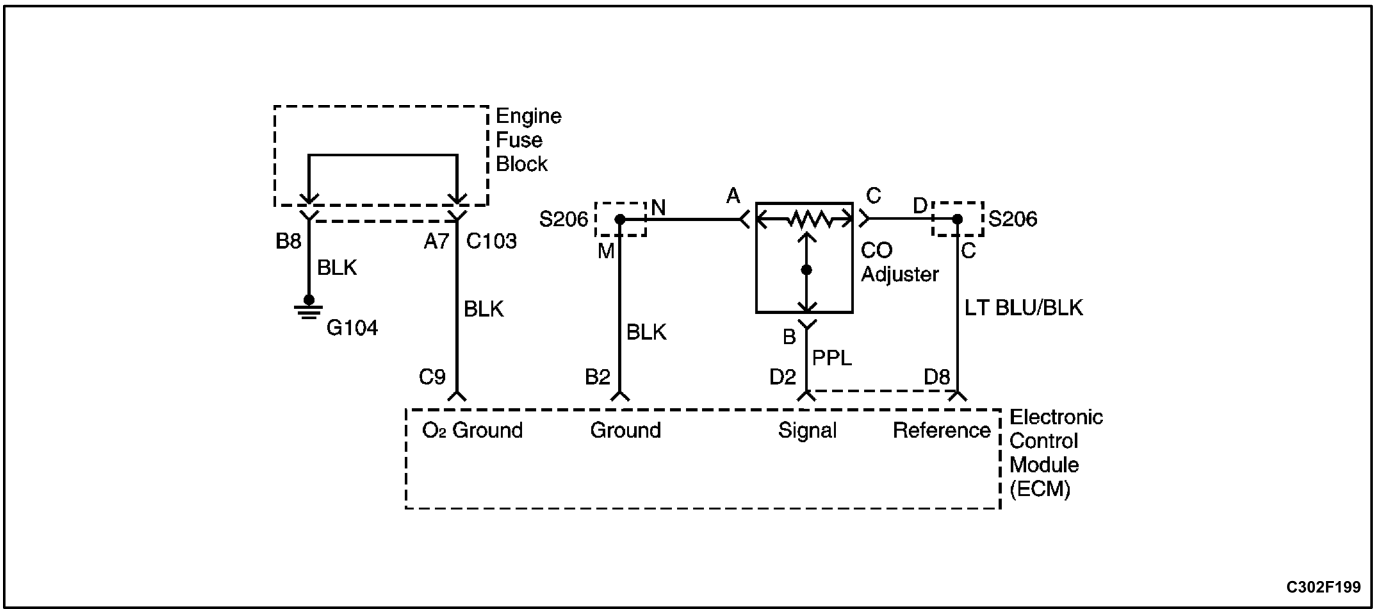
- Inspect the electronic control module (ECM) wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal–to–wire connection, and a damaged harness.

DTC 54 - CO Adjust Error (2.0L SOHC - Leaded Fuel Only)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	Adjust the CO adjuster. Is the CO adjustable and in proper adjustment?	-	System OK	Go to *Step 3*
3	1. To check the ability of the electronic control module (ECM) to provide a 5 volt supply to the CO adjuster, begin by turning the ignition OFF. 2. Disconnect the electrical connector at the CO adjuster. 3. Turn the ignition ON. 4. Measure the voltage between the CO adjuster terminal A and ground. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Check for a short to battery voltage, a short to ground, or an open in the wire between the CO adjuster terminal A and the ECM connector terminal B8. Is the problem found?	-	Go to *Step 8*	Go to *Step 7*

DTC 54 - CO Adjust Error (2.0L SOHC - Leaded Fuel Only) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	Check for a short to battery voltage, a short to ground, or an open in the wire between the CO adjuster terminal C and the ECM connector terminal B11. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
7	Check for a short to battery voltage, a short to ground, or an open in the wire between the CO adjuster terminal B and the ECM connector terminal A11. Is the problem found?	-	Go to *Step 8*	Go to *Step 6*
8	1. Repair the wire or the connector terminal, as needed. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	1. Disconnect the electrical connector at the CO adjuster. 2. Measure the resistance between terminal A and terminal B of the CO adjuster. Is the resistance the value specified?	12.6 Ω	Go to *Step 10*	Go to *Step 11*
10	To check the ability of the CO adjuster to vary the resistance in the circuit, measure the resistance between terminal A and terminal C of the CO adjuster. Does the resistance vary with the turn of the adjuster screw?	-	Go to *Step 12*	Go to *Step 11*
11	1. Replace the CO adjuster. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
12	Check for an open or a short to battery voltage between terminal B10 of the ECM and ground. Is the problem found?	-	Go to *Step 8*	Go to *Step 5*



DIAGNOSTIC TROUBLE CODE (DTC) 54
CO ADJUST ERROR (2.0L DOHC - LEADED FUEL ONLY)

Circuit Description

The CO adjuster is only used on vehicles that use leaded fuel. The CO adjuster is used in place of the O_2 sensor.

DTC 54 Will Set When

- The engine control system is in open loop.
- CO potentiometer > 250 counts or CO potentiometer < 5 counts.

Diagnostic Aids

- Inspect the electronic control module (ECM) wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged harness.

DTC 54 - CO Adjust Error (2.0L DOHC - Leaded Fuel Only)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to Diagnostic System Check"
2	Adjust the CO adjuster. Is the CO adjustable and in proper adjustment?	-	System OK	Go to *Step 3*
3	1. To check the ability of the electronic control module (ECM) to provide a 5 volt supply to the CO adjuster, begin by turning the ignition OFF. 2. Disconnect the electrical connector at the CO adjuster. 3. Turn the ignition ON. 4. Measure the voltage between the CO adjuster terminal A and ground. Does the voltage measure within the value specified?	4.5-5.5 V	Go to *Step 7*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Check for a short to battery voltage, a short to ground, or an open in the wire between the CO adjuster terminal A and the ECM connector terminal D8. Is the problem found?	-	Go to *Step 8*	Go to *Step 7*

DTC 54 - CO Adjust Error (2.0L DOHC - Leaded Fuel Only) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Replace the ECM. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	Check for a short to battery voltage, a short to ground, or an open in the wire between the CO adjuster terminal C and the ECM connector terminal D2. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
7	Check for a short to battery voltage, a short to ground, or an open in the wire between the CO adjuster terminal B and the ECM connector terminal B2. Is the problem found?	-	Go to *Step 8*	Go to *Step 6*
8	1. Repair the wire or the connector terminal, as needed. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
9	1. Disconnect the electrical connector at the CO adjuster. 2. Measure the resistance between terminal A and terminal B of the CO adjuster. Is the resistance the value specified?	12.6 Ω	Go to *Step 10*	Go to *Step 11*
10	To check the ability of the CO adjuster to vary the resistance in the circuit, measure the resistance between terminal A and terminal C of the CO adjuster. Does the resistance vary with the turn of the adjuster screw?	-	Go to *Step 12*	Go to *Step 11*
11	1. Replace the CO adjuster. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
12	Check for an open or a short to battery voltage between terminal C9 of the ECM and ground. Is the problem found?	-	Go to *Step 8*	Go to *Step 5*

DIAGNOSTIC TROUBLE CODE (DTC) 55
EEPROM OR CONFIG REG ERROR (2.0L DOHC)

Circuit Description

The electronic control module (ECM) utilizes an electronically erasable programmable read only memory (EEPROM). The EEPROM contains program information and the calibrations required for engine diagnostics operation.

DTC 55 Will Set When

- Microprocessor configuration register is not equal to $OB.

Diagnostic Aids

The diagnostic trouble code (DTC) 55 indicates that the contents of the electronically erasable programmable read only memory (EEPROM) have changed since the electronic control module (ECM) was programmed. The only possible repair is ECM replacement. Remember to program the replacement ECM with the correct software and calibration for the vehicle.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. When the electronic control module (ECM) is being replaced, the new ECM must be programmed.

DTC 55 - EEPROM or Config Reg Error (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Replace the electronic control module. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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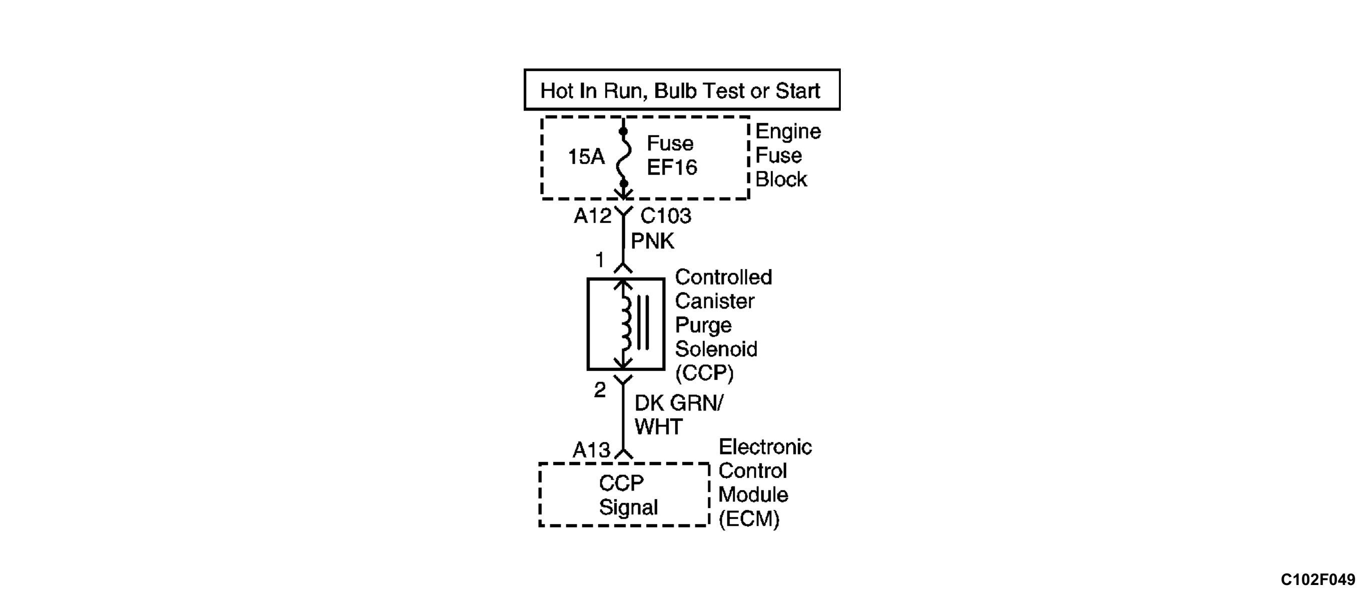


DIAGNOSTIC TROUBLE CODE (DTC) 61
CONTROLLED CANISTER PURGE SOLENOID SHORTED TO GROUND (2.0L DOHC)

Circuit Description

Evaporative canister purge is controlled by the electronic control module (ECM). The ECM applies a ground to the controlled canister purge (CCP) solenoid. The ECM determines when to activate the CCP solenoid depending on operating conditions, including throttle position, engine speed, coolant temperature, and ambient temperature.

DTC 61 Will Set When

- A short to ground condition exists and is present for more than 2 seconds.

Diagnostic Aids

- Inspect the electronic control module (ECM) wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged harness.
- If the connections and the wiring harness are in good condition, connect a test light between the CCP solenoid connector terminal 2 and battery positive while moving related connectors. If the fault is induced, the test light will turn on. This may help to isolate the location of an intermittent problem.

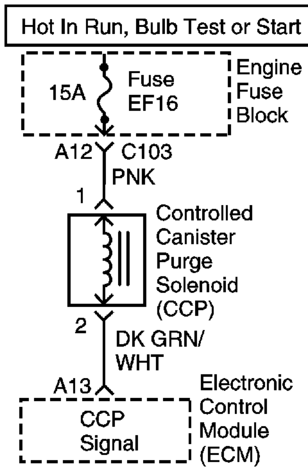
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. With the ignition OFF, the electronic control module (ECM) should not be applying ground to the CCP solenoid.
3. If the test light is still on after disconnecting the ECM red connector, the wire between the CCP solenoid and the ECM is shorted to ground. If the test light goes off, the ECM is at fault.

DTC 61 - Controlled Canister Purge Solenoid Shorted to Ground (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the controlled canister purge (CCP) solenoid connector. 2. Connect a test light between the CCP solenoid connector terminal 2 and battery positive. Is the test light on?	-	Go to *Step 3*	Go to "Diagnostic Aids"
3	Disconnect the electronic control module (ECM) red connector. Is the test light on?	-	Go to *Step 4*	Go to *Step 5*
4	1. Repair the short to ground in the wire between the CCP solenoid connector terminal 2 and the ECM connector terminal A13. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
5	1. Replace the electronic control module. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 62 CONTROLLED CANISTER PURGE SOLENOID SHORTED TO BATTERY (2.0L DOHC)

Circuit Description

Evaporative canister purge is controlled by the electronic control module (ECM). The ECM applies a ground to the controlled canister purge (CCP) solenoid. The ECM determines when to activate the CCP solenoid depending on operating conditions, including throttle position, engine speed, coolant temperature, and ambient temperature.

DTC 62 Will Set When

- A short to battery voltage condition exists and is present for more than 2 seconds.

Diagnostic Aids

- Inspect the electronic control module (ECM) wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged harness.
- If the connections and the wiring harness are in good condition, connect a test light between the CCP solenoid connector terminal 2 and battery positive while moving related connectors. If the fault is induced, the test light will turn on. This may help to isolate the location of an intermittent problem.

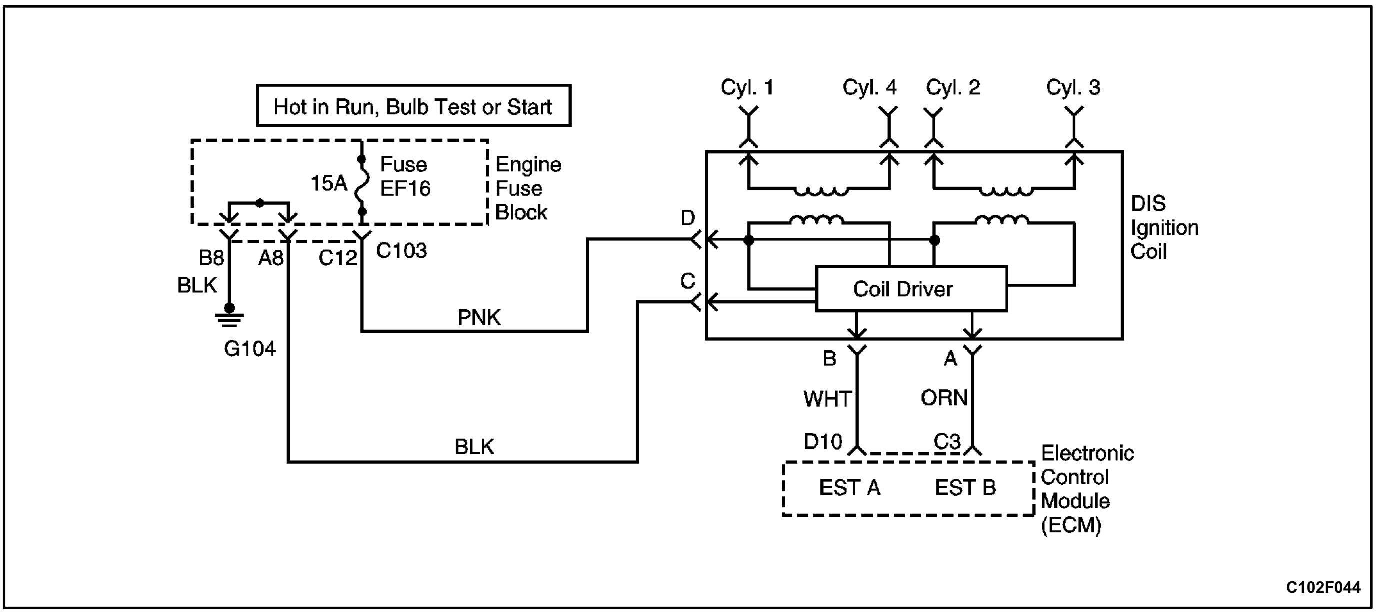
Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. If the test light is still on after disconnecting the ECM red connector, the wire between the CCP solenoid and the ECM is shorted to voltage. If the test light goes off, the ECM is at fault.

DTC 62 - Controlled Canister Purge Solenoid Shorted to Battery (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the controlled canister purge (CCP) solenoid connector. 2. Measure the resistance of the CCP solenoid. Does the resistance measure near the value specified?	≈ 0 Ω	Go to *Step 6*	Go to *Step 3*
3	1. Disconnect the CCP solenoid connector. 2. Connect a test light between the CCP solenoid connector terminal 2 and ground. Is the test light on?	-	Go to *Step 4*	Go to "Diagnostic Aids"
4	Disconnect the electronic control module (ECM) red connector. Is the test light on?	-	Go to *Step 5*	Go to *Step 7*
5	1. Repair the short to voltage in the wire between the CCP solenoid connector terminal 2 and the ECM connector terminal A13. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Replace the CCP solenoid. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
7	1. Replace the electronic control module. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 63 ELECTRONIC SPARK TIMING "B" SHORTED TO GROUND (2.0L SOHC)

Circuit Description

The direct ignition system (DIS) ignition coil is supplied with battery voltage when the ignition is ON. The electronic control module (ECM) triggers the circuit for the DIS ignition coil. Voltage is then induced in the secondary portion of the DIS ignition coil. Control of the DIS ignition coil is monitored separately for the two electronic spark timing lines.

DTC 63 Will Set When

- No voltage is supplied by the electronic control module (ECM) through the electronic spark timing "B" line while reference pulses are received by the ECM from the crankshaft position sensor.
- This error occurs over 16 times.

Diagnostic Aids

- Inspect the electronic control module (ECM) harness connectors for backed-out terminals, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged wiring harness.
- If connections and the harness are OK, connect a digital voltmeter or an oscilloscope between the affected terminal and ground while moving the related connectors and the wiring harness. If the fault is induced, the voltage reading or the scope pattern will change.

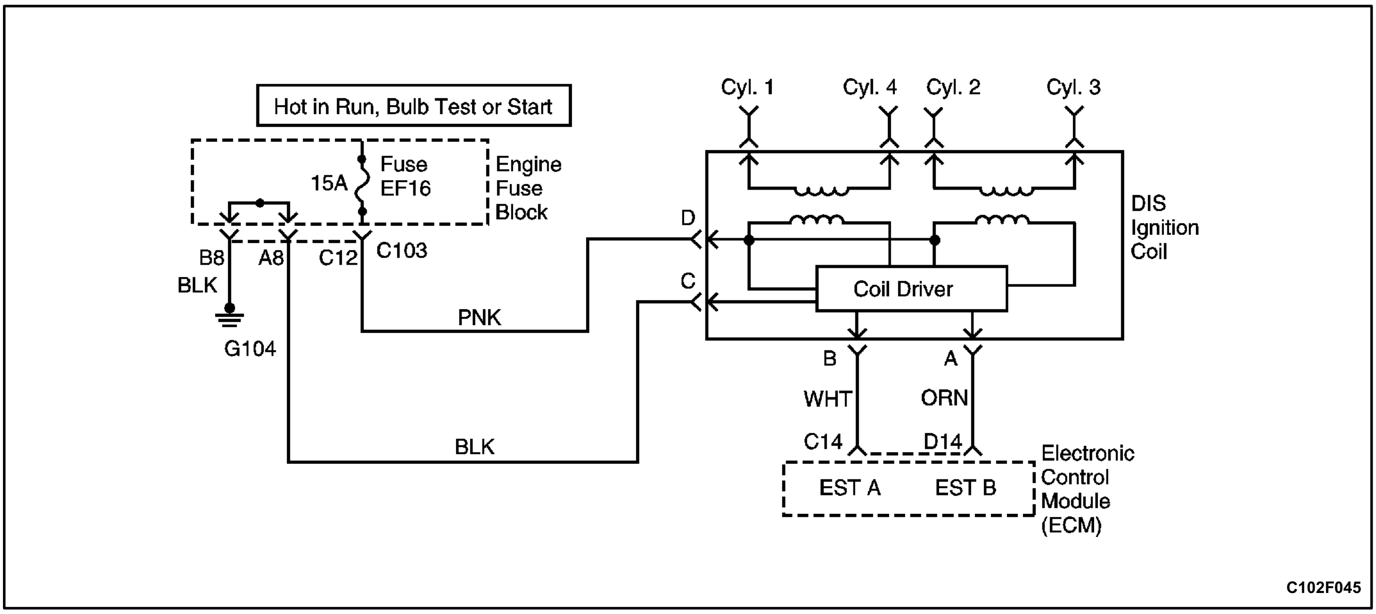
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks both the electronic spark timing (EST) "B" and the ground from the electronic control module (ECM).
6. An open circuit or short to ground that is intermittent may be at fault in the EST "B" wire from the ECM.
11. If there are not any problems in the wiring of the circuit, yet no output from the ECM, the ECM is faulty.

DTC 63 - Electronic Spark Timing "B" Shorted to Ground (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the direct ignition system (DIS) ignition coil connector. 2. Check the DIS ignition coil connector terminals to ensure that the terminals are correctly installed and none of them are touching. Is the problem found?	-	Go to *Step 9*	Go to *Step 3*
3	1. Connect a voltmeter between terminal A and terminal C of the DIS ignition coil. 2. Crank the engine. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 4*	Go to *Step 10*
4	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) white connector. 3. Check for any damaged pins or terminals at the ECM connector terminal C3 or near terminal C3. Is the problem found?	-	Go to *Step 9*	Go to *Step 5*
5	Check for an open or short to ground between the DIS ignition coil connector terminal A and the ECM connector terminal C3. Is the problem found?	-	Go to *Step 7*	Go to *Step 6*
6	Check for an open or short to ground between the DIS ignition coil connector terminal A and the ECM connector terminal C3 while moving the connectors and the wiring harness of the ignition circuit. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	1. Repair the open or short to ground between the DIS ignition coil connector terminal A and the ECM connector terminal C3. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	Check the wires and wiring harnesses of the ignition circuit for any damage that could cause an intermittent open or short to ground. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair any wire or connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the direct ignition system ignition coil assembly. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the electronic control module. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 63 ELECTRONIC SPARK TIMING "B" SHORTED TO GROUND (2.0L DOHC)

Circuit Description

The direct ignition system (DIS) ignition coil is supplied with battery voltage when the ignition is ON. The electronic control module (ECM) triggers the circuit for the DIS ignition coil. Voltage is then induced in the secondary portion of the DIS ignition coil. Control of the DIS ignition coil is monitored separately for the two electronic spark timing lines.

DTC 63 Will Set When

- No voltage is supplied by the electronic control module (ECM) through the electronic spark timing "B" line while reference pulses are received by the ECM from the crankshaft position sensor.
- This error occurs over 6 times.

Diagnostic Aids

- Inspect the electronic control module (ECM) harness connectors for backed-out terminals, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged wiring harness.
- If connections and the harness are OK, connect a digital voltmeter or an oscilloscope between the affected terminal and ground while moving the related connectors and the wiring harness. If the fault is induced, the voltage reading or the scope pattern will change.

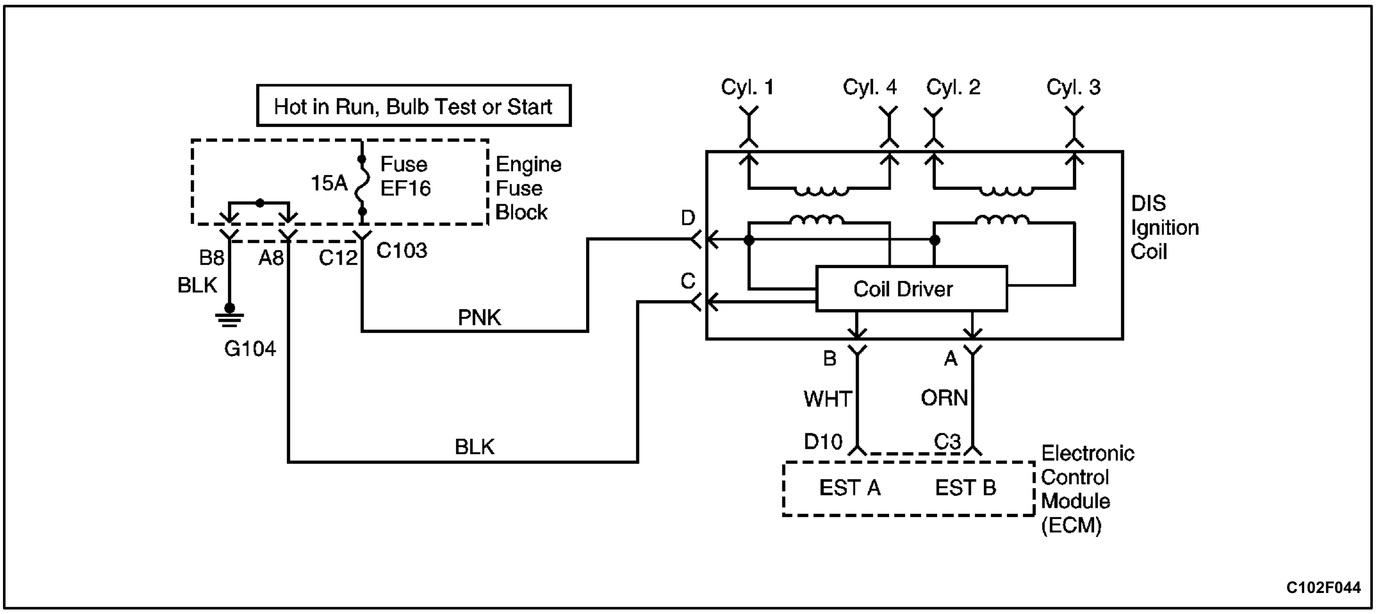
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks both the electronic spark timing (EST) "B" and the ground from the electronic control module (ECM).
6. An open circuit or short to ground that is intermittent may be at fault in the EST "B" wire from the ECM.
11. If there are not any problems in the wiring of the circuit, yet no output from the ECM, the ECM is faulty.

DTC 63 - Electronic Spark Timing "B" Shorted to Ground (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the direct ignition system (DIS) ignition coil connector. 2. Check the DIS ignition coil connector terminals to ensure that the terminals are correctly installed and none of them are touching. Is the problem found?	-	Go to *Step 9*	Go to *Step 3*
3	1. Connect a voltmeter between terminal A and terminal C of the DIS ignition coil. 2. Crank the engine. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 4*	Go to *Step 10*
4	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) white connector. 3. Check for any damaged pins or terminals at or near the ECM connector terminal D14. Is the problem found?	-	Go to *Step 9*	Go to *Step 5*
5	Check for an open or short to ground between the DIS ignition coil connector terminal A and the ECM connector terminal D14. Is the problem found?	-	Go to *Step 7*	Go to *Step 6*
6	Check for an open or short to ground between the DIS ignition coil connector terminal A and the ECM connector terminal D14 while moving the connectors and the wiring harness of the ignition circuit. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	1. Repair the open or short to ground between the DIS ignition coil connector terminal A and the ECM connector terminal D14. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	Check the wires and wiring harnesses of the ignition circuit for any damage that could cause an intermittent open or short to ground. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair any wire or connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the direct ignition system ignition coil assembly. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the electronic control module. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 64
ELECTRONIC SPARK TIMING "A" SHORTED TO GROUND
(2.0L SOHC)

Circuit Description

The direct ignition system (DIS) ignition coil is supplied with battery voltage when the ignition is ON. The electronic control module (ECM) triggers the circuit for the DIS ignition coil. Voltage is then induced in the secondary portion of the DIS ignition coil. Control of the DIS ignition coil is monitored separately for the two electronic spark timing lines.

DTC 64 Will Set When

- No voltage is supplied by the electronic control module (ECM) through the electronic spark timing "A" line while reference pulses are received by the ECM from the crankshaft position sensor.
- This error occurs over 16 times.

Diagnostic Aids

- Inspect the electronic control module (ECM) harness connectors for backed-out terminals, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged wiring harness.
- If connections and the harness are OK, connect a digital voltmeter or an oscilloscope between the affected terminal and ground while moving the related connectors and the wiring harness. If the fault is induced, the voltage reading or the scope pattern will change.

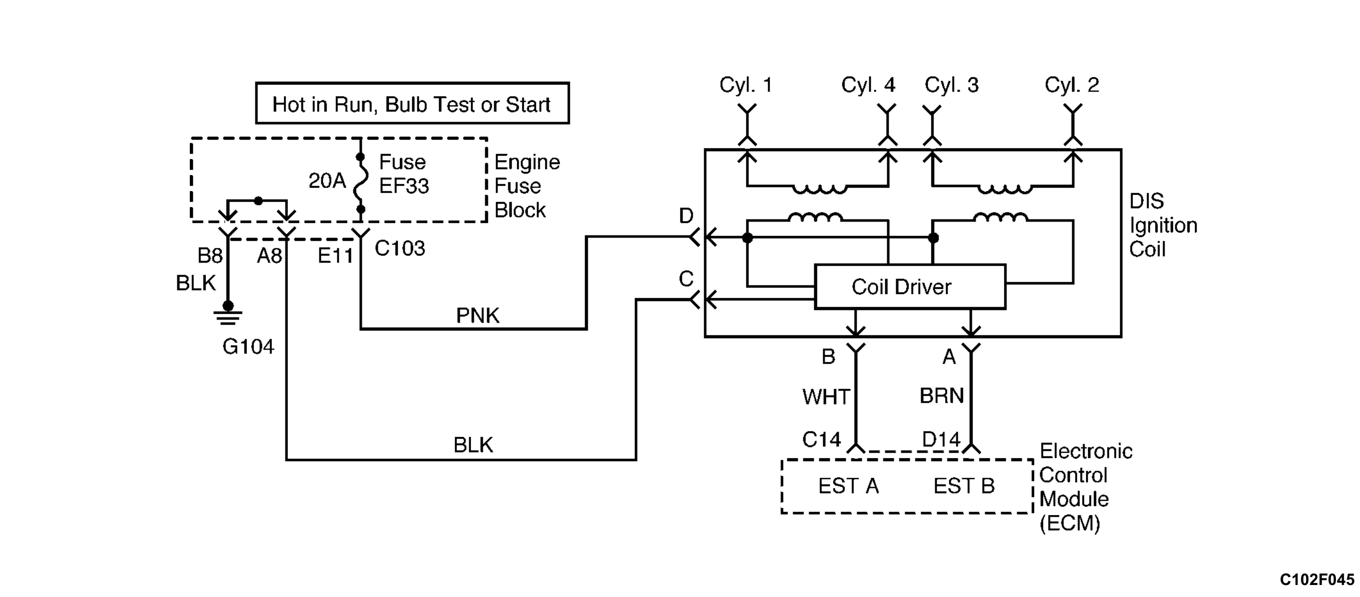
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks both the electronic spark timing (EST) "A" and the ground from the electronic control module (ECM).
6. An open circuit or short to ground that is intermittent may be at fault in the EST "A" wire from the ECM.
11. If there are not any problems in the wiring of the circuit, yet no output from the ECM, the ECM is faulty.

DTC 64 - Electronic Spark Timing "A" Shorted to Ground (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the direct ignition system (DIS) ignition coil connector. 2. Check the DIS ignition coil connector terminals to ensure that the terminals are correctly installed and none of them are touching. Is the problem found?	-	Go to *Step 9*	Go to *Step 3*
3	1. Connect a voltmeter between terminal B and terminal C of the DIS ignition coil. 2. Crank the engine. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 4*	Go to *Step 10*
4	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) white connector. 3. Check for any damaged pins or terminals at the ECM connector terminal D10 or near terminal D10. Is the problem found?	-	Go to *Step 9*	Go to *Step 5*
5	Check for an open or short to ground between the DIS ignition coil connector terminal B and the ECM connector terminal D10. Is the problem found?	-	Go to *Step 7*	Go to *Step 6*
6	Check for an open or short to ground between the DIS ignition coil connector terminal B and the ECM connector terminal D10 while moving the connectors and the wiring harness of the ignition circuit. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	1. Repair the open or short to ground between the DIS ignition coil connector terminal B and the ECM connector terminal D10. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	Check the wires and wiring harnesses of the ignition circuit for any damage that could cause an intermittent open or short to ground. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair any wire or connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the direct ignition system ignition coil assembly. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the electronic control module. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 64
ELECTRONIC SPARK TIMING “A" SHORTED TO GROUND
(2.0L DOHC)

Circuit Description

The direct ignition system (DIS) ignition coil is supplied with battery voltage when the ignition is ON. The electronic control module (ECM) triggers the circuit for the DIS ignition coil. Voltage is then induced in the secondary portion of the DIS ignition coil. Control of the DIS ignition coil is monitored separately for the two electronic spark timing lines.

DTC 64 Will Set When

- No voltage is supplied by the electronic control module (ECM) through the electronic spark timing “A" line while reference pulses are received by the ECM from the crankshaft position sensor.
- This error occurs over 6 times.

Diagnostic Aids

- Inspect the electronic control module (ECM) harness connectors for backed-out terminals, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged wiring harness.
- If connections and the harness are OK, connect a digital voltmeter or an oscilloscope between the affected terminal and ground while moving the related connectors and the wiring harness. If the fault is induced, the voltage reading or the scope pattern will change.

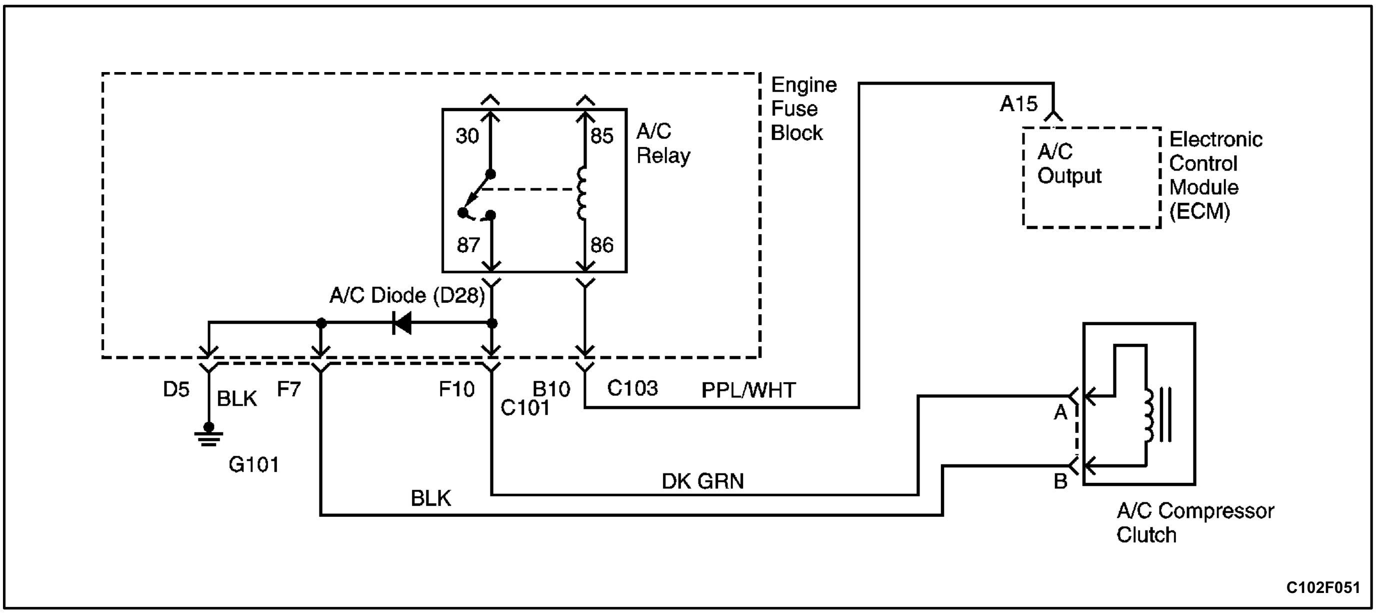
Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks both the electronic spark timing (EST) “A" and the ground from the electronic control module (ECM).
6. An open circuit or short to ground that is intermittent may be at fault in the EST “A" wire from the ECM.
11. If there are not any problems in the wiring of the circuit, yet no output from the ECM, the ECM is faulty.

DTC 64 - Electronic Spark Timing "A" Shorted to Ground (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the direct ignition system (DIS) ignition coil connector. 2. Check the DIS ignition coil connector terminals to ensure that the terminals are correctly installed and none of them are touching. Is the problem found?	-	Go to *Step 9*	Go to *Step 3*
3	1. Connect a voltmeter between terminal B and terminal C of the DIS ignition coil. 2. Crank the engine. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 4*	Go to *Step 10*
4	1. Turn the ignition OFF. 2. Disconnect the electronic control module (ECM) white connector. 3. Check for any damaged pins or terminals at the ECM connector terminal C14 or near terminal C14. Is the problem found?	-	Go to *Step 9*	Go to *Step 5*
5	Check for an open or short to ground between the DIS ignition coil connector terminal B and the ECM connector terminal C14. Is the problem found?	-	Go to *Step 7*	Go to *Step 6*
6	Check for an open or short to ground between the DIS ignition coil connector terminal B and the ECM connector terminal C14 while moving the connectors and the wiring harness of the ignition circuit. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	1. Repair the open or short to ground between the DIS ignition coil connector terminal B and the ECM connector terminal C14. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	Check the wires and wiring harnesses of the ignition circuit for any damage that could cause an intermittent open or short to ground. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
9	1. Repair any wire or connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
10	1. Turn the ignition OFF. 2. Replace the direct ignition system ignition coil assembly. 3. Clear any DTCs from the ECM. 4. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Replace the electronic control module. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 87
AIR CONDITIONING COMPRESSOR RELAY SHORTED TO GROUND
(2.0L DOHC)

Circuit Description

When the A/C switch is turned ON, the electronic control module (ECM) grounds the A/C compressor relay to initiate A/C compressor operation. Under various operating conditions, the ECM will interrupt A/C compressor operation.

DTC 87 Will Set When

- A short to ground condition exists and is present for more than 2 seconds.

Diagnostic Aids

- Inspect the electronic control module (ECM) wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged harness.
- If the connections and the wiring harness are in good condition, connect a test light between the A/C compressor relay connector terminal 85 and battery positive while moving related connectors. If the fault is induced, the test light will turn on. This may help to isolate the location of an intermittent problem.

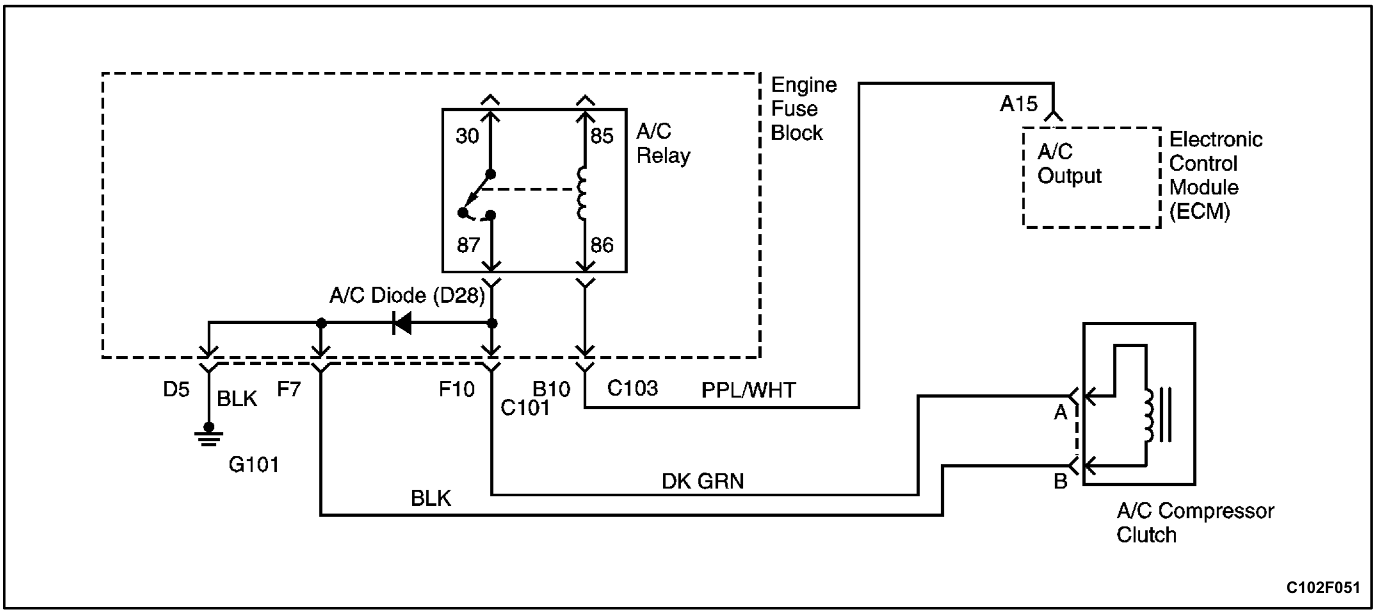
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. With the ignition OFF, the electronic control module (ECM) should not be applying ground to the A/C compressor relay.
3. If the test light is still on after disconnecting the ECM red connector, the wire between the A/C compressor relay and the ECM is shorted to ground. If the test light goes off, the ECM is at fault.

DTC 87 - Air Conditioning Compressor Relay Shorted to Ground (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the A/C compressor relay. 2. Connect a test light between the A/C compressor relay connector terminal 86 and battery positive. Is the test light on?	-	Go to *Step 3*	Go to "Diagnostic Aids"
3	Disconnect the electronic control module (ECM) red connector. Is the test light on?	-	Go to *Step 4*	Go to *Step 5*
4	1. Repair the short to ground in the wire between the A/C compressor relay connector terminal 86 and the ECM connector terminal A15. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
5	1. Replace the electronic control module. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 88 AIR CONDITIONING COMPRESSOR RELAY SHORTED TO BATTERY (2.0L DOHC)

Circuit Description

When the A/C switch is turned ON, the electronic control module (ECM) grounds the A/C compressor relay to initiate A/C compressor operation. Under various operating conditions, the ECM will interrupt A/C compressor operation.

DTC 88 Will Set When

- A short to battery voltage condition exists and is present for more than 2 seconds.

Diagnostic Aids

- Inspect the electronic control module (ECM) wiring harness connectors for improper mating, broken locks, improperly formed or damaged terminals, a poor terminal-to-wire connection, and a damaged harness.
- If the connections and the wiring harness are in good condition, connect a test light between the A/C compressor relay connector terminal 85 and ground while moving related connectors. If the fault is induced, the test light will turn on. This may help to isolate the location of an intermittent problem.

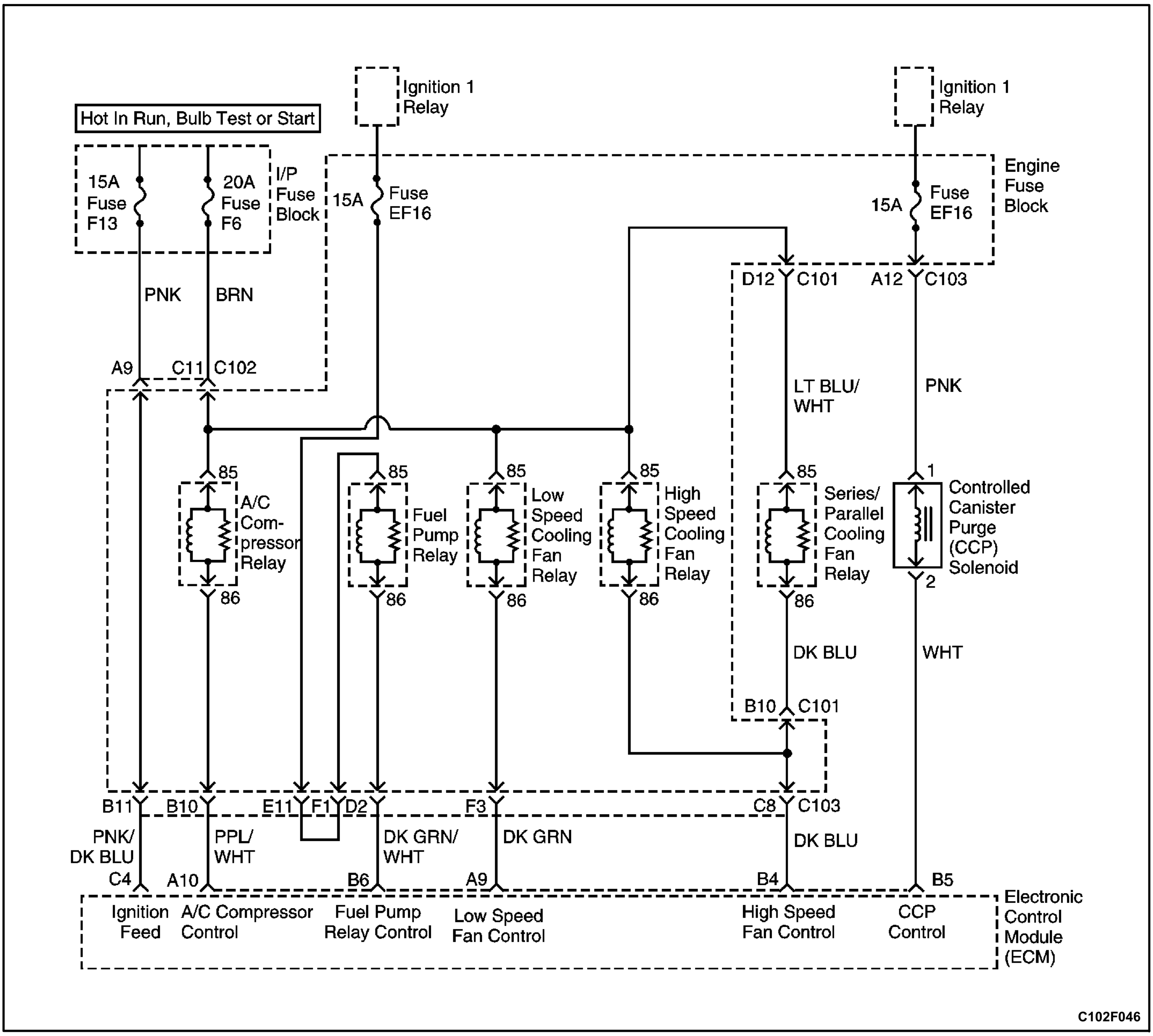
Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. If the test light is still on after disconnecting the ECM red connector, the wire between the A/C compressor relay and the ECM is shorted to voltage. If the test light goes off, the ECM is at fault.

DTC 88 - Air Conditioning Compressor Relay Shorted to Battery (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Determine whether the Diagnostic System Check has been performed. Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the A/C compressor relay. 2. Measure the resistance between the A/C compressor relay terminals 85 and 86. Does the resistance measure near the value specified?	$\approx 0\ \Omega$	Go to *Step 6*	Go to *Step 3*
3	Connect a test light between the A/C compressor relay connector terminal 86 and ground. Is the test light on?	-	Go to *Step 4*	Go to "Diagnostic Aids"
4	Disconnect the electronic control module (ECM) red connector. Is the test light on?	-	Go to *Step 5*	Go to *Step 7*
5	1. Repair the short to voltage in the wire between the A/C compressor relay connector terminal 86 and the ECM connector terminal A15. 2. Clear any diagnostic trouble codes (DTCs) from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
6	1. Replace the A/C compressor relay. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
7	1. Replace the electronic control module. 2. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-



DIAGNOSTIC TROUBLE CODE (DTC) 92 QDM FAILURE (2.0L SOHC)

Circuit Description

The electronic control module (ECM) is used to control several components such as those illustrated above. The ECM controls these devices through the use of a quad driver module (QDM). When the ECM is commanding a component on, the voltage potential of the output circuit will be "low" (near 0 volts). When the ECM is commanding the output circuit to a component off, the voltage potential of the circuit will be "high" (near battery voltage). The primary function of the QDM is to supply the ground for the component being controlled.

The QDM has a fault line which is monitored by the ECM. This ECM will compare the voltage at the QDM based on accepted values of the fault line. If the QDM fault detection circuit senses a voltage other than the accepted value, the diagnostic trouble code (DTC) 92 will be set.

The ECM has an internally protected QDM. This internal protection can be compared to a circuit breaker. If too much current flows in a controlled circuit, this type of QDM turns itself off. This allows the QDM to survive a shorted relay, solenoid, or wire. Repair the fault in the output circuit and the QDM will return to normal operation. It is not necessary to replace the ECM unless it is determined that the ECM itself is faulty.

DTC Will Set When

- A QDM fault has been detected consecutively three times.

Diagnostic Aids

- Related symptoms of a QDM fault, such components on all the time or never on, will isolate the problem circuit.
- Monitor the voltage at connector terminals shown in the wiring diagram while moving related harness connectors, including the ECM harness. This may help in locating an intermittent condition.
- Check for bent connector terminals at the ECM connectors and the connectors of the relays and solenoids.
- Check for bent pins at the ECM.
- If the DTC 92 reoccurs with no apparent connector problem, replace the ECM.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. The electronic control module (ECM) does not know which controlled circuit caused the DTC 92. This step will go through each of the circuits to determine which is at fault.
3. By grounding the assembly line diagnostic link (ALDL), this causes the ECM to actuate all relays and solenoids.
4. By removing the jumper from the ALDL, only the ignition feed should be present to the relay or solenoid. The ECM should no longer be supplying a ground to complete the circuit.
5. With the ECM connectors disconnected, only a short to ground in the wiring between the affected component and the ECM will allow the test light to turn on.
7. If there are no problems found in the wiring and the connections are OK, replace the affected relay or solenoid.
11. If there is no ignition feed to the affected component, check for a blown fuse or open in the wiring. If the fuse is blown, locate and repair the short to ground in that ignition feed circuit.

DTC 92 - QDM Failure (2.0L SOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the electronic control module (ECM) red connector. 2. Turn the ignition ON. 3. Connect an ammeter (set to 2 amp scale) between each of the following ECM connector terminals and ground: • A10 - Fan low relay. • A14 - Fan high relay. • A15 - A/C compressor relay. • A12 - Fuel pump relay. • A13 - CCP solenoid (SOHC). Does the amperage of all circuits measure within the value specified?	<0.75 amps but not 0.0 amps	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Connect the ECM red connector. 3. Use the wiring diagram to determine the specific component terminals to be tested. 4. Disconnect the relay/solenoid from the affected circuit. 5. Jumper terminals A and B of the assembly line diagnostic link (ALDL). 6. Turn the ignition ON. 7. Connect a test light between the connector terminals for the component of the affected circuit. Is the test light on?	-	Go to *Step 4*	Go to *Step 8*

DTC 92 - QDM Failure (1.8L and 2.0L SOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
4	Remove the jumper from the ALDL. Is the test light on?	-	Go to *Step 5*	Go to *Step 7*
5	1. Turn the ignition OFF. 2. Disconnect the ECM red connector. 3. Turn the ignition ON. 4. Connect a test light between the connector terminals for the component of the affected circuit. Is the test light on?	-	Go to *Step 6*	Go to *Step 12*
6	1. Turn the ignition OFF. 2. Repair the short to ground between the component of the affected circuit and the ECM. 3. Connect the ECM red connector. 4. Clear any DTCs from the ECM. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
7	1. Turn the ignition OFF. 2. Check for poor connections and repair as needed. 3. If the connections are OK, replace the component of the affected circuit. 4. Clear any DTCs from the ECM. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	Connect the test light between the ignition feed connector terminal for the component of the affected circuit and ground. Is the test light on?	-	Go to *Step 9*	Go to *Step 11*
9	1. Turn the ignition OFF. 2. Check for an open in the wiring between the component of the affected circuit and the ECM. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
10	1. Repair the open wire. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Repair the open in the affected component ignition feed circuit. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
12	1. Replace the ECM. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

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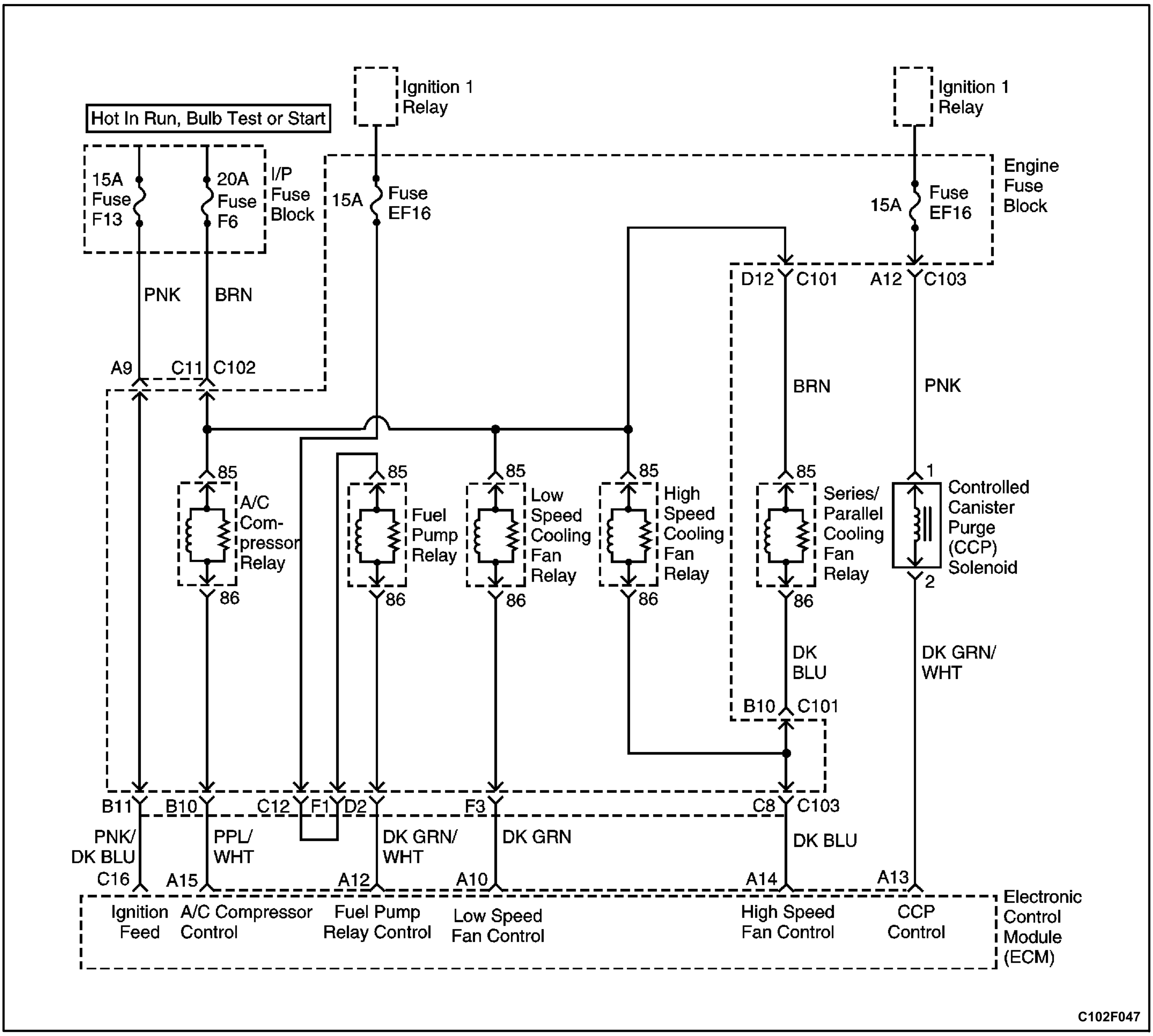


DIAGNOSTIC TROUBLE CODE (DTC) 93
QDM FAILURE (2.0L DOHC)

Circuit Description

The electronic control module (ECM) is used to control several components such as those illustrated above. The ECM controls these devices through the use of a quaddriver module (QDM). When the ECM is commanding a component on, the voltage potential of the output circuit will be "low" (near 0 volts). When the ECM is commanding the output circuit to a component off, the voltage potential of the circuit will be "high" (near battery voltage). The primary function of the QDM is to supply the ground for the component being controlled.

The ECM has an internally protected QDM. This internal protection can be compared to a circuit breaker. If too much current flows in a controlled circuit, this type of QDM turns itself off. This allows the QDM to survive a shorted relay, solenoid, or wire. Repair the fault in the output circuit and the QDM will return to normal operation. It is not necessary to replace the ECM unless it is determined that the ECM itself is faulty.

Each QDM has a fault line which is monitored by the ECM. The ECM will compare the voltage at the QDM based on accepted values of the fault line. If the QDM fault detection circuit senses a voltage other than the accepted value, the diagnostic trouble code (DTC) 93 will be set.

DTC 93 Will Set When

- A QDM fault has been detected consecutively three times.

Diagnostic Aids

- Related symptoms of a QDM fault, such components on all the time or never on, will isolate the problem circuit.
- Monitor the voltage at connector terminals shown in the wiring diagram while moving related harness connectors, including the ECM harness. This may help in locating an intermittent condition.
- Check for bent connector terminals at the ECM connectors and the connectors of the relays and solenoids.
- Check for bent pins at the ECM.
- If the DTC 93 reoccurs with no apparent connector problem, replace the ECM.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. The electronic control module (ECM) does not know which controlled circuit caused the DTC 93. This step will go through each of the circuits to determine which is at fault.
3. By grounding the assembly line diagnostic link (ALDL), this causes the ECM to actuate all relays and solenoids.
4. By removing the jumper from the ALDL, only the ignition feed should be present to the relay or solenoid. The ECM should no longer be supplying a ground to complete the circuit.
5. With the ECM connectors disconnected, only a short to ground in the wiring between the affected component and the ECM will allow the test light to turn on.
7. If there are no problems found in the wiring and the connections are OK, replace the affected relay or solenoid.
11. If there is no ignition feed to the affected component, check for a blown fuse or open in the wiring. If the fuse is blown, locate and repair the short to ground in that ignition feed circuit.

DTC 93 - QDM Failure (2.0L DOHC)

Step	Action	Value(s)	Yes	No
1	Was the Diagnostic System Check performed?	-	Go to *Step 2*	Go to "Diagnostic System Check"
2	1. Disconnect the electronic control module (ECM) red connector. 2. Turn the ignition ON. 3. Connect an ammeter (set to 2 amp scale) between each of the following ECM connector terminals and ground: • A10 - Fan low relay. • A14 - Fan high relay. • A15 - A/C compressor relay. • A12 - Fuel pump relay. • A13 - CCP solenoid. Does the amperage of all circuits measure within the value specified?	<0.75 amps but not 0.0 amps	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Connect the ECM red connector. 3. Use the wiring diagram to determine the specific component terminals to be tested. 4. Disconnect the relay/solenoid from the affected circuit. 5. Jumper terminals A and B of the assembly line diagnostic link (ALDL). 6. Turn the ignition ON. 7. Connect a test light between the connector terminals for the component of the affected circuit. Is the test light on?	-	Go to *Step 4*	Go to *Step 8*

DTC 93 - QDM Failure (2.0L DOHC) (Cont'd)

Step	Action	Value(s)	Yes	No
4	Remove the jumper from the ALDL. Is the test light on?	-	Go to *Step 5*	Go to *Step 7*
5	1. Turn the ignition OFF. 2. Disconnect the ECM red connector. 3. Turn the ignition ON. 4. Connect a test light between the connector terminals for the component of the affected circuit. Is the test light on?	-	Go to *Step 6*	Go to *Step 12*
6	1. Turn the ignition OFF. 2. Repair the short to ground between the component of the affected circuit and the ECM. 3. Connect the ECM red connector. 4. Clear any DTCs from the ECM. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
7	1. Turn the ignition OFF. 2. Check for poor connections and repair as needed. 3. If the connections are OK, replace the component of the affected circuit. 4. Clear any DTCs from the ECM. 5. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
8	Connect the test light between the ignition feed connector terminal for the component of the affected circuit and ground. Is the test light on?	-	Go to *Step 9*	Go to *Step 11*
9	1. Turn the ignition OFF. 2. Check for an open in the wiring between the component of the affected circuit and the ECM. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
10	1. Repair the open wire. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
11	1. Repair the open in the affected component ignition feed circuit. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-
12	1. Replace the ECM. 2. Clear any DTCs from the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	-	System OK	-

DIAGNOSIS (2.2L DOHC)
SYSTEM DIAGNOSIS

DIAGNOSTIC AIDS

If an intermittent problem is evident, follow the guidelines below.

Preliminary Checks

Before using this section you should have already performed the "On-Board Diagnostic System Check."

Perform a thorough visual inspection. This inspection can often lead to correcting a problem without further checks and can save valuable time. Inspect for the following conditions:

- Engine control module (ECM) grounds for being clean, tight, and in their proper location.
- Vacuum hoses for splits, kinks, collapsing and proper connections as shown on the Vehicle Emission Control Information label. Inspect thoroughly for any type of leak or restriction.
- Air leaks at the throttle body mounting area and the intake manifold sealing surfaces.
- Ignition wires for cracks, hardness, proper routing, and carbon tracking.
- Wiring for proper connections.
- Wiring for pinches or cuts.

Diagnostic Trouble Code Tables

Do not use the diagnostic trouble code (DTC) tables to try and correct an intermittent fault. The fault must be present to locate the problem.

Incorrect use of the DTC tables may result in the unnecessary replacement of parts.

Faulty Electrical Connections or Wiring

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful inspection of suspect circuits for the following:

- Poor mating of the connector halves.
- Terminals not fully seated in the connector body.
- Improperly formed or damaged terminals. All connector terminals in a problem circuit should be carefully inspected, reformed, or replaced to insure contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body.

Road Test

If a visual inspection does not find the cause of the problem, the vehicle can be driven with a voltmeter or a scan tool connected to a suspected circuit. An abnormal voltage or scan tool reading will indicate that the problem is in that circuit.

If there are no wiring or connector problems found and a DTC was stored for a circuit having a sensor, except for DTC P0171 and DTC P0172, replace the sensor.

Fuel System

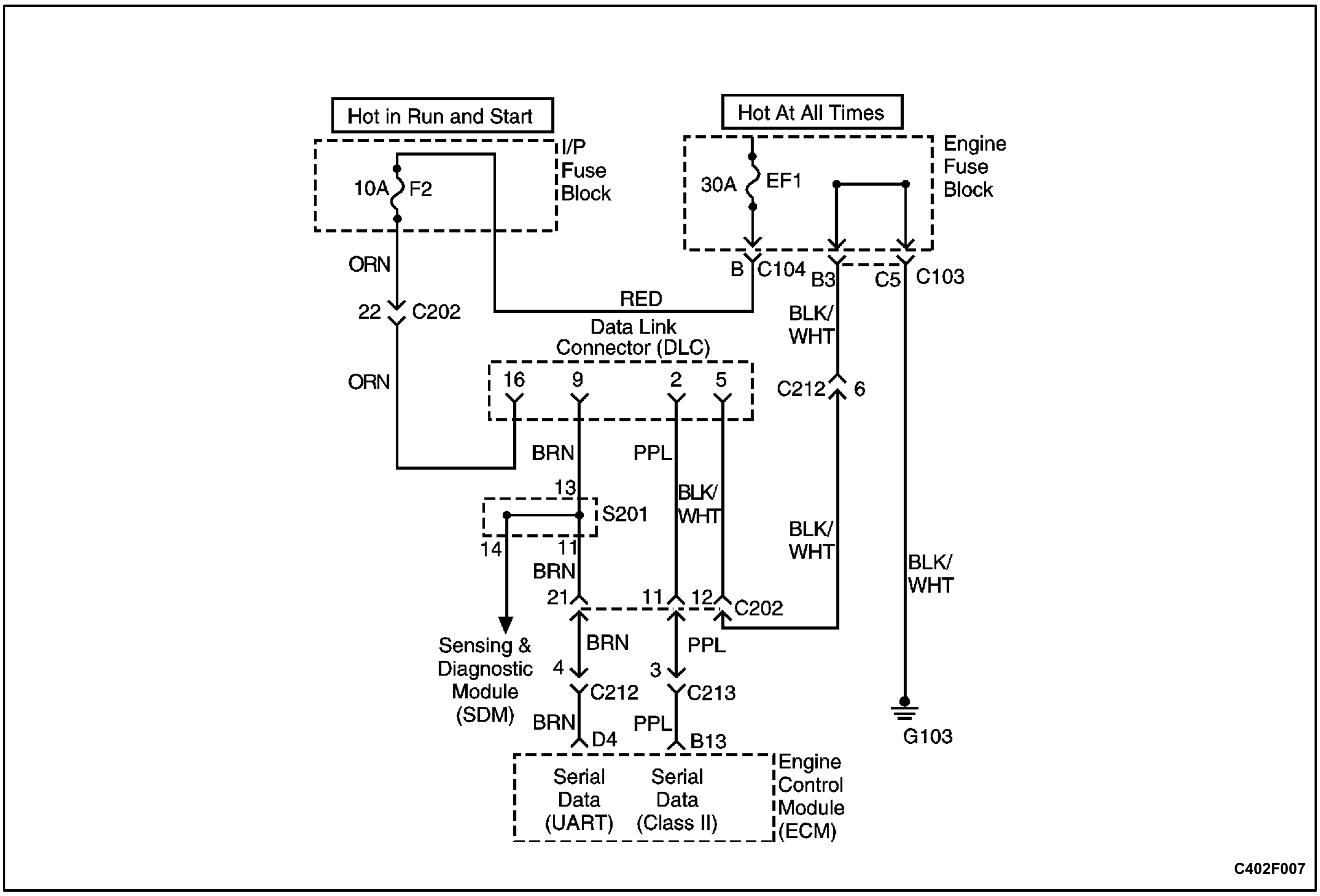
Some intermittent driveability problems can be attributed to poor fuel quality. If a vehicle is occasionally running rough, stalling, or otherwise performing badly, ask the customer about the following fuel buying habits:

- Do they always buy from the same source? If so, fuel quality problems can usually be discounted.
- Do they buy their fuel from whichever fuel station that is advertising the lowest price? If so, check the fuel tank for signs of debris, water, or other contamination.

IDLE LEARN PROCEDURE

Whenever the battery cables, the engine control module (ECM), or the fuse is disconnected or replaced, the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.
4. Start the engine in park/neutral.
5. Allow the engine to run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.
7. Turn the A/C OFF for 10 seconds, if equipped.
8. If the vehicle is equipped with an automatic transaxle, apply the parking brake. While pressing the brake pedal, place the transaxle in D (drive).
9. Turn the A/C ON for 10 seconds, if equipped.
10. Turn the A/C OFF for 10 seconds, if equipped.
11. Turn the ignition OFF. The idle learn procedure is complete.



ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

Circuit Description

The OnBoard Diagnostic (OBD) System Check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the engine control module (ECM) and the engine grounds for cleanliness and tightness.

The OBD system check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbedthrough wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the ECM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connections, and damaged harness.

Test Description

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

1. The Malfunction Indicator Lamp (MIL) should be on steady with the ignition on and the engine off. If not, go to "Diagnostic Aids."
2. Checks the Class 2 data circuit and ensures that the ECM is able to transmit serial data.
3. This test ensures that the ECM is capable of controlling the MIL, and the MIL driver circuit is not shorted to ground.
4. If the engine will not start, refer to "Engine Cranks But Will Not Run" in this section.
7. A scan tool parameter which is not within the typical range may help to isolate the area which is causing the problem.
10. This vehicle is equipped with an ECM, which utilizes an electrically erasable programmable read only memory (EEPROM). The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

OnBoard Diagnostic (OBD) System Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition ON with the engine OFF. 2. Observe the Malfunction Indicator Lamp (MIL). Is the MIL on?	-	Go to *Step 2*	Go to "No Malfunction Indicator Lamp"
2	1. Turn the ignition OFF. 2. Install the scan tool. 3. Turn the ignition ON. 4. Attempt to display the engine control module (ECM) engine data with the scan tool. Does the scan tool display the ECM engine data?	-	Go to *Step 3*	Go to *Step 8*
3	1. Using the scan tool output test function, select the MIL dash lamp control and command the MIL off. 2. Observe the MIL. Does the MIL turn off?	-	Go to *Step 4*	Go to "Malfunction Indicator Lamp on Steady"
4	Attempt to start the engine. Does the engine start and continue to run?	-	Go to *Step 5*	Go to "Engine Cranks But Will Not Run"
5	Select DISPLAY DTC with the scan tool. Are any Diagnostic Trouble Codes stored?	-	Go to *Step 6*	Go to *Step 7*
6	Check the display for DTCs P0107, P0108, P0113, P0118, P0122, P0123, P0172, P1392. Are two or more of the following DTCs stored?	-	Go to "Multiple ECM Information Sensor DTCs Set"	Go to applicable DTC table
7	Compare the ECM data values displayed on the scan tool to the typical engine scan data values. Are the displayed values normal or close to the typical values?	-	Go to "ECM Output Diagnosis"	Go to indicated component system check
8	1. Turn the ignition OFF and disconnect the ECM. 2. Turn the ignition ON with the engine OFF. 3. Check the class 2 data circuit for an open, short to ground, or short to voltage. Also check the Data Link Connector (DLC) ignition feed circuit for an open or short to ground, and check the DLC ground circuits for an open. Is a problem found?	-	Go to *Step 9*	Go to *Step 10*
9	Repair the open, short to ground, or short to voltage in the class 2 data circuit or the DLC ignition feed circuit. Is the repair complete?	-	System OK	-
10	1. Attempt to reprogram the ECM. 2. Attempt to display the ECM data with the scan tool. Does the scan tool display ECM engine data?	-	Go to *Step 2*	Go to *Step 11*
11	Replace the ECM. Is the repair complete?	-	System OK	-

ECM OUTPUT DIAGNOSIS

Circuit Description

The engine control module (ECM) controls most components with electronic switches which complete a ground circuit when turned on. These switches are arranged in groups of 4 and 7, and they are called either a Surface Mounted Quad Driver Module, which can independently control up to 4 output terminals or an Output Driver Module (ODM), which can independently control up to 7 outputs. Not all of the outputs are always used.

Drivers are fault protected. If a relay or solenoid is shorted, having very low or zero resistance, or if the control side of the circuit is shorted to voltage, it would allow too much current flow into the ECM. The driver senses this and the output is either turned OFF or its internal resistance increases to limit current flow and protect the ECM and driver. The result is high output terminal voltage when it should be low. If the circuit from B+ to the component or the component is open, or the control side of the circuit is shorted to ground, terminal voltage will be low. Either of these conditions is considered to be a driver fault.

Drivers also have a fault line to indicate the presence of a current fault to the ECM's central processor. A scan tool displays the status of the driver fault lines as 0=OK and 1=Fault.

Diagnostic Aids

The scan tool has the ability to command certain components and functions ON and OFF. If a component or function does not have this capability, operate the vehicle during its normal function criteria to check for an open or shorted circuit.

An open or short to ground will appear in the open positions on the scan tool only when it is not commanded by the ECM or the scan tool, while a short to voltage will appear in the short positions on the scan tool only while the component is being commanded by the ECM or scan tool.

Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. A 1 in any of the positions indicates that an open or short is present in the corresponding circuit for that position.
4. An open or short to ground will appear in the open positions on the scan tool only when it is not commanded by the ECM or scan tool, while a short to voltage will appear in the short positions on the scan tool only while the component is being commanded by the ECM or scan tool.
5. Proper operation of any component of function with no 1 in any operation of the positions indicates that system operation is normal at this time.
6. A component or function that failed to operate at this point indicates that the fault is not on the ECM side of the circuitry.
7. The 1 disappears after disconnecting the component electrical connector. This indicates that the component or component side wiring is at fault. If the scan tool indicates a fault after disconnecting the component electrical connector and verifying that no open or short is present in the circuit, then the ECM is faulty.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
9. If no faults have been found at this point, refer to "Diagnostic Aids" in this section for additional checks and information.

ECM Output Diagnosis

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Install the scan tool. Is there a number 1 below any of the numbered positions in the OUTPUT DRIVERS?	-	Go to *Step 3*	Go to *Step 4*
3	Check for an open or shorted circuit in any corresponding position (circuit) that contained a number 1 and repair as necessary. Is a repair necessary?	-	Go to *Step 10*	Go to *Step 8*
4	Command the output being checked with a scan tool while watching the corresponding position for each circuit. Do any of the positions change to a 1?	-	Go to *Step 7*	Go to *Step 5*
5	Command the output being checked with a scan tool while watching the corresponding position for each circuit. Does the component or function operate when commanded?	-	Go to *Step 10*	Go to the appropriate component repair
6	Repair the short to voltage in the corresponding circuit for position (circuit) that displayed a 1. Is the repair complete?	-	Go to *Step 10*	-
7	Disconnect the electrical connector to the component connected to the faulty circuit. Is a 1 still displayed in the corresponding OUTPUT DRIVER position?	-	Go to *Step 9*	Go to the appropriate component repair
8	Replace the engine control module (ECM). Is the repair complete?	-	Go to *Step 10*	-
9	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*

MULTIPLE ECM INFORMATION SENSOR DTCS SET

Circuit Description

The engine control module (ECM) monitors various sensors to determine engine operating conditions. The ECM controls fuel delivery, spark advance, transaxle operation, and emission control device operation based on the sensor inputs.

The ECM provides a sensor ground to all of the sensors. The ECM applies 5 volts through a pull-up resistor and monitors the voltage present between the sensor and the resistor to determine the status of the Engine Coolant Temperature Sensor (CTS), the Intake Manifold Air Temperature (MAT) sensor. The ECM provides the Exhaust Gas Recirculation (EGR) Pintle Position Sensor, the Throttle Position Sensor (TPS), the Manifold Absolute Pressure (MAP) sensor, and the Fuel Tank Pressure Sensor with a 5 volt reference and a sensor ground signal. The ECM monitors the separate feedback signals from these sensors to determine their operating status.

Diagnostic Aids

Be sure to inspect the ECM and the engine grounds for being secure and clean.

A short to voltage in one of the sensor circuits can cause one or more of the following DTCs to be set: P0108, P0113, P0118, P0123, P1106, P1111, P1115, P1121, P1625.

If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the ECM and the splice will cause one or more of the following DTCs to be set: P0108, P0113, P0118, P0123, P1106, P1111, P1115, P1121.

A short to ground in the 5 volt reference circuit or an open in the 5 volt reference circuit between the ECM and the splice will cause one or more of the following DTCs to be set: P0107, P0112, P0117, P0122, P1107, P1112, P1114, P1122.

Check for the following conditions:

- Inspect for a poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Inspect the wiring harness for damage. If the harness appears to be OK, observe an affected sensor's displayed value on the scan tool with the ignition ON and the engine OFF while moving connectors and wiring harnesses related to the affected sensors. A change in the affected sensor's displayed value will indicate the location of the fault.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
9. A faulty EGR valve can leak a small amount of current from the ignition feed circuit to the 5 volt reference circuit. If the problem does not exist with the EGR valve disconnected, replace the EGR valve.

12 - 19. If a sensor input circuit has been shorted to voltage, ensure that the sensor has not been damaged. A damaged MAT or CTS sensor will continue to indicate a high voltage or low temperature after the affected circuit has been repaired. A damaged Air Conditioning Pressure (ACP), TP, MAP, Fuel Tank Pressure, or EGR Pintle Position sensor will indicate a high or low voltage or may be stuck at a fixed value after the affected circuit has been repaired. If the sensor has been damaged, replace it.

21. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

Multiple ECM Information Sensor DTCs Set

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the check performed?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"

Multiple ECM Information Sensor DTCs Set (Cont'd)

Step	Action	Value(s)	Yes	No
2	1. Turn the ignition OFF and disconnect the engine control module (ECM). 2. Turn the ignition ON and check the 5 volt reference circuit for the following conditions: • Poor connection at the ECM. • Open between the ECM connector affected sensors shorted to ground or voltage. 3. If a problem is found, locate and repair the open or short circuit as necessary. Is a problem found?	-	Go to *Step 19*	Go to *Step 3*
3	1. Check the sensor ground circuit for the following conditions: • Poor connection at the ECM or affected sensors. • Open between the ECM connector and the affected sensors. 2. If a problem is found, repair it as necessary. Is a problem found?	-	Go to *Step 19*	Go to *Step 4*
4	Measure the voltage between the Exhaust Gas Recirculation (EGR) Pintle Position Sensor signal circuit at the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 5*	Go to *Step 9*
5	Measure the voltage between the Manifold Absolute Pressure (MAP) sensor signal circuit and the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 6*	Go to *Step 11*
6	Measure the voltage between the throttle position sensor (TPS) signal circuit and the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 7*	Go to *Step 12*
7	Measure the voltage between the Intake Manifold Air Temperature (MAT) Sensor signal circuit and the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 8*	Go to *Step 13*
8	Measure the voltage between the Engine Coolant Temperature (CTS) sensor signal circuit and the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 16*	Go to *Step 14*
9	1. Disconnect the EGR valve. 2. Measure the voltage between the EGR Pintle Position sensor signal circuit and the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 10*	Go to *Step 15*
10	Replace the EGR valve. Is the repair complete?	-	Go to *Step 19*	-
11	Locate and repair the short to voltage in the MAP sensor signal circuit. Is the repair complete?	-	Go to *Step 19*	-

Multiple ECM Information Sensor DTCs Set (Cont'd)

Step	Action	Value(s)	Yes	No
12	Locate and repair the short to voltage in the TPS signal circuit. Is the repair complete?	-	Go to *Step 19*	-
13	Locate and repair the short to voltage in the MAT sensor signal circuit. Is the repair complete?	-	Go to *Step 19*	-
14	Locate and repair the short to voltage in the CTS sensor signal circuit. Is the repair complete?	-	Go to *Step 19*	-
15	Locate and repair the short to voltage in the EGR Pintle Position sensor circuit. Is the repair complete?	-	Go to *Step 19*	-
16	Measure the voltage between the Fuel Tank Pressure sensor signal circuit and the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 18*	Go to *Step 17*
17	Locate and repair the short to voltage in the Fuel Tank Pressure sensor signal circuit. Is the repair complete?	-	Go to *Step 19*	-
18	Replace the ECM. Is the repair complete?	-	Go to *Step 19*	-
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTCs as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 20*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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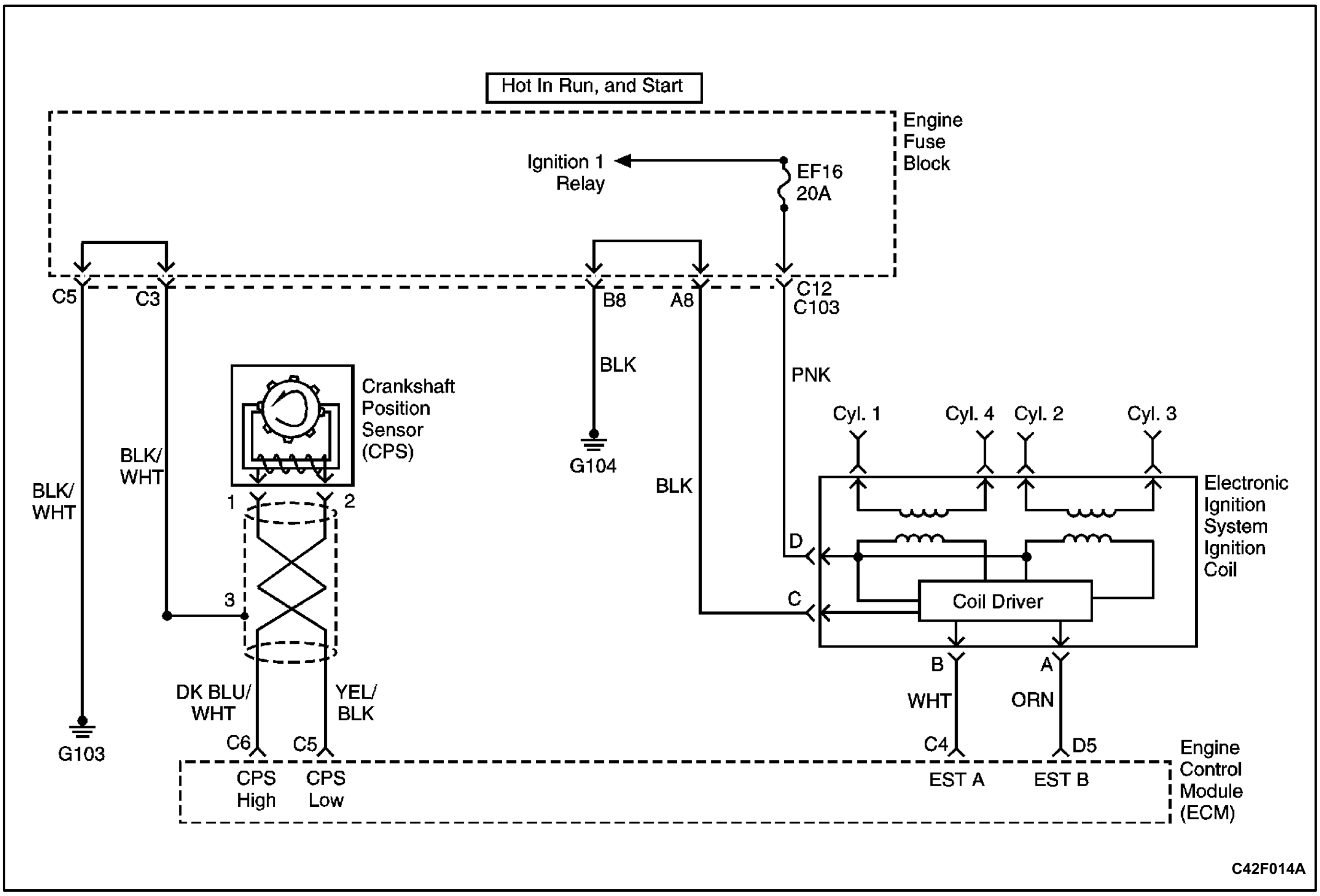
Hot In Run, and Start
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Fuse
Block
Ignition 1
Relay
EF16
20A
C5
C3
B8
A8
C12
C103
BLK
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Crankshaft
Position
Sensor
(CPS)
G104
BLK/
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BLK
Cyl. 1
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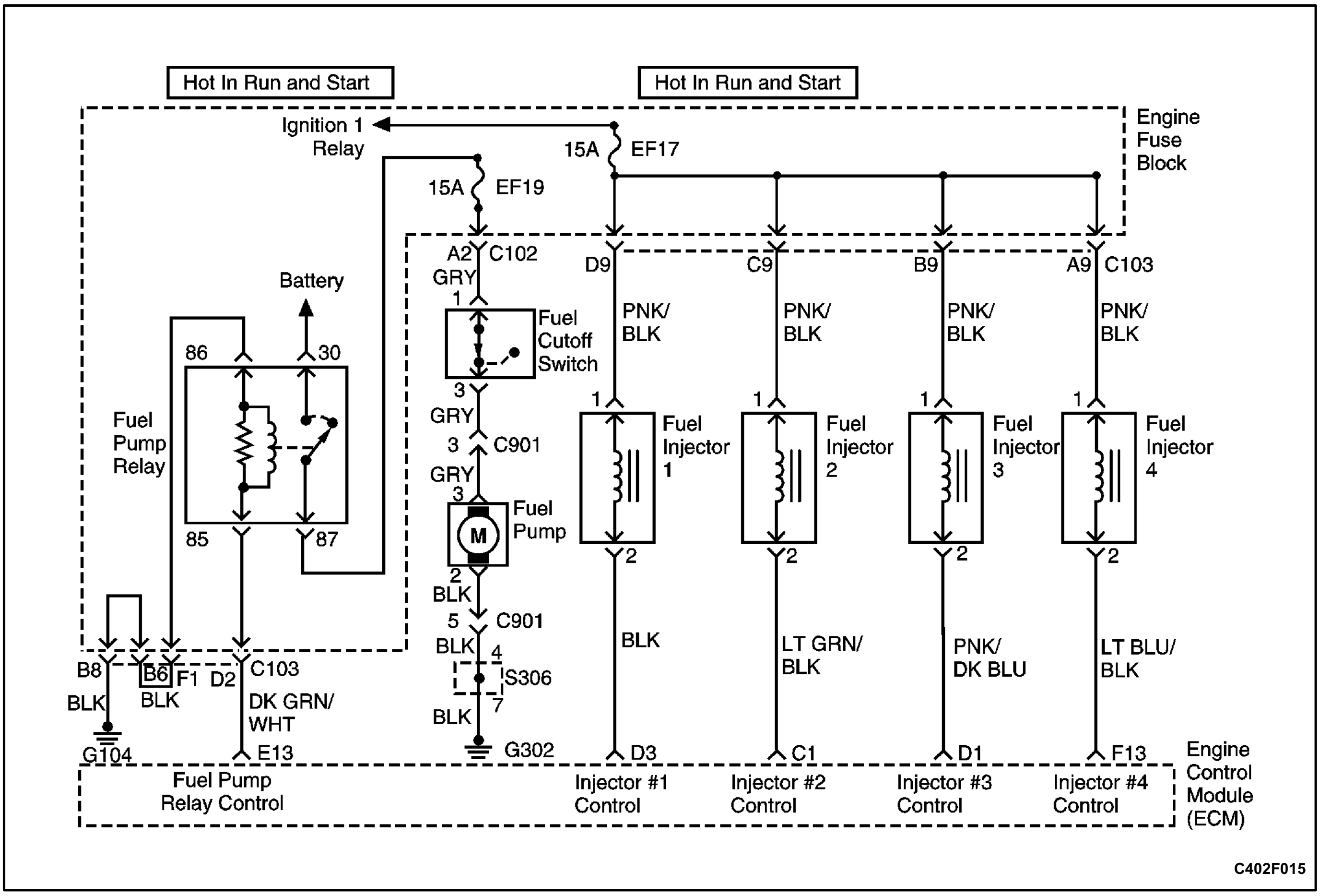
Module
(ECM)
C42F014A


Hot In Run and Start
Hot In Run and Start
Engine
Fuse
Block
Ignition 1
Relay
15A
EF17
15A
EF19
A2
C102
GRY
1
Fuel
Cutoff
Switch
3
GRY
3
C901
GRY
3
Fuel
Pump
2
BLK
5
C901
BLK
4
S306
7
BLK
G302
Battery
86
30
85
87
Fuel
Pump
Relay
D9
C9
B9
A9
C103
PNK/
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BLK
PNK/
DK BLU
LT BLU/
BLK
B8
B6
F1
D2
C103
BLK
BLK
DK GRN/
WHT
G104
E13
D3
C1
D1
F13
Fuel Pump
Relay Control
Injector #1
Control
Injector #2
Control
Injector #3
Control
Injector #4
Control
Engine
Control
Module
(ECM)
C402F015

ENGINE CRANKS BUT WILL NOT RUN

Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. By performing a compression test, it can be determined if the engine has the mechanical ability to run.
9. It is important to check for the presence of spark from all of the ignition wires. If spark is present from one to three of the ignition coil terminals, the crankshaft position sensor (CPS) is OK.
19. In checking the engine control module (ECM) outputs for the electronic spark timing signal, it is recommended to use an oscilloscope to view the varying voltage signals. In measuring these outputs with a voltmeter, intermittent errors may occur that cannot be seen by a voltmeter.
35. This step checks for proper operation of the ECM's control of the fuel pump circuit.
59. This step checks for a ground signal being supplied by the ECM to operate the fuel injectors. If there is no ground present during the cranking of the engine, and the fuel injector wiring is OK, the ECM is at fault.

Engine Cranks But Will Not Run

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Important: If a no start condition exists, ensure the fuel cutoff switch has not been tripped prior to further diagnosis.

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Crank the engine. Does the engine start and continue to run?	-	System OK	Go to *Step 3*
3	Perform a cylinder compression test. Is the cylinder compression for all of the cylinders at or above the value specified?	689 kPa (100 psi)	Go to *Step 7*	Go to *Step 4*
4	Inspect the timing belt alignment. Is the timing belt in alignment?	-	Go to *Step 6*	Go to *Step 5*
5	Align or replace the timing belt as needed. Is the repair complete?	-	Go to *Step 2*	-
6	Repair the internal engine damage as needed. Is the repair complete?	-	Go to *Step 2*	-
7	Inspect the fuel pump fuse. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
8	Replace the fuse. Is the repair complete?	-	Go to *Step 2*	-
9	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	-	Go to *Step 34*	Go to *Step 10*
10	1. Measure the resistance of the ignition wires. 2. Replace any of the ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	30,000 Ω	Go to *Step 2*	Go to *Step 11*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition OFF. 2. Disconnect the crankshaft position sensor (CPS) connector. 3. Turn the ignition ON. 4. Measure the voltage between the CPS connector terminals 1 and 3. Does the voltage measure near the value specified?	1.08 V	Go to *Step 12*	Go to *Step 13*
12	Measure the voltage between the CPS connector terminals 2 and 3. Does the voltage measure near the value specified?	1.08 V	Go to *Step 19*	Go to *Step 14*
13	Measure the voltage between the CPS connector terminal 1 and ground. Does the voltage measure near the value specified?	1.08 V	Go to *Step 15*	Go to *Step 16*
14	Measure the voltage between the CPS connector terminal 2 and ground. Does the voltage measure near the value specified?	1.08 V	Go to *Step 15*	Go to *Step 17*
15	Check for an open or short in the wire between the CPS connector terminal 3 and ground. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
16	Check for an open or short in the wire between the CPS connector terminal 1 and the engine control module (ECM) connector terminal C6. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
17	Check for an open or short in the wire between the CPS connector terminal 2 and the ECM connector terminal C5. Is the problem found?	-	Go to *Step 18*	Go to *Step 33*
18	Repair the wiring as needed. Is the repair complete?	-	Go to *Step 2*	-
19	1. Disconnect the direct ignition system (DIS) ignition coil connector to prevent the vehicle from starting. 2. Measure the voltage at the ECM connector terminal C6 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with ignition ON, 1.20 V during cranking	Go to *Step 20*	Go to *Step 21*
20	Measure the voltage at the ECM connector terminal C5 by backprobing the ECM connector. Are the voltage readings near the values specified?	1.08 V with ignition ON, 1.20 V during cranking	Go to Step 22	Go to *Step 21*
21	Replace the CPS. Is the repair complete?	-	Go to *Step 2*	-
22	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the DIS ignition coil. 3. Connect a test light between terminal D of the DIS ignition coil connector and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 23*	Go to *Step 24*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
23	Connect a test light between terminal C of the DIS ignition coil connector and battery positive. Is the test light on?	-	Go to *Step 27*	Go to *Step 25*
24	Check for an open in the wiring between the battery and the DIS ignition coil connector terminal D. Is the problem found?	-	Go to *Step 26*	Go to "Ignition 1 Relay Circuit Check"
25	Check for an open in the wire from the DIS ignition coil to ground. Is the problem found?	-	Go to *Step 26*	-
26	1. Repair the wiring as needed. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	Go to *Step 2*	Go to *Step 27*
27	1. Turn the ignition OFF. 2. Disconnect the DIS ignition coil connector. 3. While cranking the engine, measure the voltage at the DIS ignition coil connector terminal B. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 28*	Go to *Step 29*
28	While cranking the engine, measure the voltage at the DIS ignition coil connector terminal A. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 32*	Go to *Step 30*
29	Check for an open in the wire from the DIS ignition coil connector terminal B to the ECM connector terminal C4. Is the problem found?	-	Go to *Step 31*	Go to *Step 33*
30	Check for an open in the wire from the DIS ignition coil connector terminal A to the ECM connector terminal D5. Is the problem found?	-	Go to *Step 31*	Go to *Step 33*
31	1. Repair the wiring as needed. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	Go to *Step 2*	Go to *Step 32*
32	Replace the DIS ignition coil. Is the repair complete?	-	Go to *Step 2*	-
33	Replace the ECM. Is the repair complete?	-	Go to *Step 2*	-
34	1. Turn the ignition OFF. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is any fuel pressure present?	-	Go to *Step 37*	Go to *Step 35*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
35	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector terminals 3 and 2. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 36*	Go to *Step 46*
36	Replace the fuel pump. Is the repair complete?	-	Go to *Step 2*	-
37	Is the fuel pressure within the value specified?	283-324 kPa (41-47 psi)	Go to *Step 41*	Go to *Step 38*
38	1. Check the fuel filter for a restriction. 2. Inspect the fuel lines for kinks and restrictions. Is the problem found?	-	Go to *Step 39*	Go to *Step 40*
39	1. Replace the fuel filter and/or the fuel lines as needed. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is the fuel pressure within the value specified?	283-324 kPa (41-47 psi)	Go to *Step 2*	Go to *Step 40*
40	1. Disconnect the vacuum line from the fuel pressure regulator. 2. Inspect the vacuum line for the presence of fuel. 3. Inspect the fuel pressure regulator vacuum port for the presence of fuel. Is any fuel present?	-	Go to *Step 43*	Go to *Step 44*
41	Check the fuel for contamination. Is the fuel contaminated?	-	Go to *Step 42*	Go to *Step 64*
42	1. Remove the contaminated fuel from the fuel tank. 2. Clean the fuel tank as needed. Is the repair complete?	-	Go to *Step 2*	-
43	Replace the fuel pressure regulator. Is the repair complete?	-	Go to *Step 2*	-
44	1. Remove the fuel pump assembly from the fuel tank. 2. Inspect the fuel pump sender and the fuel coupling hoses for a restriction. 3. Inspect the intank fuel filter for a restriction. Is the problem found?	-	Go to *Step 45*	Go to *Step 36*
45	Replace the fuel pump sender, the intank fuel filter, and/or the fuel coupling hoses as needed. Is the repair complete?	-	Go to *Step 2*	-

Engine Cranks But Will Not Run (Cont'd)

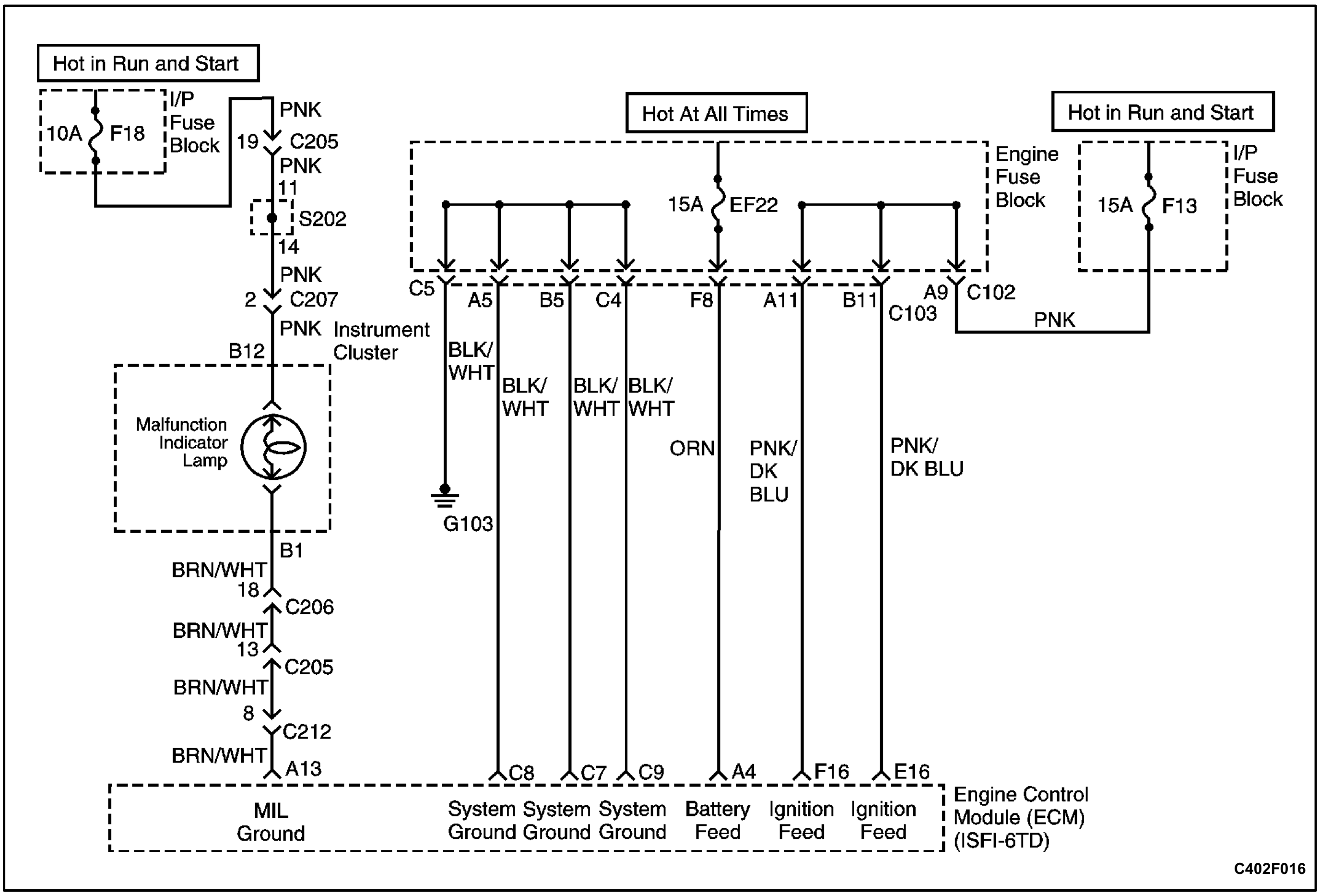
Step	Action	Value(s)	Yes	No
46	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump connector terminal 3 and a known good ground. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 47*	Go to *Step 48*
47	Repair the open wire between the fuel pump connector terminal 2 and ground. Is the repair complete?	-	Go to *Step 2*	-
48	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 86 and battery positive. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 49*	Go to *Step 60*
49	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 85 and ground. 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 50*	Go to *Step 61*
50	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 51*	Go to *Step 63*
51	1. Turn the ignition ON. 2. Measure the voltage at the fuse EF19 connection. Is the voltage within the specified value?	11-14 V	Go to *Step 53*	Go to *Step 52*
52	Replace the fuel pump relay. Is the repair complete?	-	Go to *Step 2*	-
53	Measure the voltage at the fuse EF19 again. Is the voltage within the specified value	11-14 V	Go to *Step 55*	Go to *Step 54*
54	Replace the engine fuse block. Is the repair complete?	-	Go to *Step 2*	-
55	1. Disconnect the fuel cutoff switch connector. 2. Measure the voltage at terminal 1 of the fuel cutoff switch connector. Is the repair complete?	-	Go to *Step 57*	Go to *Step 56*
56	Repair the open or short between the fuel cutoff switch and fuse EF19. Is the repair complete?	-	Go to *Step 2*	-
57	1. Reconnect the fuel cutoff switch. 2. Measure the voltage at terminal 3 of the fuel cutoff switch connector. Is the voltage within the specified value?	11-14 V	Go to *Step 58*	Go to *Step 59*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
58	Repair the short or opening the circuit between the fuel cutoff switch and the fuel pump. Is the repair complete?	-	Go to *Step 2*	-
59	Replace the fuel cutoff switch. Is the repair complete?	-	Go to *Step 2*	-
60	Check for an open or short to voltage in the circuit between the fuel pump relay terminal 86 and ground. Is a problem found and corrected?	-	Go to *Step 2*	Go to *Step 61*
61	Check the wire between the fuel pump relay connector terminal 85 to the ECM connector terminal E13 for an open. Is the problem found?	-	Go to *Step 62*	Go to *Step 33*
62	Repair the wire between the fuel pump relay connector terminal 85 to the ECM connector terminal E13. Is the repair complete?	-	Go to *Step 2*	-
63	Repair the wire between the fuel pump relay connector terminal 30 and the battery. Is the repair complete?	-	Go to *Step 2*	-
64	1. Turn the ignition OFF. 2. Disconnect the fuel injector harness connectors from all of the fuel injectors. 3. Turn the ignition ON. 4. Connect a test light between the fuel injector harness connector 1 and ground. 5. Repeat step 4 for each of the remaining fuel injectors. Is the test light on at all of the fuel injectors?	-	Go to *Step 65*	Go to *Step 68*
65	1. Turn the ignition OFF. 2. Connect a test light between the fuel injector harness connector terminal 2 and battery positive. 3. Crank the engine. 4. Repeat steps three and four for each of the remaining fuel injectors. Does the test light flash for all of the fuel injectors?	-	Go to *Step 66*	Go to *Step 69*
66	Measure the resistance of each fuel injector. Is the resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6-12.4 Ω	System OK	Go to *Step 67*
67	Replace any of the fuel injectors with a resistance out of specification. Is the repair complete?	-	Go to *Step 2*	-
68	Repair the open wire(s) between the fuel injector harness connector(s) terminal 1 and the battery. Is the repair complete?	-	Go to *Step 2*	-

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
69	1. Check for an open between the fuel injector 1 harness connector terminal 2 and the ECM connector terminal D3. 2. Check for an open between the fuel injector 2 harness connector terminal 2 and the ECM connector terminal C1. 3. Check for an open between the fuel injector 3 harness connector terminal 2 and the ECM connector terminal D1. 4. Check for an open between the fuel injector 4 harness connector terminal 2 and the ECM connector terminal F13. Is the problem found?	-	Go to *Step 70*	Go to *Step 72*
70	Repair the open fuel injector harness wire(s). Is the repair complete?	-	Go to *Step 2*	-
71	Replace the fuse or repair the wiring as needed. Is the repair complete?	-	Go to *Step 2*	-
72	1. Inspect the engine fuse block fuse EF17. 2. Check for an open between the circuit from terminal 1 for each of the four fuel injectors and the ignition 1 relay connector terminal 87. Is the problem found?	-	Go to *Step 65*	Go to "Ignition 1 Relay Circuit Check"



NO MALFUNCTION INDICATOR LAMP

Circuit Description

When the ignition is turned ON, the Malfunction Indicator Lamp (MIL) will momentarily flash ON then OFF and remain ON until the engine is running, if no Diagnostic Trouble Codes (DTCs) are stored. Battery voltage is supplied through the ignition switch directly to the MIL telltale. The engine control module (ECM) controls the MIL by providing a ground path through the MIL control circuit to turn ON the MIL.

Diagnostic Aids

An open ignition #5 fuse will cause the entire cluster to be inoperative, and may set DTC P1625.

Check the battery and ignition feed circuits for poor connections if the MIL is intermittent.

Any circuitry, that is suspected as causing an intermittent complaint, should be thoroughly checked for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.

Test Description

Number(s) below refer to the step number(s) on the diagnostic table.

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on then scan tool, if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is stored in the scan tool for later reference.
3. Connections that are suspected of being faulty should be thoroughly checked as described in the diagnostic aids.
4. If the engine fails to start and the MIL is inoperative, then the fault can be isolated to either the ECM ignition feed, the battery feed, or a poor ground at the engine block or the ECM.
6. Probing the MIL circuit with a test light to ground stimulates the ECM's control of the MIL. If the MIL illuminates, then the malfunction can be isolated to the control of the MIL or a poor connection at the MIL terminal to the ECM. Connections that are suspected of being faulty should be thoroughly checked as described in the diagnostic aids.
8. It takes very little resistance for the battery and ignition feed circuits to cause an intermittent condition and should also be checked for a poor connection as described in diagnostic aids.
11. Before replacing the ECM, check for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor

terminal-to-wiring harness. Replacement ECMs must be reprogrammed. Refer to the latest Techline information for reprogramming procedures.

20. ECM grounds will only cause a problem if all of the grounds are not making a good connection. If an ECM ground problem is suspected, the most probable place to check is where all the grounds meet, at the engine block.
22. If not faults have been found at this point and no DTCs were set, refer to the diagnostic aids for additional checks and information.

No Malfunction Indicator Lamp

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Turn the ignition switch ON with the engine OFF. Is the Malfunction Indicator Lamp (MIL) on?	-	Go to *Step 3*	Go to *Step 4*
3	Check for a poor connection at the battery feed terminal A4 or ignition feed terminal F16. Is the problem found and repaired?	-	Go to *Step 22*	Go to *Step 5*
4	Attempt to start the engine. Does the engine start?	-	Go to *Step 6*	Go to *Step 5*
5	Check for a faulty engine control module (ECM) ground connection at the engine block or ECM connector ground terminals and repair as necessary. Is the repair complete?	-	Go to *Step 22*	-
6	1. Turn the ignition OFF. 2. Disconnect the ECM connectors from the ECM. 3. Turn the ignition switch ON. Is the MIL ON?	-	Go to *Step 8*	Go to *Step 9*
7	Inspect the ignition and battery feed fuses. Are the fuses OK?	-	Go to *Step 10*	Go to *Step 11*
8	Check for a poor connection in the battery feed terminal A4, ignition feed terminal F16 or the MIL control circuits and repair as necessary. Is a repair necessary?	-	Go to *Step 22*	Go to *Step 12*
9	Probe the MIL control circuit with a test light connected to ground. Is the test light illuminated?	-	Go to *Step 13*	Go to *Step 14*
10	1. Turn the ignition switch OFF. 2. Disconnect the ECM connectors from the ECM. 3. Turn the ignition switch ON. 4. Probe the ignition feed terminal F16 with a test light connected to ground. Does the test light illuminate?	-	Go to *Step 15*	Go to *Step 16*
11	1. Check for a short to ground in the circuit of the fuse that was open and repair if necessary. 2. Replace the open fuse. Is the repair complete?	-	Go to *Step 22*	-

No Malfunction Indicator Lamp (Cont'd)

Step	Action	Value(s)	Yes	No
12	Replace the ECM. Is the repair complete?	-	Go to *Step 22*	-
13	Repair the short to voltage in the MIL control circuit. Is the repair complete?	-	Go to *Step 22*	-
14	Check for an open or a poor connection in the MIL control circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 22*	Go to *Step 17*
15	With a test light still connected to the ground, probe the ignition feed terminal F16. Does the test light illuminate?	-	Go to *Step 18*	Go to *Step 19*
16	Repair the open battery feed circuit. Is the repair complete?	-	Go to *Step 22*	-
17	Check for an open ignition feed circuit or fuse to the MIL and repair as necessary. Is a repair necessary?	-	Go to *Step 22*	Go to *Step 20*
18	Check for a poor connection in the battery feed terminal A4 or the ignition feed terminal F16 and repair as necessary. Is a repair necessary?	-	Go to *Step 22*	Go to *Step 21*
19	Repair the open in the ignition feed circuit from terminal F16. Is the repair complete?	-	Go to *Step 22*	-
20	Replace the instrument panel cluster. Refer to *Section 9E, Instrumentation/Driver Information*. Is the repair complete?	-	Go to *Step 22*	-
21	Check for a faulty ECM ground connection at the engine block or ECM connector and repair as necessary. Is the repair necessary?	-	Go to *Step 22*	Go to *Step 12*
22	1. Allow the engine to idle until normal operating temperature is reached. 2. Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to the applicable DTC table	System OK

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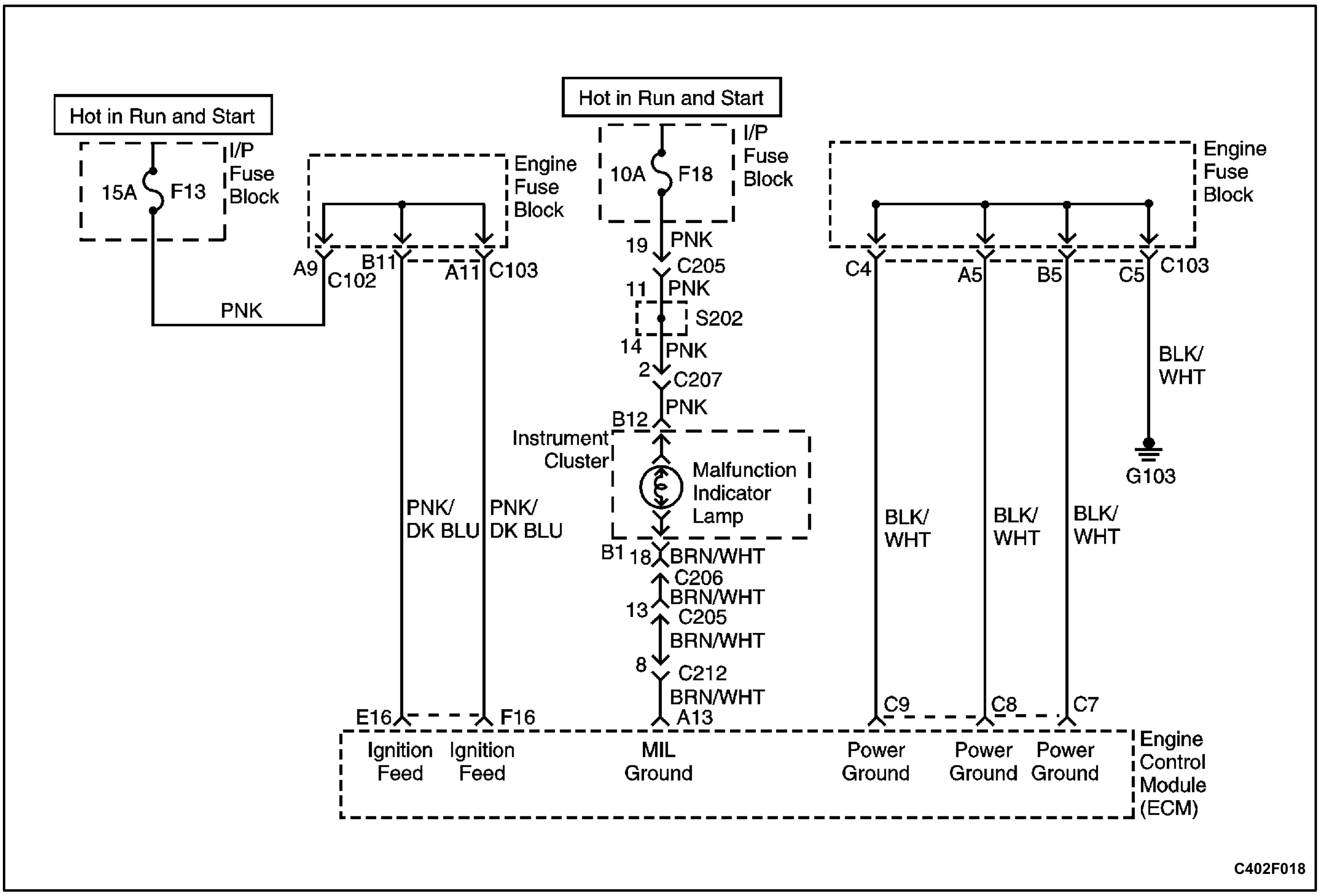

MALFUNCTION INDICATOR LAMP ON STEADY

Circuit Description

When the ignition is turned ON, the Malfunction Indicator Lamp (MIL) will momentarily flash ON then OFF and remain ON until the engine is running if no Diagnostic Trouble Codes (DTCs) are stored. Battery voltage is supplied through the ignition switch directly to the MIL telltale. The engine control module (ECM) controls the MIL by providing a ground path through the MIL control circuit to turn ON the MIL.

Test Description

Number(s) below refer to the step number(s) on the diagnostic table.

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on then scan tool, if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is stored in the scan tool for later reference.
2. When the ignition is turned on, the MIL should momentarily flash ON and OFF then remain ON until the engine is running or if an emission related DTC is stored.
3. This step checks the ability of the ECM to control the MIL. The scan tool has the ability to command the MIL ON and OFF.
5. A shorted MIL circuit can be diagnosed with a scan tool.
7. The replacement ECM must be reprogrammed. Refer to the latest Techline information for reprogramming procedures.

Malfunction Indicator Lamp On Steady

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Turn the ignition switch ON with the engine OFF. Is the Malfunction Indicator Lamp (MIL) ON?	-	Go to *Step 3*	Go to "No Malfunction Indicator Lamp"
3	1. Install the scan tool. 2. Command the MIL On and OFF. Does the MIL turn ON and OFF when commanded?	-	Go to *Step 8*	Go to *Step 4*
4	1. Turn the ignition switch OFF. 2. Disconnect the engine control module (ECM) connectors. 3. Turn the ignition switch ON. Is the MIL OFF?	-	Go to *Step 7*	Go to *Step 5*
5	Check the MIL control circuit for a short to ground and repair if necessary. Is a repair necessary?	-	Go to *Step 8*	Go to *Step 6*
6	Replace the instrument panel cluster. Refer to *Section 9E, Instrumentation/Driver Information*. Is the repair complete?	-	Go to *Step 8*	-
7	Replace the ECM. Is the repair complete?	-	Go to *Step 8*	-
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Attempt to start the engine. Does the engine start and continue to run?	-	Go to *Step 9*	Go to *Step 1*
9	1. Allow the engine to idle until normal operating temperature is reached. 2. Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to the applicable DTC table	System OK

FUEL SYSTEM DIAGNOSIS

Circuit Description

The fuel pump is an in-tank fuel pump mounted to a fuel sender assembly. The fuel pump will remain on as long as the engine is cranking or running and the engine control module (ECM) is receiving reference pulses from the crankshaft position sensor (CPS). If there are no reference pulses, the ECM will turn off the fuel pump two seconds after the ignition switch is turned ON or two seconds after the engine stops running. The fuel pump delivers fuel to the fuel rail and the fuel injectors, where the fuel system pressure is controlled from 284 to 325 kPa (41 to 47 psi) by the fuel pressure regulator. The excess fuel is returned to the fuel tank.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. When the engine is idling, the intake manifold vacuum is high. This vacuum is applied to the fuel pressure regulator diaphragm, offsetting the spring pressure inside the fuel pressure regulator and lowering the fuel pressure.
10. If there is fuel bleeding back through the fuel return outlet, this is due to a faulty fuel pressure regulator.
14. Another symptom often present when the fuel injectors are leaking is hard starting. Leaking fuel injectors can cause a flooding condition.
23. Fuel leaking from the fuel pump inlet is due to a faulty oneway check valve in the fuel pump.

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump fuse EF19 from the engine fuse box.
3. Start the engine and allow the engine to stall.
4. Crank the engine for an additional 10 seconds.

Fuel System Diagnosis

Step	Action	Value(s)	Yes	No
1	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	Go to *Step 2*	Go to *Step 5*
2	1. Disconnect the fuel pressure regulator vacuum hose. 2. Start the engine. 3. Allow the engine to idle. 4. Connect the fuel pressure regulator vacuum hose. Did the fuel pressure decrease?	-	System OK	Go to *Step 3*
3	1. Allow the engine to idle. 2. Disconnect the vacuum hose from the fuel pressure regulator. 3. Connect a vacuum pump with a gauge to the fuel pressure regulator vacuum port. 4. Apply 41-47 kPa (12-14 in. Hg) of vacuum to the fuel pressure regulator. Did the fuel pressure decrease?	-	Go to *Step 4*	Go to *Step 16*
4	1. Locate and correct the cause of the vacuum restriction to the fuel pressure regulator. 2. Confirm the operation of the fuel pressure regulator. Is the repair complete?	-	System OK	-

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified but not holding steady?	284-325 kPa (41-47 psi)	Go to *Step 6*	Go to *Step 17*
6	Inspect the fuel lines for a leak. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	1. Replace the fuel line(s) as needed. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
8	1. Remove the fuel pump assembly. 2. With the fuel pump under pressure, inspect the fuel pump coupling hoses for leaking. Is the problem found?	-	Go to *Step 9*	Go to *Step 10*
9	1. Tighten or replace the fuel pump coupling hoses as needed. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
10	With the fuel system under pressure, inspect the fuel return outlet for leaking. Is the problem found?	-	Go to *Step 11*	Go to *Step 12*
11	1. Replace the fuel pressure regulator. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
12	With the fuel system under pressure, inspect the fuel inlet for leaking. Is the problem found?	-	Go to *Step 13*	Go to *Step 14*
13	1. Replace the fuel pump assembly. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-
14	1. Remove the fuel rail and the fuel injectors as an assembly. 2. With the fuel system under pressure, inspect all of the fuel injectors for leaking. Is the problem found?	-	Go to *Step 15*	-
15	1. Replace the leaking fuel injector(s). 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure within the values specified and holding steady?	284-325 kPa (41-47 psi)	System OK	-

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
16	1. Replace the fuel pressure regulator. 2. Disconnect the fuel pressure regulator vacuum hose. 3. Start the engine. 4. Allow the engine to idle. 5. Connect the fuel pressure regulator vacuum hose. Did the fuel pressure decrease?	-	System OK	-
17	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel system pressure below the values specified and holding steady?	284-325 kPa (41-47 psi)	Go to *Step 13*	Go to *Step 18*
18	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel system pressure below the values specified and not holding steady?	284-325 kPa (41-47 psi)	Go to *Step 19*	-
19	Inspect the fuel lines for leaks. Is the problem found?	-	Go to *Step 7*	Go to *Step 20*
20	1. Remove the fuel pump assembly. 2. With the fuel pump under pressure, inspect the fuel pump coupling hoses for leaking. Is the problem found?	-	Go to *Step 9*	Go to *Step 21*
21	1. Remove the fuel pump assembly. 2. With the fuel system under pressure, inspect the fuel return outlet for leaking. Is the problem found?	-	Go to *Step 11*	Go to *Step 22*
22	1. Remove the fuel pump assembly. 2. With the fuel system under pressure, inspect the fuel inlet for leaking. Is the problem found?	-	Go to *Step 13*	Go to *Step 23*
23	1. Remove the fuel rail and the fuel injectors as an assembly. 2. With the fuel system under pressure, inspect all of the fuel injectors for leaking. Is the problem found?	-	Go to *Step 15*	Go to *Step 13*

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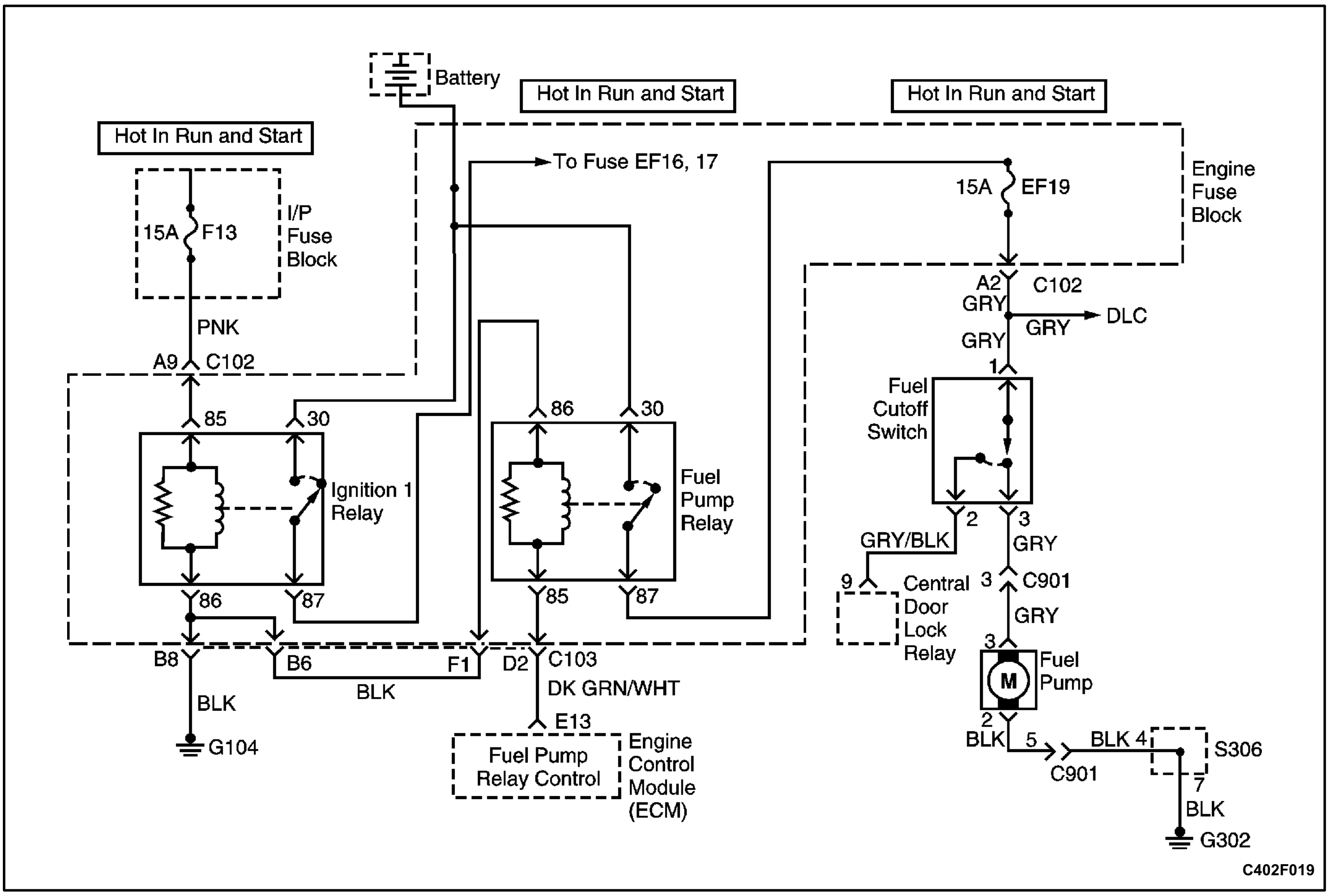

FUEL PUMP RELAY CIRCUIT CHECK

Circuit Description

When the ignition switch is turned ON, the engine control module (ECM) will activate the fuel pump relay and run the in-tank fuel pump. The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

If there are no reference pulses, the ECM will shut off the fuel pump within 2 seconds after the ignition switch is turned ON.

Diagnostic Aids

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

Test Description

The number(s) below refer to step(s) on the diagnostic table.

3. This step checks for the engine control module (ECM) providing a ground for the operation of the fuel pump relay.
7. By confirming that the wiring is OK using steps 2 through 6, it can be determined that the fuel pump relay is at fault.
9. After determining that there is no ground being provided by the ECM to the fuel pump relay, the fault is either the ECM or the wiring between the ECM and the fuel pump relay.

Fuel Pump Relay Circuit Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF for 10 seconds. 2. Turn the ignition ON. 3. Listen for intank fuel pump operation. Does the fuel pump operate for the time specified?	2 sec	System OK	Go to *Step 2*
2	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 86 and battery positive. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 3*	Go to *Step 8*
3	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 85 and ground. 3. Turn the ignition ON. 4. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec	Go to *Step 4*	Go to *Step 9*
4	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 5*	Go to *Step 11*
5	Check for an open or short to ground in the wire between the fuel pump relay connector terminal 87 and the fuel cutoff switch terminal 1. Is the problem found?	-	Go to *Step 6*	Go to *Step 7*
6	1. Repair the wire between the fuel pump relay connector terminal 87 and the fuel cutoff switch terminal 1. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
7	1. Replace the fuel pump relay. 2. Turn the ignition OFF for 10 seconds. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
8	Check for an open wire between the fuel pump relay connector terminal 86 and the ignition 1 relay con-nector terminal 86. Is the problem found?	-	Go to *Step 13*	Go to "Ignition 1 Relay Circuit Check"
9	Check for an open wire between the fuel pump relay connector terminal 85 to the engine control module (ECM) connector terminal E13. Is the problem found?	-	Go to *Step 10*	Go to *Step 12*
10	1. Repair the wire between the fuel pump relay connector terminal 85 to the ECM connector terminal E13. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-

Fuel Pump Relay Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Repair the wire between the fuel pump relay connector terminal 30 and the battery. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
12	1. Replace the ECM. 2. Turn the ignition OFF for 10 seconds. 3. Turn the ignition ON. Does the fuel pump operate for the time specified?	2 sec	System OK	-
13	Repair the wire between the fuel pump relay connector terminal 86 and the ignition 1 relay connector terminal 86. Is the repair complete?	-	System OK	-

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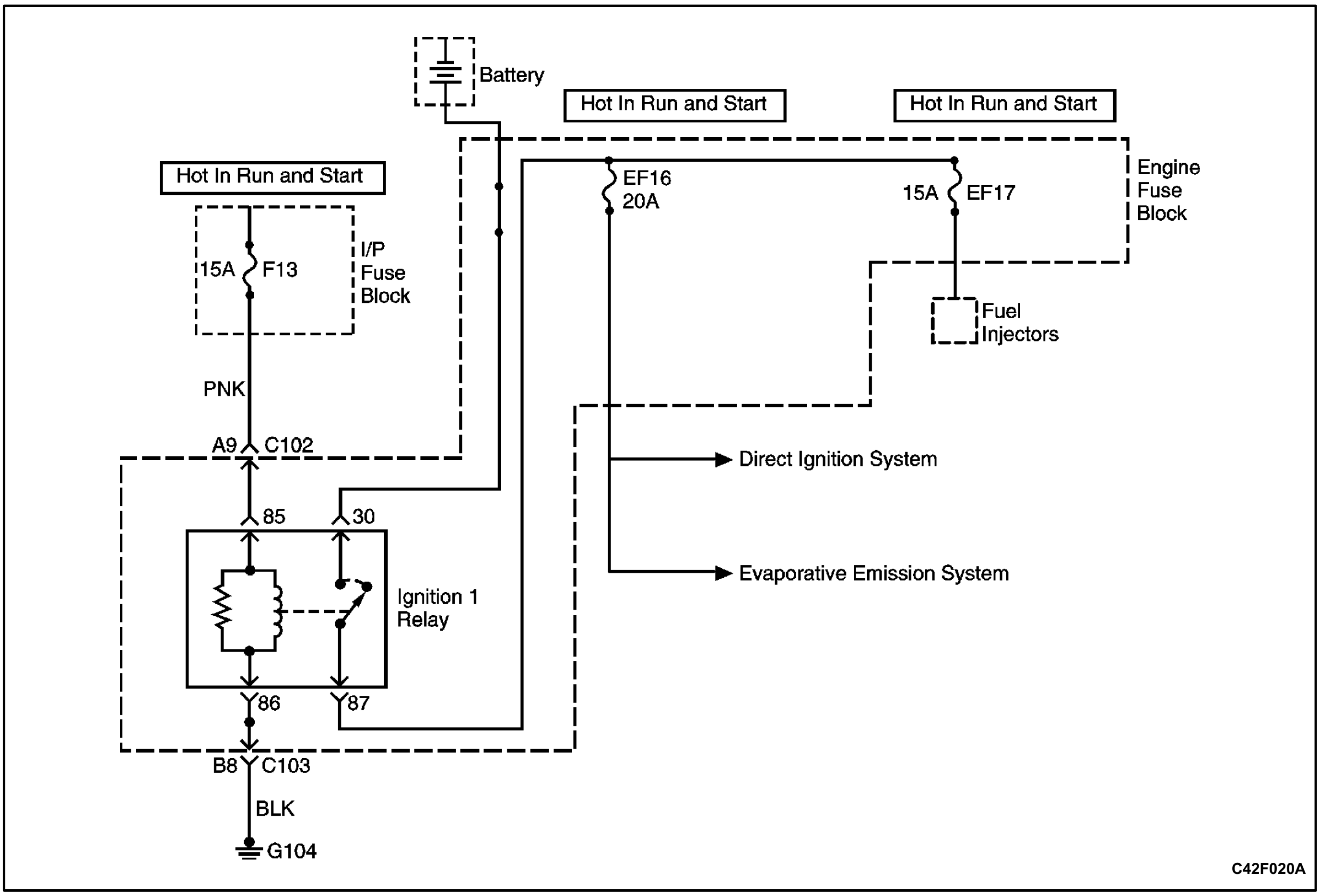


IGNITION 1 RELAY CIRCUIT CHECK

Circuit Description

When the ignition is turned ON or to the START position, the ignition 1 relay is energized. The ignition 1 relay then supplies voltage to the engine fuse box fuse EF16 and the engine fuse box fuse EF17. The direct ignition system (DIS) ignition coil, and the evaporative emission canister purge solenoid are supplied voltage through the engine fuse box fuse EF16. The fuel injectors are supplied voltage through the engine fuse box fuse EF17.

Diagnostic Aids

- An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.
- A faulty ignition 1 relay will cause a no start condition. There will be no voltage supplied to the DIS ignition coil, or the fuel injectors. Without voltage supplied to these components, they will not operate.

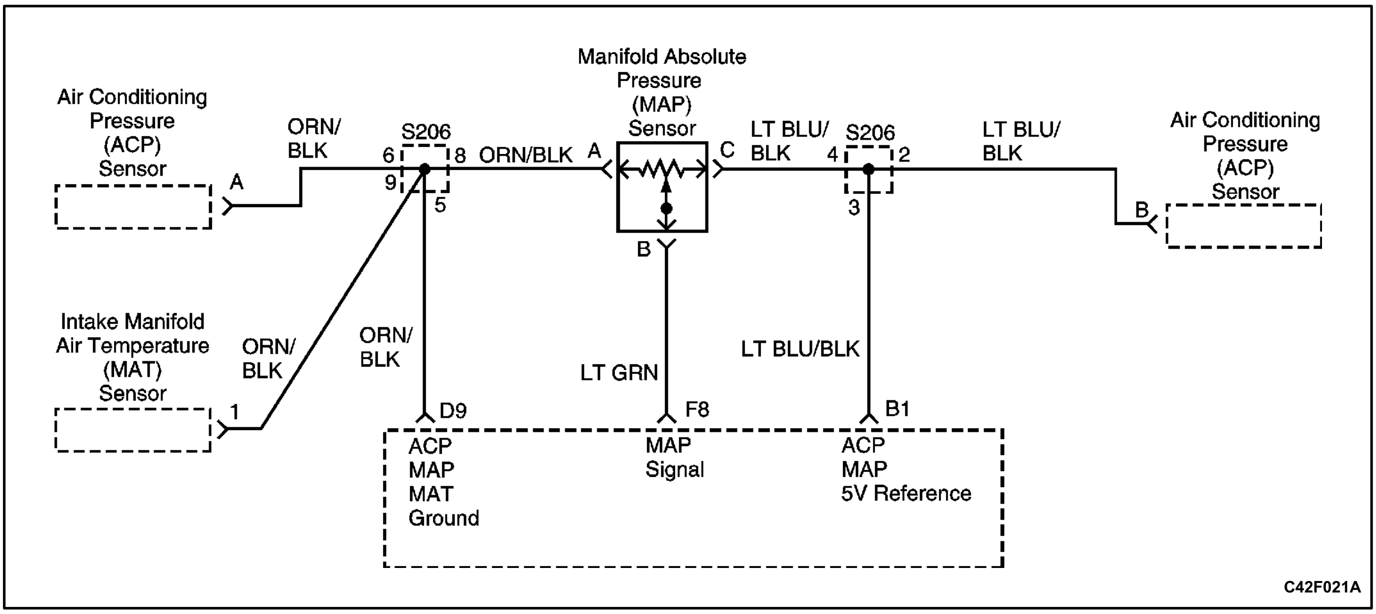
Test Description

The number(s) below refer to specific step(s) on the diagnostic table.

1. If the test light is on at both of the fuse terminals, the ignition 1 relay is OK.
5. This step, along with steps 6, 7, and 8, checks for correct voltage and ground to the ignition 1 relay terminals.
14. After confirming correct voltage and ground to the ignition 1 relay terminals, it can be determined that the ignition 1 relay is faulty.

Ignition 1 Relay Circuit Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF. 2. Disconnect the engine fuse block fuses EF16 and EF17. 3. Turn the ignition ON. 4. With a test light connected to ground, probe the fuse terminals nearest the ignition 1 relay for fuses EF16 and EF17. Is the test light on at both terminals?	-	System OK	Go to *Step 2*
2	Check the test light. Is the test light on at only one terminal?	-	Go to *Step 9*	Go to *Step 3*
3	Check the test light. Is the test light off at both terminals?	-	Go to *Step 4*	-
4	1. Turn the ignition OFF. 2. Inspect the instrument panel fuse block fuse F13. Is the fuse OK?	-	Go to *Step 5*	Go to *Step 10*
5	1. Disconnect the ignition 1 relay. 2. Connect a test light between the ignition 1 relay connector terminal 85 and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 6*	Go to *Step 11*
6	Connect a test light between the ignition 1 relay connector terminal 86 and battery voltage. Is the test light on?	-	Go to *Step 7*	Go to *Step 12*
7	Connect a test light between the ignition 1 relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 8*	Go to *Step 13*
8	Check for an open in the wiring between the ignition 1 relay connector terminal 87 and the engine fuse block terminals for fuses EF16 and EF17. Is the problem found?	-	Go to *Step 9*	Go to *Step 14*
9	Repair the open in the wiring between the ignition 1 relay connector terminal 87 and the engine fuse block terminal(s) for fuses EF16 and EF17. Is the repair complete?	-	System OK	-
10	Replace the instrument panel fuse block fuse F13. Is the repair complete?	-	System OK	-
11	Repair the open in the wiring between the ignition 1 relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
12	Repair the open in the wiring between the ignition 1 relay connector terminal 86 and ground. Is the repair complete?	-	System OK	-
13	Repair the open in the wiring between the ignition 1 relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
14	Replace the ignition 1 relay. Is the repair complete?	-	System OK	-



MANIFOLD ABSOLUTE PRESSURE CHECK

Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load (intake manifold vacuum) and rpm changes. The MAP sensor converts these changes into a voltage output. The engine control module (ECM) sends a 5 volt reference voltage to the MAP sensor. As the intake manifold pressure changes, the output voltage of the MAP sensor also changes. A low voltage (high vacuum) output of 1 to 2 volts is present at idle. A high voltage (low vacuum) output of 4.0 to 4.8 volts is present at wide open throttle. The MAP sensor is also used under certain conditions to measure barometric pressure. This allows the ECM to make adjustments for altitude changes. The ECM uses the MAP sensor for fuel delivery and ignition timing changes.

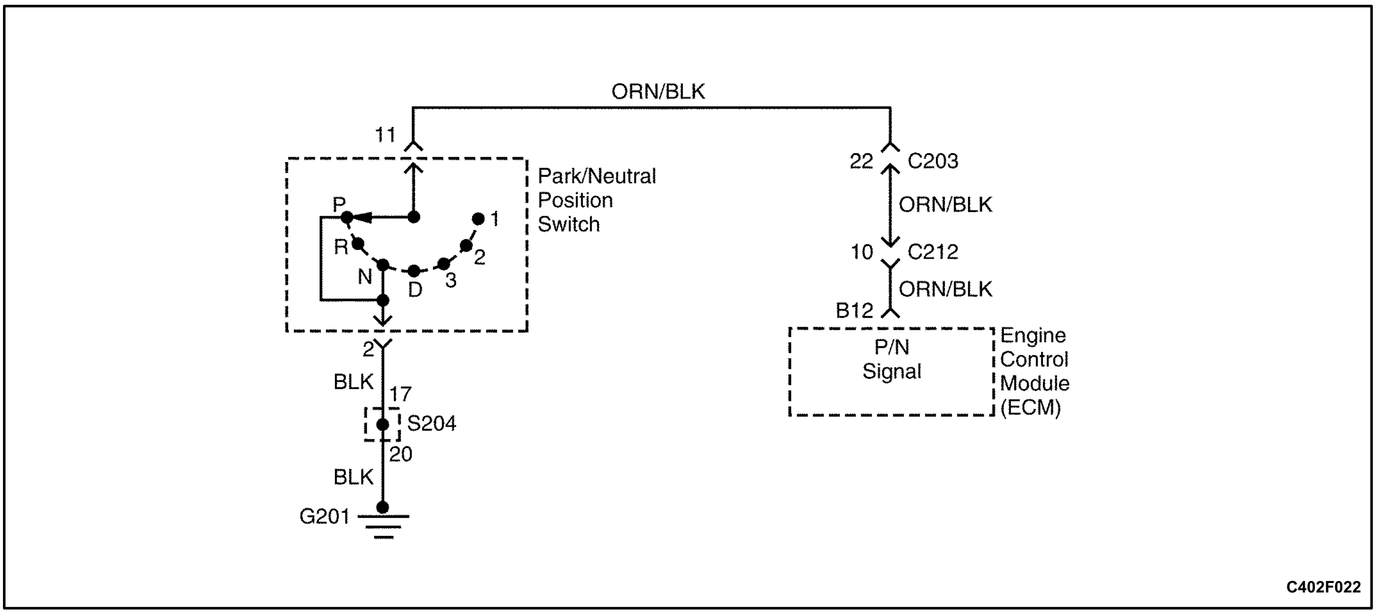
Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. Applying 34 kPa (10 inches Hg) of vacuum to the manifold absolute pressure (MAP) sensor should cause the voltage to change. Subtract the second voltage reading from the first. That voltage value should be more than 1.5 volts. When applying vacuum to the MAP sensor, the change in the voltage should happen instantly. A slow voltage change indicates a faulty MAP sensor.
3. Disconnect the MAP sensor from the bracket and twist the MAP sensor. Output changes more than 0.1 volt indicate a faulty connector or connection.

Manifold Absolute Pressure Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF. 2. Connect a scan tool to the data link connector (DLC). 3. Turn the ignition ON. 4. Compare the manifold absolute pressure (MAP) sensor voltage reading from the scanner with that from a known good vehicle. Is the difference in the two voltage readings less than the value specified?	0.4 V	Go to *Step 2*	Go to *Step 5*
2	1. Turn the ignition OFF. 2. Connect a scan tool to the DLC. 3. Disconnect the MAP sensor vacuum line. 4. Connect a hand vacuum pump to the MAP sensor. 5. Turn the ignition ON. 6. Note the MAP sensor voltage. 7. Apply 34 kPa (10 in. Hg) of vacuum to the MAP sensor and note the voltage change. Is the difference in voltage readings more than the value specified?	1.5 V	System OK	Go to *Step 3*
3	Inspect the MAP sensor connector terminals. Is the problem found?	-	Go to *Step 4*	Go to *Step 5*
4	Repair the MAP sensor connector terminals as needed. Is the repair complete?	-	System OK	-
5	Replace the manifold absolute pressure sensor. Is the repair complete?	-	System OK	-



PARK/NEUTRAL POSITION SWITCH

Circuit Description

The park/neutral position (PNP) switch contacts are a part of the selector position switch. The contacts are closed to ground in park and neutral and open in the drive ranges.

The engine control module (ECM) supplies ignition voltage through a current limiting resistor to the signal wire and senses a closed switch when the voltage on the signal wire drops to less than 1 volt. The ECM uses the PNP signal as one of the inputs to control idle air and spark timing.

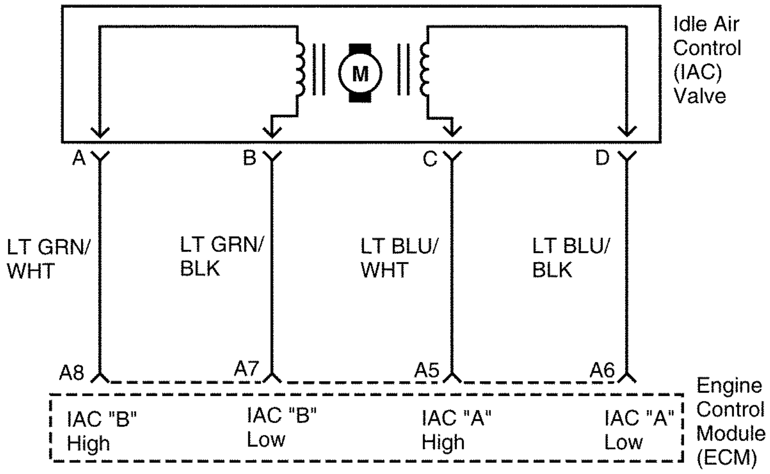
Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. Checks for the park/neutral position (PNP) switch closed to ground in the park position. Different makes of scan tools will read park/neutral differently. Refer to the tool operations manual for the type of display used.
2. Checks for an open PNP switch in the drive range.

Park/Neutral Position Switch

Step	Action	Value(s)	Yes	No
1	1. Connect a scan tool to the data link connector (DLC). 2. Place the transaxle in P (Park). 3. Turn the ignition ON. Does the scan tool indicate park or neutral?	-	Go to *Step 2*	Go to *Step 10*
2	Place the transaxle in D (Drive). Does the scan tool indicate drive?	-	System OK	Go to *Step 3*
3	Disconnect the park/neutral position (PNP) switch. Does the scan tool indicate drive?	-	Go to *Step 4*	Go to *Step 7*
4	Check the PNP switch adjustment. Is the problem found?	-	Go to *Step 5*	Go to *Step 6*
5	Adjust the PNP switch. Is the repair complete?	-	System OK	-
6	Replace the PNP switch. Is the repair complete?	-	System OK	-
7	Check for an open or short to ground in the wire between the PNP switch connector terminal 11 and the engine control module (ECM) connector terminal B12. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
8	Repair the open or short to ground in the wire between the PNP switch connector terminal 11 and the ECM connector terminal B12. Is the repair complete?	-	System OK	-
9	Replace the ECM. Is the repair complete?	-	System OK	-
10	1. Disconnect the PNP switch. 2. Jumper the PNP switch connector terminals 11 and 2. 3. Turn the ignition ON. Does the scan tool indicate park?	-	Go to *Step 4*	Go to *Step 11*
11	Jumper the PNP switch connector terminal 11 to ground. Does the scan tool indicate park?	-	Go to *Step 12*	Go to *Step 7*
12	Repair the open wire between the PNP switch connector terminal 2 and ground. Is the repair complete?	-	System OK	-



IDLE AIR CONTROL SYSTEM CHECK

Circuit Description

The engine control module (ECM) controls the engine idle speed with the idle air control (IAC) valve. To increase the idle speed, the ECM pulls the IAC pintle away from its seat, allowing more air to pass by the throttle bore. To decrease the idle speed, it extends the IAC valve pintle toward its seat, reducing bypass air flow. A scan tool will read the ECM commands to the IAC valve in counts. The higher counts indicate more air bypass (higher idle). The lower counts indicate less air is allowed to bypass (lower idle).

Diagnostic Aids

If the idle is too high, stop the engine. Fully extend the idle air control (IAC) valve with a IAC tester. Start the engine. If the idle speed is above 800 rpm, locate and repair the vacuum leak. Also, check for a binding throttle plate or throttle linkage or an incorrect base idle setting.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. The idle air control (IAC) valve is extended and retracted by the IAC driver. IAC valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be removed from the throttle body and tested. Connect the IAC driver to the removed IAC valve and turn the ignition ON. Do not start the engine.
5. This step checks the quality of the IAC valve movement in step 2. Fully extending the IAC valve may cause an engine stall. This may be normal.
6. Steps 2 and 5 verify proper IAC valve operation. This step checks the IAC circuit for a wiring or engine control module (ECM) fault.

Idle Air Control Valve Reset Procedure

Whenever the battery cable or the engine control module (ECM) connector or the ECM fuse EF22 is disconnected or replaced, the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.
4. Start the engine in park/neutral.
5. Allow the engine to run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.
7. Turn the A/C OFF for 10 seconds, if equipped.
8. If the vehicle is equipped with an automatic transaxle, apply the parking brake. While pressing the brake pedal, place the transaxle in D (drive).
9. Turn the A/C ON for 10 seconds, if equipped.
10. Turn the A/C OFF for 10 seconds, if equipped.
11. Turn the ignition OFF. The idle learn procedure is complete.

Idle Air Control System Check

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Was the check performed?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Connect the idle air control driver to the idle air control (IAC) valve. 3. Connect a scan tool to the data link connector (DLC). 4. Start the engine. 5. With the IAC driver, extend and retract the IAC valve. Engine rpm should increase and decrease as the IAC valve is cycled. Does the engine rpm change?	-	Go to *Step 5*	Go to *Step 3*
3	1. Remove the IAC valve. 2. Inspect the IAC passages for restrictions. Is the problem found?	-	Go to *Step 4*	Go to *Step 19*
4	Clean the IAC passages. Is the repair complete?	-	System OK	-
5	1. Turn the ignition OFF. 2. Start the engine. 3. Using the IAC driver, extend and retract the IAC valve. Engine rpm should increase and decrease as the IAC valve is cycled. Does the rpm change smoothly within the value specified with each flash of the IAC driver?	700-1500 rpm	Go to *Step 6*	Go to *Step 3*
6	1. Turn the ignition OFF. 2. Connect the IAC driver to the IAC valve. 3. Install an IAC node light to the IAC valve connector. 4. Start the engine. 5. Cycle the IAC driver. 6. Watch the node lights of the IAC driver. Do both lights cycle red and green but never off as the rpm is changed?	-	Go to *Step 7*	Go to *Step 9*
7	1. Measure the resistance of the IAC valve between terminals A and B. 2. Measure the resistance of the IAC valve between terminals C and D. Does the resistance measure within the value specified?	40-80 Ω	Go to *Step 8*	Go to *Step 19*
8	1. Measure the resistance of the IAC valve between terminals B and C. 2. Measure the resistance of the IAC valve between terminals A and D. Does the ohmmeter show the specified value?	∞	Go to "Diagnostic Aids"	Go to *Step 19*
9	Inspect the IAC connector terminals. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
10	Repair or replace the IAC connector terminals as needed. Is the repair complete?	-	System OK	-

Idle Air Control System Check (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open or short in the wire between the IAC connector terminal A and the engine control module (ECM) connector terminal A8. Is the problem found?	-	Go to *Step 15*	Go to *Step 12*
12	Check for an open or short in the wire between the IAC connector terminal B and the ECM connector terminal A7. Is the problem found?	-	Go to *Step 15*	Go to *Step 13*
13	Check for an open or short in the wire between the IAC connector terminal C and the ECM connector terminal A5. Is the problem found?	-	Go to *Step 15*	Go to *Step 14*
14	Check for an open or short in the wire between the IAC connector terminal D and the ECM connector terminal A6. Is the problem found?	-	Go to *Step 15*	Go to *Step 16*
15	Repair the wire as needed. Is the repair complete?	-	System OK	-
16	Inspect the ECM connector terminals. Is the problem found?	-	Go to *Step 17*	Go to *Step 18*
17	Repair the ECM connector terminals as needed. Is the repair complete?	-	System OK	-
18	Replace the ECM. Is the repair complete?	-	System OK	-
19	Replace the idle air control valve. Is the repair complete?	-	System OK	-

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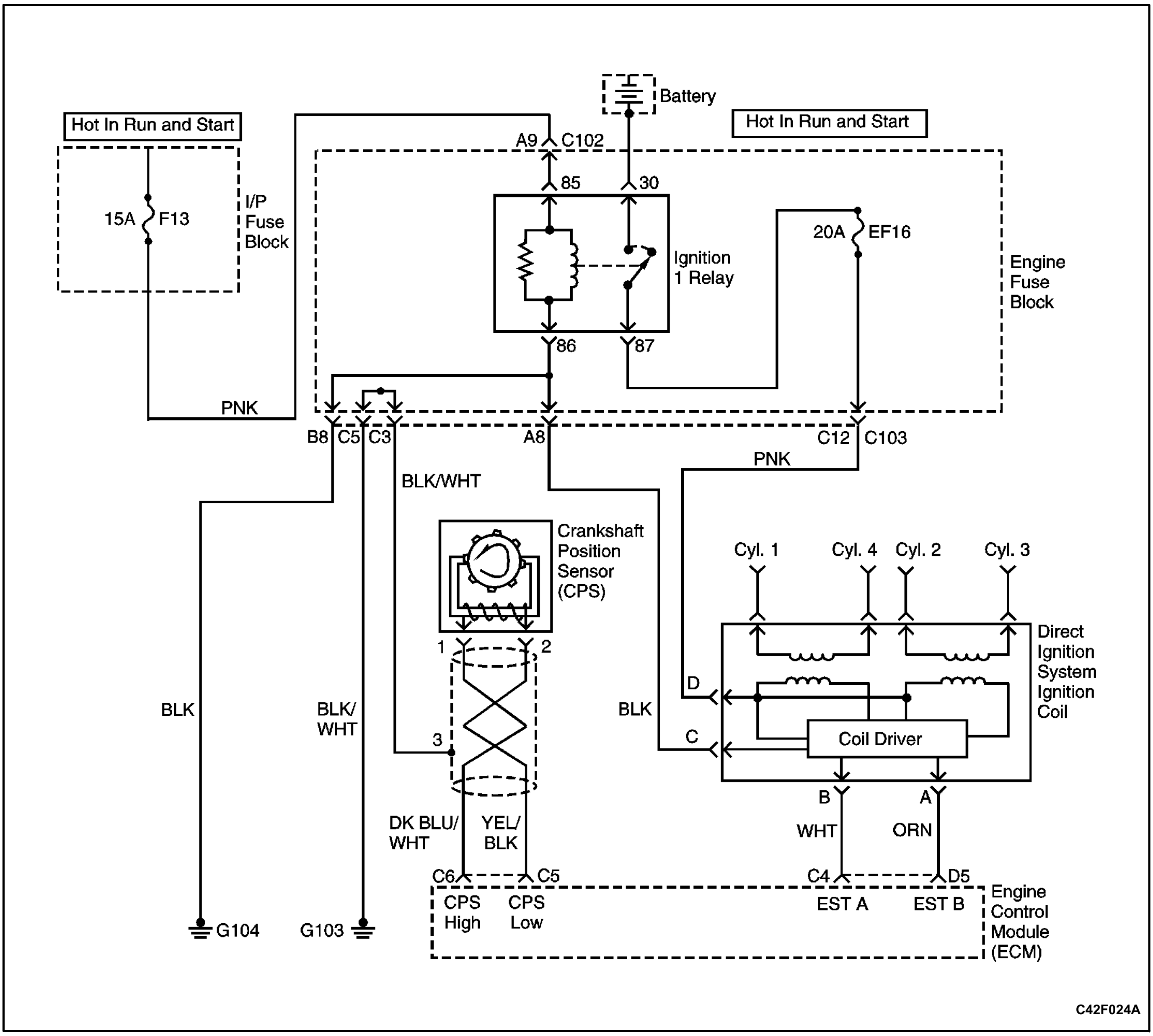


IGNITION SYSTEM CHECK

Circuit Description

The direct ignition system (DIS) uses a waste spark method of spark distribution. In this type of DIS system, the crankshaft position sensor (CPS) is mounted to the oil pump near a slotted wheel that is a part of the crankshaft pulley. The CPS sends reference pulses to the engine control module (ECM). The ECM then triggers the DIS ignition coil. Once the ECM triggers the DIS ignition coil, both of the connected spark plugs fire at the same time. One cylinder is on its compression stroke at the same time that the other is on the exhaust stroke, resulting in lower energy needed to fire the spark plug in the cylinder on its exhaust stroke. This leaves the remainder of the high voltage to be used to fire the spark plug in the cylinder on its compression stroke. Since the CPS is in a fixed position, timing adjustments are not possible or needed.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

2. It is important to check for the presence of spark to all of the cylinders to isolate the problem to either direct ignition system (DIS) ignition coil inputs or outputs.

5. In checking the engine control module (ECM) outputs for the electronic spark timing signal, it recommended to use an oscilloscope to view the varying voltage signals. In measuring these outputs with a voltmeter, intermittent errors may occur that cannot be seen by a voltmeter.
6. After confirming ECM inputs for the electronic spark timing to the DIS ignition coil are OK, it can be determined that a faulty DIS ignition coil is at fault.
11. After confirming proper crankshaft position sensor inputs to the ECM and no wiring problems present, it can be determined that the ECM is at fault.
24. This step, along with step 25, checks for battery voltage and a ground to the DIS ignition coil.
26. If the wiring between the DIS ignition coil and the ignition 1 relay connector terminal 87 is OK, the problem is in the ignition 1 relay circuit.

Ignition System Check

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

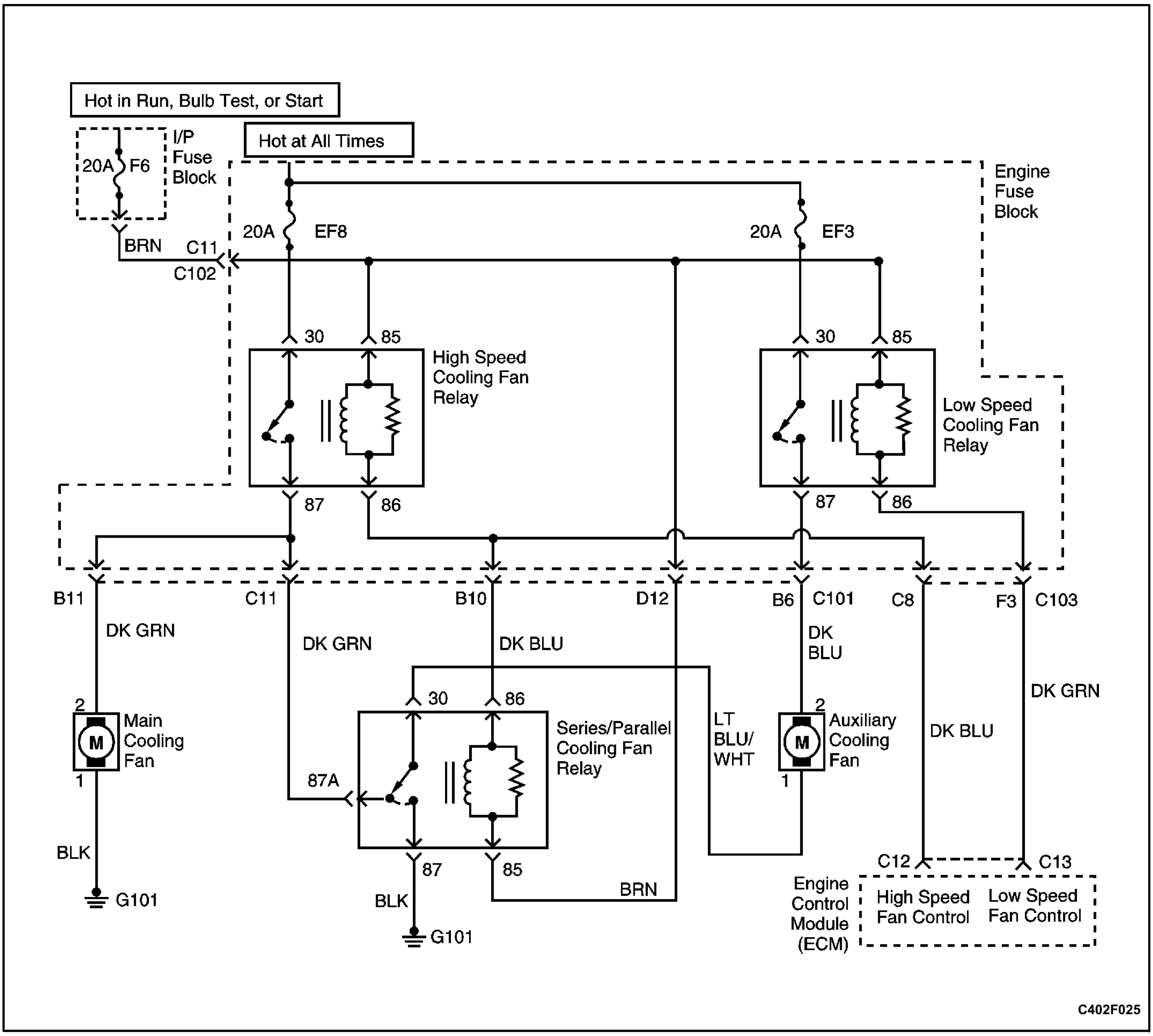
Step	Action	Value(s)	Yes	No
1	1. Remove the spark plugs. 2. Inspect for wet spark plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Replace the spark plugs as needed. Is the repair complete?	-	System OK	Go to *Step 2*
2	Check for the presence of spark from all of the igni tion wires while cranking the engine. Is spark present from all of the ignition wires?	-	System OK	Go to *Step 3*
3	1. Measure the resistance of the ignition wires. 2. Replace any ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	30,000 Ω	System OK	Go to *Step 4*
4	Is spark present from at least one of the ignition wires, but not all of the ignition wires?	-	Go to *Step 5*	Go to *Step 12*
5	1. Turn the ignition OFF. 2. Disconnect the direct ignition system (DIS) ignition coil connector. 3. While cranking the engine, measure the voltage at the DIS ignition coil connector terminal B. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 6*	Go to *Step 7*
6	While cranking the engine, measure the voltage at the DIS ignition coil connector terminal A. Does the voltage fluctuate within the values specified?	0.2-2.0 V	Go to *Step 10*	Go to *Step 8*
7	Check for an open in the wire from the DIS ignition coil connector terminal B to the engine control module (ECM) connector terminal C4. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*
8	Check for an open in the wire from the DIS ignition coil connector terminal A to the ECM connector terminal D5. Is the problem found?	-	Go to *Step 9*	Go to *Step 11*

Ignition System Check (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Repair the wiring as needed. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	System OK	-
10	1. Replace the DIS ignition coil. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	System OK	-
11	1. Replace the ECM. 2. Connect the DIS ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	-	System OK	-
12	1. Turn the ignition OFF. 2. Disconnect the crankshaft position sensor (CPS) connector. 3. Measure the resistance between the CPS terminals 1 and 2. Is the resistance within the value specified?	400-600 Ω	Go to *Step 13*	Go to *Step 28*
13	1. Measure the resistance between the CPS terminals 1 and 3. 2. Measure the resistance between the CPS terminals 2 and 3. Is the resistance infinite (open circuit)?	-	Go to *Step 14*	Go to *Step 28*
14	1. Turn the ignition ON. 2. Measure the voltage between the CPS connector terminals 1 and 3. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 20*	Go to *Step 15*
15	Measure the voltage between the CPS connector terminal 1 and ground. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 17*	Go to *Step 16*
16	Check the wire between the CPS connector terminal 1 and the ECM connector terminal C6 for an open or short. Is the problem found?	-	Go to *Step 18*	Go to *Step 11*
17	Check the wire between the CPS connector terminal 3 and ground for an open or short. Is the problem found?	-	Go to *Step 19*	Go to *Step 11*
18	Repair the wire between the CPS connector terminal 1 and the ECM connector terminal C6. Is the repair complete?	-	System OK	-
19	Repair the wire between the CPS connector terminal 3 and ground. Is the repair complete?	-	System OK	-

Ignition System Check (Cont'd)

Step	Action	Value(s)	Yes	No
20	1. Turn the ignition ON. 2. Measure the voltage between the CPS connector terminals 2 and 3. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 24*	Go to *Step 21*
21	Measure the voltage between the CPS connector terminal 2 and ground. Is the voltage within the value specified?	0.95-1.10 V	Go to *Step 17*	Go to *Step 22*
22	Check the wire between the CPS connector terminal 2 and the ECM connector terminal C5 for an open or short. Is the problem found?	-	Go to *Step 23*	Go to *Step 11*
23	Repair the wire between the CPS connector terminal 2 and the ECM connector terminal C5. Is the repair complete?	-	System OK	-
24	1. Turn the ignition OFF. 2. Connect a test light between the DIS ignition coil connector terminal D and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 25*	Go to *Step 26*
25	Connect a test light between the DIS ignition coil connector terminal C and battery positive. Is the test light on?	-	Go to *Step 5*	Go to *Step 27*
26	Check for an open in the wiring between the DIS ignition coil connector, terminal D and the ignition 1 relay connector terminal 87. Is the problem found?	-	Go to *Step 29*	Go to "Ignition 1 Relay Circuit Check"
27	Repair the wire between the DIS ignition coil connector terminal C and ground. Is the repair complete?	-	System OK	-
28	Replace the crankshaft position sensor. Is the repair complete?	-	System OK	-
29	Repair the open in the wiring between the DIS ignition coil connector terminal D and the ignition 1 relay connector terminal 87. Is the repair complete?	-	System OK	-



ENGINE COOLING FAN CIRCUIT CHECK

Circuit Description

The engine cooling fan circuit operates the main cooling fan and the auxiliary cooling fan. The cooling fans are controlled by the engine control module (ECM) based on inputs from the engine coolant temperature sensor (CTS) and the air conditioning pressure (ACP) sensor. The ECM controls the low speed cooling fan operation by internally grounding the ECM connector terminal C13. This energizes the low speed cooling fan relay and operates the main cooling fan and the auxiliary cooling fan at low speed as the cooling fans are connected in a series circuit. The ECM controls the high speed cooling fan operation by internally grounding the ECM connector terminal C13 and the ECM connector terminal C12 at the same time. This energizes the low speed cooling fan relay, the high speed cooling fan relay, and the series/parallel cooling fan relay resulting in high speed fan operation as the cooling fans are now connected in a parallel circuit.

Diagnostic Aids

- If the owner complained of an overheating problem, it must be determined if the complaint was due to an actual boil over, or the engine coolant temperature gauge indicated overheating. If the engine is overheating and the cooling fans are on, the cooling system should be checked.
- If the engine fuse block fuses EF3 or EF8 become open (blown) immediately after installation, inspect for a short to ground in the wiring of the appropriate circuit. If the fuses become open (blown) when the cooling fans are to be turned on by the engine control module (ECM), suspect a faulty cooling fan motor.
- The ECM will turn the cooling fans on at low speed when the coolant temperature is 93°C (199°F). The ECM will turn the cooling fans off when the coolant temperature is 90°C (194°F).

- The ECM will turn the cooling fans on at high speed when the coolant temperature is 97°C (207°F). The ECM will change the cooling fans from high speed to low speed when the coolant temperature is 94°C (201°F).
- The ECM will turn the cooling fans on at low speed when the A/C system is on. The ECM will change the cooling fans from low speed to high speed when the high side A/C pressure is 1,859 kPa (269 psi) then return to low speed when the high side A/C pressure is 1,449 kPa (210 psi).
- The cooling fan circuit can be checked quickly by disconnecting the ECM white connector and grounding the connector terminal C13. This should create low speed cooling fan operation with the ignition ON. By grounding the ECM connector terminals C13 and C12 and turning the ignition ON, high speed cooling fan operation should be achieved.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

4. This step, along with step 5, checks for the ability of the engine control module (ECM) to operate the cooling fans.
8. This step, along with step 9, checks for the ability of the ECM to operate the cooling fans in response to A/C pressure readings.
16. After confirming battery voltage and the ECM supplying a ground to the coil side of the low speed cooling fan relay, by jumpering connector terminals 30 and 87 it will be determined if the relay is at fault or a wiring problem is present.
31. This step checks for the presence of battery voltage to the main cooling fan when the A/C is on. If battery voltage is present and the cooling fans are not operating, the problem is in the ground side of the cooling fan circuit.
37. By directly grounding the ECM connector terminals C13 and C12, the main and auxiliary cooling fans should run at high speed.

Engine Cooling Fan Circuit Check

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Was the check performed?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Check the engine fuse block fuse EF3. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Check the engine fuse block fuse EF8. 2. Replace the fuse as needed. Is the fuse OK?	-	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. 3. Connect a scan tool to the data link connector (DLC). 4. Start the engine. 5. The cooling fans should run at low speed when the coolant temperature reaches 93°C (199°F). Do the cooling fans run at low speed?	-	Go to *Step 5*	Go to *Step 10*

Engine Cooling Fan Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. 3. Connect a scan tool to the DLC. 4. Start the engine. 5. The cooling fans should run at high speed when the coolant temperature reaches 97°C (207°F). Do the cooling fans run at high speed?	-	Go to *Step 6*	Go to *Step 33*
6	1. Turn the ignition OFF. 2. Start the engine. 3. Turn the A/C switch ON. Does the A/C compressor clutch engage?	-	Go to *Step 8*	Go to *Step 7*
7	1. Diagnose the A/C compressor clutch circuit. 2. Repair the A/C compressor clutch circuit as needed. 3. Start the engine. 4. Turn the A/C switch ON. Does the A/C compressor clutch engage?	-	Go to *Step 8*	-
8	Do the cooling fans run at low speed?	-	Go to *Step 9*	Go to *Step 31*
9	1. Turn the ignition OFF. 2. Connect the A/C pressure gauges. 3. Start the engine. 4. Turn the A/C switch ON. 5. The cooling fans should run at high speed when the high side A/C pressure reaches 1 882 kPa (273 psi). Do the cooling fans run at high speed?	-	System OK	-
10	1. Turn the ignition OFF. 2. Connect a scan tool to the DLC. 3. The coolant temperature should be above 93°C (199°F). 4. Disconnect the auxiliary cooling fan connector. 5. Turn the ignition ON. 6. Connect a test light between the auxiliary cooling fan connector terminal 2 and ground. Is the test light on?	-	Go to *Step 11*	Go to *Step 12*
11	1. Turn the ignition OFF. 2. Connect a scan tool to the DLC. 3. The coolant temperature should be above 93°C (199°F). 4. Disconnect the auxiliary cooling fan connector. 5. Connect a test light between the auxiliary cooling fan connector terminal 1 and battery positive. Is the test light on?	-	Go to *Step 28*	Go to *Step 17*
12	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 13*	Go to *Step 24*

Engine Cooling Fan Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Turn the ignition OFF. 2. Connect the low speed cooling fan relay. 3. Disconnect the engine control module (ECM) red connector. 4. Connect a fused jumper between the ECM connector terminal C13 and ground. 5. Turn the ignition ON. Do the cooling fans run at low speed?	-	Go to *Step 30*	Go to *Step 14*
14	Check for an open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal C13. Is the problem found?	-	Go to *Step 25*	Go to *Step 15*
15	1. Turn the ignition OFF. 2. Disconnect the low speed cooling fan relay. 3. Connect a test light between the low speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 16*	Go to *Step 23*
16	Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 26*	Go to *Step 17*
17	1. Disconnect the series/parallel cooling fan relay. 2. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 3. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. Do the cooling fans run at low speed?	-	Go to *Step 27*	Go to *Step 18*
18	Check the wire between the low speed cooling fan relay connector terminal 87 to the auxiliary cooling fan connector terminal 2 for an open. Is the problem found?	-	Go to *Step 22*	Go to *Step 19*
19	Check the wire between the auxiliary cooling fan connector terminal 1 and the series/parallel cooling fan relay connector terminal 30 for an open. Is the problem found?	-	Go to *Step 22*	Go to *Step 20*
20	Check the wire between the series/parallel cooling fan relay connector terminal 87 and the main cooling fan connector terminal 2 for an open. Is the problem found?	-	Go to *Step 22*	Go to *Step 21*
21	Check for an open wire between the main cooling fan connector terminal 1 and ground. Is the problem found?	-	Go to *Step 22*	Go to *Step 29*
22	Repair the open wire as needed. Is the repair complete?	-	System OK	-
23	Repair the open between the low speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-

Engine Cooling Fan Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
24	Repair the open between the low speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
25	Repair the open wire between the low speed cooling fan relay connector terminal 86 and the ECM connector terminal C13. Is the repair complete?	-	System OK	-
26	Replace the low speed cooling fan relay. Is the repair complete?	-	System OK	-
27	Replace the series/parallel cooling fan relay. Is the repair complete?	-	System OK	-
28	Replace the auxiliary cooling fan. Is the repair complete?	-	System OK	-
29	Replace the main cooling fan. Is the repair complete?	-	System OK	-
30	Replace the ECM. Is the repair complete?	-	System OK	-
31	1. Turn the ignition OFF. 2. Disconnect the auxiliary cooling fan connector. 3. Connect a test light between the auxiliary cooling fan connector terminal B and ground. 4. Turn the A/C switch ON. 5. Start the engine. Is the test light on?	-	Go to *Step 32*	Go to *Step 12*
32	1. Turn the ignition OFF. 2. Connect a test light between the main cooling fan connector terminal A and battery positive. 3. Turn the A/C switch ON. 4. Start the engine. Is the test light on?	-	Go to *Step 28*	Go to *Step 17*
33	1. Turn the ignition OFF. 2. Disconnect the high speed cooling fan relay. 3. Connect a test light between the high speed cooling fan relay connector terminal 85 and ground. 4. Turn the ignition ON. Is the test light on?	-	Go to *Step 34*	Go to *Step 44*
34	1. Turn the ignition OFF. 2. Connect a test light between the high speed cooling fan relay connector terminal 30 and ground. Is the test light on?	-	Go to *Step 35*	Go to *Step 45*
35	1. Disconnect the series/parallel cooling fan relay. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 85 and ground. 3. Turn the ignition ON. Is the test light on?	-	Go to *Step 36*	Go to *Step 46*

Engine Cooling Fan Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
36	1. Turn the ignition OFF. 2. Connect a test light between the series/parallel cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 37*	Go to *Step 47*
37	1. Connect the auxiliary cooling fan connector. 2. Connect the high speed cooling fan relay. 3. Connect the series/parallel cooling fan relay. 4. Disconnect the ECM white connector. 5. Connect a fused jumper between the ECM connector terminal C13 and ground. 6. Connect a fused jumper between the ECM connector terminal C12 and ground. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 30*	Go to *Step 38*
38	1. Turn the ignition OFF. 2. Check for an open wire between the high speed cooling fan relay connector terminal 86 and the ECM connector terminal C12. Is the problem found?	-	Go to *Step 22*	Go to *Step 39*
39	1. Disconnect the high speed cooling fan relay. 2. Connect a test light between the high speed cooling fan relay connector terminal 87 and battery positive. Is the test light on?	-	Go to *Step 40*	Go to *Step 48*
40	1. Disconnect the ECM red connector. 2. Connect a fused jumper between the ECM connector terminal C12 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a test light between the series/parallel cooling fan relay connector terminal 86 and battery positive. Is the test light on?	-	Go to *Step 41*	Go to *Step 49*
41	1. Connect the series/parallel cooling fan relay. 2. Connect a fused jumper between the ECM connector terminal C12 and ground. 3. Disconnect the high speed cooling fan relay. 4. Connect a fused jumper between the high speed cooling fan relay connector terminals 30 and 87. 5. Disconnect the low speed cooling fan relay. 6. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 7. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 43*	Go to *Step 42*

Engine Cooling Fan Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
42	1. Turn the ignition OFF. 2. Connect a fused jumper between the ECM connector terminal C12 and ground. 3. Disconnect the series/parallel cooling fan relay. 4. Connect a fused jumper between the series/parallel cooling fan relay connector terminals 30 and 87. 5. Connect a fused jumper between the low speed cooling fan relay connector terminals 30 and 87. 6. Turn the ignition ON. Do the cooling fans run at high speed?	-	Go to *Step 27*	-
43	Replace the high speed cooling fan relay. Is the repair complete?	-	System OK	-
44	Repair the open wire between the high speed cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
45	Repair the open wire between the high speed cooling fan relay connector terminal 30 and the battery. Is the repair complete?	-	System OK	-
46	Repair the open wire between the series/parallel cooling fan relay connector terminal 85 and the ignition switch. Is the repair complete?	-	System OK	-
47	Repair the open wire between the series/parallel cooling fan relay connector terminal 87 and ground. Is the repair complete?	-	System OK	-
48	Repair the open wire between the high speed cooling fan relay connector terminal 87 and the main cooling fan connector terminal 2. Is the repair complete?	-	System OK	-
49	Repair the open wire between the series/parallel cooling fan relay connector terminal 86 and the ECM connector terminal C12. Is the repair complete?	-	System OK	-

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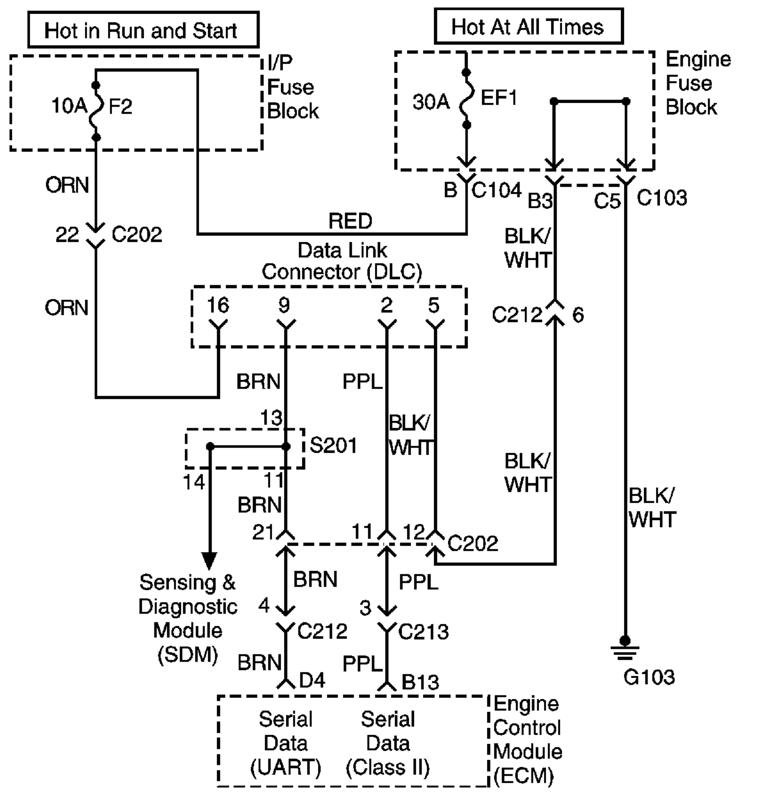

DATA LINK CONNCTSOR DIAGNOSIS

Circuit Description

The provision for communicating with the engine control module (ECM) is the Data Link Connector (DLC). It is located under the instrument panel. The DLC is used to connect the scan tool. Battery power and ground is supplied for the scan tool through the DLC. The Class II serial data circuit to the DLC allows the ECM to communicate with the scan tool. A Universal Asynchronous Receiver Transmitter (UART) serial data line is used to communicate with the other modules such as the Electronic Brake Control Module (EBCM), the Supplemental Inflatable Restraint (SIR) system and the Instrument Panel Cluster (IPC).

Diagnostic Aids

Ensure that the correct application (model line, car year, etc.) has been selected on the scan tool. If communication still cannot be established, try the scan tool on another vehicle to ensure that the scan tool or cables are not the cause of the condition.

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

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

- Backed-out terminals.
- Improper mating of terminals.
- Broken locks.
- Improperly formed or damaged terminals.
- Poor terminal-to-wiring connection.
- Physical damage to the wiring harness.
- Corrosion.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. Unlike the UART serial data circuit, the only time a Class II serial data circuit has any voltage on it is when a scan tool asks the ECM for information and sends the information out.
8. Locate and repair any shorts that may have caused the fuse to open before replacement, if the no voltage condition was due to an open fuse.
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
16. The scan tool or associated cables could be malfunctioning. Refer to the scan tool's manual for repair information.

Data Link Connector Diagnosis

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Was the check performed?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON, engine OFF. 2. Install the scan tool. Does the scan tool power up?	-	Go to *Step 3*	Go to *Step 4*
3	1. Disconnect the scan tool. 2. With a test light connected to ground, probe the Class II serial data terminal 2 at the Data Link Connector (DLC). Does the test light remain OFF?	-	Go to *Step 5*	Go to *Step 6*
4	With the test light connected to ground, probe the DLC battery feed circuit terminal 16. Does the test light remain OFF?	-	Go to *Step 7*	Go to *Step 8*
5	With the test light connected to B+, probe the Class II serial data terminal 2 at the DLC. Does the test light remain OFF?	-	Go to *Step 9*	Go to *Step 10*
6	Check the Class II serial data circuit for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 17*	Go to *Step 11*
7	With the test light connected to B+, probe the DLC ground circuit terminals 4. Does the test light illuminate for both circuits?	-	Go to *Step 15*	Go to *Step 12*
8	Repair the open or short to ground in the DLC battery feed circuit. Is the repair complete?	-	Go to *Step 17*	-
9	Check the Class II serial data circuit for an open or a poor connection and repair as necessary. Is a repair necessary?	-	Go to *Step 17*	Go to *Step 13*
10	Check the Class II serial data circuit for short to ground and repair as necessary. Is a repair necessary?	-	Go to *Step 17*	Go to *Step 11*
11	Replace the engine control module (ECM). Is the repair complete?	-	Go to *Step 17*	-

Data Link Connector Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
12	Repair the open or poor connection(s) in the DLC ground circuit(s). Is the repair complete?	-	Go to *Step 17*	-
13	Reinstall the scan tool. Can the scan tool communicate with the ECM?	-	Go to *Step 17*	Go to *Step 14*
14	Install the scan tool on another vehicle with a Class II serial data terminal and check for proper operation. Does the scan tool work properly on a different vehicle?	-	Go to *Step 11*	Go to *Step 16*
15	Check the DLC electrical terminals for proper tension or excessive resistance and repair as necessary. Is a repair necessary?	-	Go to *Step 17*	Go to *Step 16*
16	1. The scan tool is malfunctioning. 2. Refer to the scan tool's manual for repair. Is the repair complete?	-	Go to *Step 17*	-
17	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Attempt to start the engine. Does the engine start and continue to run?	-	Go to *Step 18*	Go to *Step 1*
18	1. Allow the engine to idle until normal operation temperature is reached. 2. Check if any DTCs are set. Are any DTCs displayed that have not been diag□ nosed?	-	Go to applicable DTC table	System OK

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FUEL INJCTSOR BALANCE TEST

A fuel injector tester is used to energize the injector for a precise amount of time, thus spraying a measured amount of fuel into the intake manifold. This causes a drop in the fuel rail pressure that can be recorded and used to compare each of the fuel injectors. All of the fuel injectors should have the same pressure drop 10 kPa (1.5 psi).

Injector Balance Test Example

Cylinder	1	2	3	4
First Reading	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)
Second Reading	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)
Amount Of Drop	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)
Average Range: 156-176 kPa (22.525.5 psi)	Injector OK	Faulty Injector - Too Much Pressure Drop	Injector OK	Faulty Injector - Too Little Pressure Drop

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Notice: In order to prevent flooding of the engine, do not perform the Injector Balance Test more than once (including any retest on faulty fuel injectors) without running the engine.

Test

1. An engine cool down period of 10 minutes is necessary in order to avoid irregular readings due to hot soak fuel boiling.
2. Connect the fuel pressure gauge carefully to avoid any fuel spillage.
3. The fuel pump should run about 2 seconds after the ignition is turned to the ON position.
4. Insert a clear tube attached to the vent valve of the fuel pressure gauge into a suitable container.
5. Bleed the air from the fuel pressure gauge and hose until all of the air is bled from the fuel pressure gauge.
6. The ignition switch must be in the OFF position at least 10 seconds in order to complete the engine control module (ECM) shutdown cycle.
7. Turn the ignition ON in order to get the fuel pressure to its maximum level.
8. Allow the fuel pressure to stabilize and then record this initial pressure reading. Wait until there is no movement of the needle on the fuel pressure gauge.
9. Follow the manufacturer's instructions for the use of the adapter harness. Energize the fuel injector tester once and note the fuel pressure drop at its lowest point. Record this second reading. Subtract it from the first reading to determine the amount of the fuel pressure drop.
10. Disconnect the fuel injector tester from the fuel injector.
11. After turning the ignition ON, in order to obtain maximum pressure once again, make a connection at the next fuel injector. Energize the fuel injector tester and record the fuel pressure reading. Repeat this procedure for all the injectors.
12. Retest any of the fuel injectors that the pressure drop exceeds the 10 kPa (1.5 psi) specification.
13. Replace any of the fuel injectors that fail the retest.
14. If the pressure drop of all of the fuel injectors is within 10 kPa (1.5 psi), then the fuel injectors are flowing normally and no replacement should be necessary.
15. Reconnect the fuel injector harness and review the symptom diagnostic tables.

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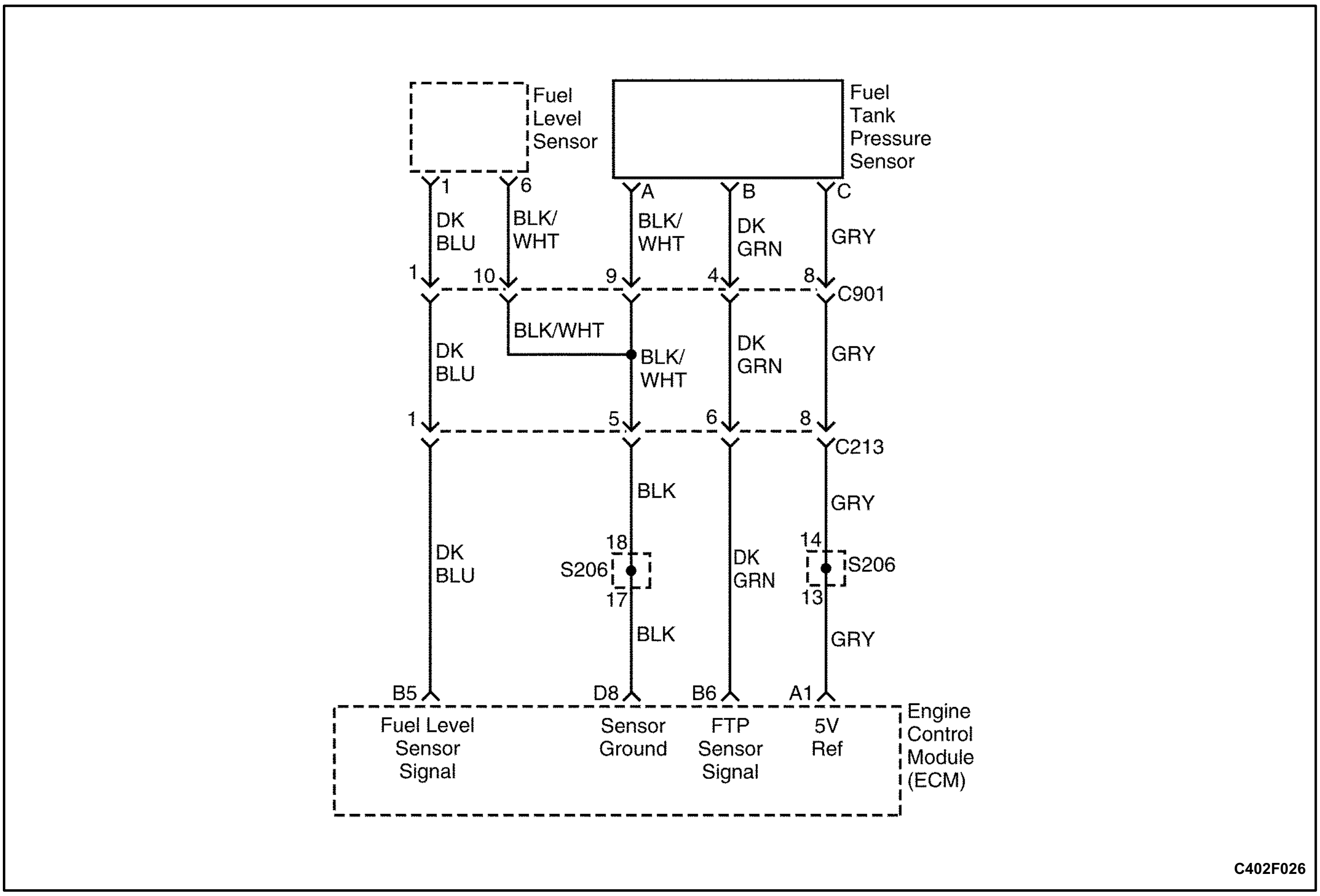

EVAP CONTROL SYSTEM DIAGNOSIS

Circuit Description

The evaporative emission (EVAP) system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The engine control module (ECM) monitors the vacuum level through the fuel tank pressure sensor signal. At an appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned on, allowing the engine to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned off, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, when all other variables remain constant. A leak, blockage or faulty component in the system will cause a Diagnostic Trouble Code (DTC) to be set.

Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM. Inspect harness connectors for the following conditions:
  - Backedout terminals.
  - Improper mating.
  - Broken locks.
  - Damaged terminals.
  - Poor terminaltowire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the Fuel Tank Vacuum Pressure display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.
- Incorrect purge or vacuum source line routing. Verify that the source vacuum and purge lines to the EVAP canister purge valve are not switched.

EVAP Control System Diagnosis

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Install the scan tool. 3. Turn the ignition ON. Are any Diagnostic Trouble Codes (DTCs) set?	-	Go to applicable DTC table	Go to *Step 3*
3	1. Disconnect the fuel tank pressure sensor electrical connector. 2. Using a digital voltmeter (DVM), measure the voltage between the 5 volt reference circuit and the sensor ground circuit at the fuel tank pressure sensor harness connector. Is the voltage near the specified value?	5 V	Go to *Step 6*	Go to *Step 4*
4	Check the 5 volt reference circuit for a poor terminal connection at the engine control module (ECM). Is a problem found?	-	Go to *Step 12*	Go to *Step 5*
5	Check for an open 5 volt reference circuit to the fuel tank pressure sensor harness connector. Is a problem found?	-	Go to *Step 11*	Go to *Step 9*
6	1. Remove the fuel cap. 2. Connect a jumper between terminal A at the fuel tank pressure sensor pigtail and terminal A at the harness connector on the ECM side. 3. Connect a jumper between terminal C at the fuel tank pressure sensor pigtail and terminal C at the harness connector on the ECM side. 4. Using a DVM, measure voltage at terminal B at the fuel tank pressure sensor pigtail. Is the voltage between the specified values?	1.3-1.7 V	Go to *Step 7*	Go to *Step 14*
7	Check the fuel tank pressure sensor signal circuit for a poor terminal connection at the ECM and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 8*
8	Check the fuel tank pressure sensor signal circuit between the fuel tank pressure sensor connector and the ECM for an open, short to ground, or short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 13*	Go to *Step 15*
9	Check the sensor ground circuit for a poor terminal connection at the ECM and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 10*
10	Check for an open in the sensor ground circuit. Is a problem found?	-	Go to *Step 13*	Go to *Step 15*
11	Check for a poor circuit terminal connection at the fuel tank pressure sensor connector and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 14*
12	Replace the malfunctioning harness connector terminals. Is the repair complete?	-	System OK	-

EVAP Control System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
13	Locate and repair the open/short circuit in the wiring harness. Is the repair complete?	-	System OK	-
14	Replace the fuel tank pressure sensor. Is the repair complete?	-	System OK	-
15	Replace the ECM. Is the repair complete?	-	System OK	-

TROUBLE CODE DIAGNOSIS

CLEARING TROUBLE CODES

Notice: To prevent engine control module (ECM) damage, the key must be OFF when disconnecting or reconnecting the power to the ECM (for example battery cable, ECM pigtail connector, ECM fuse, jumper cables, etc.).

When the ECM sets a diagnostic trouble code (DTC). The Malfunction Indicator Lamp (MIL) lamp will be turned on only for type A and B but a DTC will be stored in the ECM's memory for all type of DTC. If the problem is intermittent, the MIL will go out after 10 seconds if the fault is no longer present. The DTC will stay in the ECM's memory until cleared by scan tool. Removing battery voltage for 10 seconds will clear some stored DTCs.

DTCs should be cleared after repairs have been completed. Some diagnostic tables will tell you to clear the codes before using the chart. This allows the ECM to set the DTC while going through the chart, which will help to find the cause of the problem more quickly.

DIAGNOSTIC TROUBLE CODES

DTC	Description	Type	Illuminate MIL
P0106	Manifold Absolute Pressure Rationality	B	Yes
P0107	Manifold Absolute Pressure Low Voltage	A	Yes
P0108	Manifold Absolute Pressure High Voltage	A	Yes
P0112	Intake Air Temperature Low Voltage	A	Yes
P0113	Intake Air Temperature High Voltage	A	Yes
P0117	Engine Coolant Temperature Low Voltage	A	Yes
P0118	Engine Coolant Temperature High Voltage	A	Yes
P0122	Throttle Position Sensor Low Voltage	A	Yes
P0123	Throttle Position Sensor High Voltage	A	Yes
P0131	O2 Bank 1 Sensor 1 Low Voltage	A	Yes
P0132	O2 Bank 1 Sensor 1 High Voltage	A	Yes
P0134	O2 Bank 1 Sensor 1 No Activity	A	Yes
P0137	O2 Bank 1 Sensor 2 Low Voltage	A	Yes
P0138	O2 Bank 1 Sensor 2 High Voltage	A	Yes
P0140	O2 Bank 1 Sensor 2 No Activity	A	Yes
P0141	O2 Bank 1 Sensor 2 Heater	B	Yes
P0201	Injector 1 Circuit Fault	A	Yes
P0202	Injector 2 Circuit Fault	A	Yes
P0203	Injector 3 Circuit Fault	A	Yes
P0204	Injector 4 Circuit Fault	A	Yes

Diagnostic Trouble Codes (Cont'd)

DTC	Description	Type	Illuminate MIL
P0325	Knock Sensor SNEF Internal Malfunction	B	Yes
P0327	Knock Sensor Circuit Fault	B	Yes
P0336	58X Crank Position Extra/Missing Pulses	B	Yes
P0337	58X Crank Position No Signal	A	Yes
P0351	Ignition Control A Circuit Fault	A	Yes
P0352	Ignition Control B Circuit Fault	A	Yes
P0404	Exhaust Gas Recirculation Open Valve Position Error	B	Yes
P0405	Exhaust Gas Recirculation Pintle Position Low Voltage	A	Yes
P0406	Exhaust Gas Recirculation Pintle Position High Voltage	A	Yes
P0443	Evaporative Emission System Purge Control Circuit	A	Yes
P0480	Cooling Fan Relay 1 Fan Control Circuit Fault	D	No
P0481	Cooling Fan Relay 2 Fan Control Circuit Fault	D	No
P0502	Vehicle Speed (Engine Side) No Signal	B	Yes
P0506	Idle Speed RPM Lower Than Desired Idle Speed	B	Yes
P0507	Idle Speed RPM Higher Than Desired Idle Speed	B	Yes
P0562	System Voltage (Engine Side) Too Low	D	No
P0563	System Voltage (Engine Side) Too High	D	No
P0601	ECM (Engine Side) Checksum Fault	A	Yes
P1106	Manifold Absolute Pressure Intermittent High Voltage	D	No
P1107	Manifold Absolute Pressure Intermittent Low Voltage	D	No
P1109	Variable Geometry Induction Solenoid Electrical Fault	D	No
P1111	Intake Air Temperature Intermittent High Voltage	D	No
P1112	Intake Air Temperature Intermittent Low Voltage	D	No
P1114	Engine Coolant Temperature Intermittent Low Voltage	D	No
P1115	Engine Coolant Temperature Intermittent High Voltage	D	No
P1121	Throttle Position Sensor Intermittent High Voltage	D	No
P1122	Throttle Position Sensor Intermittent Low Voltage	D	No
P1404	Exhaust Gas Recirculation Closed Valve Pintle Error	B	Yes
P1509	Idle Air Control Counts Too High	D	No
P1520	Park/Neutral Discrete Fault	D	No
P1625	ECM Internal System Reset	D	No
P1640	ODM Internal SPI Communication	A	Yes

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DIAGNOSTIC TROUBLE CODE (DTC) P0106

MANIFOLD ABSOLUTE PRESSURE RATIONALITY

Circuit Description

The engine control module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure which results from engine load (intake manifold vacuum) and the rpm changes, and it converts these into voltage outputs. The ECM can detect if the MAP sensor is not responding to the TP changes by comparing the actual MAP change to a predicted MAP change based on the amount of TP change that occurs. If the ECM does not see the expected MAP change or more, DTC P0106 will set.

Conditions for Setting the DTC

- DTCs P0107, P0108, P0117, P0118, P0122, P0123, P0201, P0202, P0203, P0204, P0300, P0351, P0352, P0402, P0404, P0405, P0406, P0443, P0506, P0507, P1404, P1441, P1627 not set.
- Engine running.
- Valid barometric pressure (BARO) update.
- A/C steady state.
- No power steering cramp.
- No TPS fail conditions present.
- No MAP fail conditions present.
- Change in Idle Air Control (IAC) is less than 4 counts.
- Coolant temperature is greater than -10°C (14°F).
- Change in rpm is less than 200.
- Change in TPS is less than 6%.
- The rpm is between 1300 and 4500.
- All of the above are stabilized for 0.5 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The Coolant fan turns on.
- The ECM will substitute a fixed MAP value and use TP to control the fuel delivery. (The scan tool will not show defaulted value.)

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same ±0.4 volts.

The MAP sensor vacuum source should be thoroughly checked for restrictions at the intake manifold.

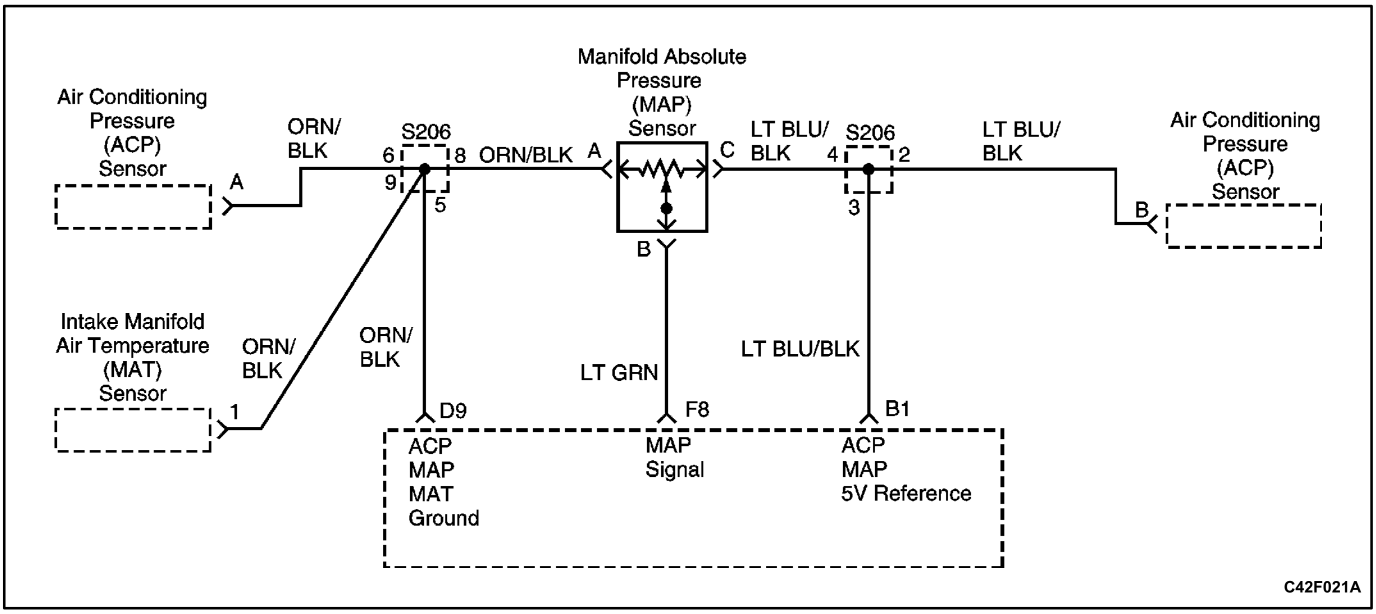
Test Description

Numbers below refer to the step numbers on the Diagnostic Table.

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. A sensor that displays an ignition ON, engine OFF BARO value that does not appear normal for the altitude the vehicle is in should be considered to be malfunctioning.
3. While starting the engine, the MAP sensor should detect any changes in the manifold pressure. This test is to determine if the sensor is stuck at a valve.
4. A normal MAP sensor will react as quickly to the throttle changes as they can be made. A sensor should not appear to be lazy or catch up with the throttle movements.
5. This step checks if the reason for no MAP change was due to a faulty sensor or vacuum source to the sensor.
7. The MAP sensor vacuum source should be thoroughly checked for restrictions. A drill bit can be used to clean out any casting flash that may exist in the vacuum port.
9. The MAP Sensor System Performance diagnostic may have to complete several tests before determining if the diagnostic has passed or failed the last test. Operate the vehicle in the Conditions for Setting the DTC several times to ensure that the diagnostic runs enough tests to pass or fail.
10. If no faults have been found at this point and no additional DTCs are set, refer to "Diagnostic Aids" in this section for additional checks and information.

DTC P0106 Manifold Absolute Pressure Rationality

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool. 2. Turn the ignition switch ON with the engine not running. 3. Compare the barometric pressure (BARO) reading with a known good vehicle. Is the BARO reading normal for your altitude?	0.25 V	Go to *Step 3*	Go to *Step 8*
3	Start the engine while watching the Manifold Absolute Pressure (MAP) sensor value. Does the MAP sensor value change while starting the engine?	4.7 V	Go to *Step 4*	Go to *Step 5*
4	With the engine still running, snap the throttle while watching the MAP sensor display on the scan tool. Does the MAP sensor value change rapidly with the throttle position changes?	0.25 V	Go to *Step 9*	Go to *Step 6*
5	1. Disconnect the MAP sensor vacuum hose and install a vacuum gauge to the MAP sensor. 2. Turn the ignition switch ON, with the engine OFF. 3. Apply 15 in HG to the MAP sensor. Does the MAP sensor value on the scan tool change?	-	Go to *Step 7*	Go to *Step 8*
6	1. Remove the MAP sensor hose from the manifold port. 2. Inspect the port and the hose for restrictions and repair as necessary. Is the action complete?	4.0 V	Go to *Step 9*	Go to *Step 8*
7	Repair the restriction in the MAP sensor vacuum port or hose. Is the action complete?	-	Go to *Step 9*	-
8	Replace the MAP sensor. Is the action complete?	-	Go to *Step 9*	-
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0107 MANIFOLD ABSOLUTE PRESSURE LOW VOLTAGE

Circuit Description

The engine control module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure which results from engine load (intake manifold vacuum) and the rpm changes, and it converts these into voltage outputs. The ECM sends a 5 volt reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the MAP sensor also changes. By monitoring the MAP sensor output voltage, the ECM knows the manifold pressure. A low pressure (low voltage) output voltage will be about 1.0 to 1.5 volts at idle, while higher pressure (high voltage) output voltage will be about 4.5 to 4.8 at Wide Open Throttle (WOT). The MAP sensor is also used, under certain conditions, to measure barometric pressure (BARO), allowing the ECM to make adjustments for different altitudes.

Conditions for Setting the DTC

- No Throttle Position Sensor (TPS) fail conditions present.
- Engine running.
- MAP is less than 12 kPa.
- The TPS is greater than or equal to 2.0% if the rpm is less than or equal to 2000.
- The TPS is greater than 5.0% if the rpm is greater than 2000.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The Coolant fan turns on.
- The ECM will substitute a fixed MAP value and use TP to control the fuel delivery. (The scan tool will not show defaulted 0.)

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same ±0.4 volt.

If a DTC P0107 is intermittent, refer to "Manifold Absolute Pressure Check" in this section for further diagnosis.

Important: After repairs, use the scan tool FUEL TRIM RESET function to reset longterm fuel trim to 128 (0%).

Test Description

Numbers below refer to the step numbers on the Diagnostic Table.

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the

malfunction occurred. The information is then stored on the scan tool for later reference.

2. This step will determine if DTC P0107 is the result of a hard failure or an intermittent condition.
3. Jumpering harness terminal B to C (signal circuit to 5 volts) will determine if the sensor is malfunctioning or if there is a problem with the ECM or wiring.
6. The scan tool may not display 5 volts. The important thing is that the ECM recognizes the voltage as more than 4 volts, indicating that the ECM and the signal circuit are OK. A test light that illuminates indicates a short to ground in the signal circuit.
7. A short to ground in the 5 volt reference circuit could also set additional DTCs.
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for the ECM reprogramming.

DTC P0107 Manifold Absolute Pressure Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	With engine idling, install a scan tool. Does the scan tool display Manifold Absolute Pressure (MAP) voltage below the specified value?	0.25 V	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition switch OFF. 2. Disconnect the MAP sensor electrical connector. 3. Jumper the MAP signal circuit at terminal B to the 5 volt reference circuit at terminal C. 4. Turn the ignition switch on. Does the MAP voltage read more than the specified value?	4.7 V	Go to *Step 5*	Go to *Step 6*
4	1. Turn the ignition switch ON with the engine OFF, review the Freeze Frame data, and note the parameters. 2. Operate the vehicle within the freeze frame conditions and Conditions For Setting the DTC as noted. Does the scan tool display MAP voltage below the specified value?	0.25 V	Go to *Step 3*	Go to "Diagnostic Aids"
5	Inspect the MAP sensor harness electrical connector terminals for the following conditions: • Poor connections. • Proper contact tension. • Poor terminal to wire connection. Is a problem found?	-	Go to *Step 8*	Go to *Step 9*
6	1. Turn the ignition switch OFF. 2. Remove the jumper wire. 3. Probe the MAP sensor signal circuit terminal F8 with a test light to B+. 4. Turn the ignition switch ON. Does the scan tool read over the specified value?	4.0 V	Go to *Step 7*	Go to *Step 12*
7	Check the MAP sensor 5 volt reference circuit at terminal B1 for an open or short to ground. Is a problem found?	-	Go to *Step 10*	Go to *Step 11*

DTC P0107 Manifold Absolute Pressure Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	Repair the connection terminals as necessary. Is the action complete?	-	Go to *Step 14*	-
9	Replace the MAP sensor. Is the action complete?	-	Go to *Step 14*	-
10	Repair the MAP sensor 5 volt reference circuit. Is the action complete?	-	Go to *Step 14*	-
11	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 14*	-
12	Check the MAP sensor signal circuit for the following conditions: • Open. • Short to ground. • Short to sensor ground. Is a problem found?	-	Go to *Step 13*	Go to *Step 11*
13	Repair the MAP sensor signal circuit. Is the action complete?	-	Go to *Step 14*	-
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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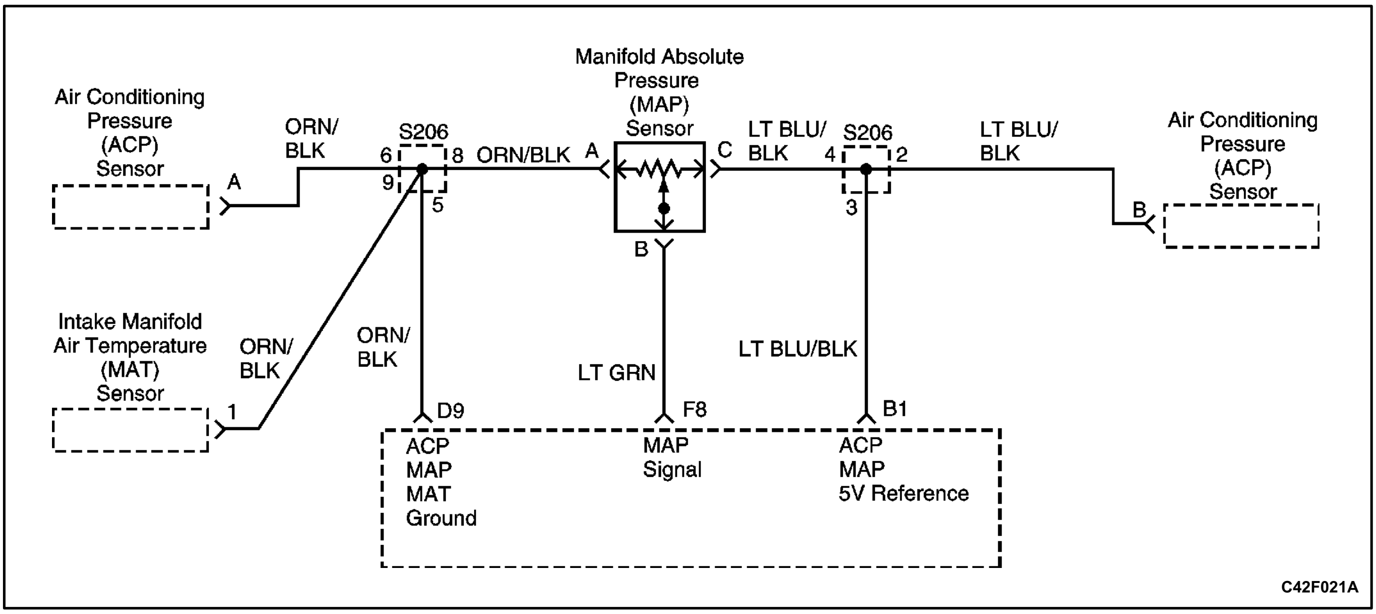

DIAGNOSTIC TROUBLE CODE (DTC) P0108 MANIFOLD ABSOLUTE PRESSURE HIGH VOLTAGE

Circuit Description

The engine control module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure which results from engine load (intake manifold vacuum) and the rpm changes; and converts these into voltage outputs. The ECM sends a 5 volt reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the MAP sensor also changes. By monitoring the MAP sensor output voltage, the ECM knows the manifold pressure. A low pressure (low voltage) output voltage will be about 1.0 to 1.5 volts at idle, while higher pressure (high Voltage) output voltage will be about 4.5 to 4.8 at Wide Open Throttle (WOT). The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the ECM to make adjustments for different altitudes.

Conditions for Setting the DTC

- No Throttle Position Sensor (TPS) fail conditions present.
- Engine running.
- MAP is greater than 12 kPa.
- The TPS is less than 37% if the rpm is less than or equal to 2500.
- The TPS is less than 56% if the rpm is greater than 2500.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.
- The ECM will substitute a fixed MAP value and use TP to control the fuel delivery. (The scan tool will not show defaulted 0.)

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmospheric pressure, and the signal voltage will be high. This information is used by the ECM as an indication of vehicle altitude. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same ±0.4 volt.

If a DTC P0108 is intermittent, refer to MAP Sensor Output Check for further diagnosis.

DTC P0172 may set as a result of a misfire. If misfire is present, repair the cause of misfire before using this table. The misfire counters may be used to determine which cylinder(s) is misfiring.

Important: After repairs, use the scan tool FUEL TRIM RESET function to reset longterm fuel trim to 128 (0%).

If DTC P0172 is also set, check the 5 volt reference circuit for a short to voltage.

Test Description

Numbers below refer to the step numbers on the Diagnostic Table.

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step will determine if DTC P0108 is the result of a hard failure or an intermittent condition.
3. This step simulates conditions for a DTC P0107. If the ECM recognizes the change, the ECM, the 5 volt reference and the sensor signal circuits are OK.
5. This step also looks for an open in the sensor ground circuit. If the circuit is open, additional DTCs will also be set. If no other DTCs are set and the circuit is found to be open, then the open must be between the MAP sensor and the electrical connector ground splice.
6. When the sensor signal circuit is shorted to battery voltage, the TP will be displayed above 0% at all times and A/C High Side will be displayed high. The vehicle will also remain in Open Loop.
8. The MAP sensor vacuum source should only supply vacuum to the MAP sensor. Check the vacuum port for a restriction caused by casting flash.
9. Disconnect all sensors that use a 5 volt reference one at a time while monitoring the short on the 5 volt reference circuit. Replace any sensor that may have caused the short on the 5 volt reference circuit.
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for the ECM reprogramming.

DTC P0108 Manifold Absolute Pressure High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Install a scan tool. 2. Idle the engine. Does the scan tool display a Manifold Absolute Pressure (MAP) voltage of the specified value or less?	4.0 V	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition switch OFF. 2. Disconnect the MAP sensor electrical connector. 3. Turn the ignition switch on. Does the scan tool display a MAP voltage of the specified value or less?	1.0 V	Go to *Step 5*	Go to *Step 6*
4	1. Turn the ignition switch ON, with the engine OFF, review the Freeze Frame data and note the parameters. 2. Operate the vehicle within the freeze frame conditions and Conditions For Setting the DTC as noted. Does the scan tool display a MAP voltage equal to or greater than the specified value?	4.0 V	Go to *Step 3*	Go to "Diagnostic Aids"
5	Probe the MAP sensor signal ground circuit at terminal F8 with a test light connected to battery voltage. Does the test light illuminate?	-	Go to *Step 7*	Go to *Step 11*

DTC P0108 Manifold Absolute Pressure High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
6	Check the MAP sensor signal circuit at terminal F8 for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 14*	Go to *Step 12*
7	With a digital volt meter (DVM) connected to ground, probe the 5 volt reference circuit at terminal B1. Does the DVM display near the specified value?	5 V	Go to *Step 8*	Go to *Step 9*
8	Check the MAP sensor vacuum source for being plugged or leaking. Is a problem found?	-	Go to *Step 10*	Go to *Step 13*
9	Check the 5 volt reference circuit at terminal B1 for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 14*	Go to *Step 12*
10	Repair the vacuum source as necessary. Is the action complete?	-	Go to *Step 14*	-
11	Check for an open in the MAP sensor ground circuit at terminal D9 and repair as necessary. Is a repair necessary?	-	Go to *Step 14*	Go to *Step 12*
12	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 14*	-
13	Replace the MAP sensor. Is the action complete?	-	Go to *Step 14*	-
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has ran and passed?	-	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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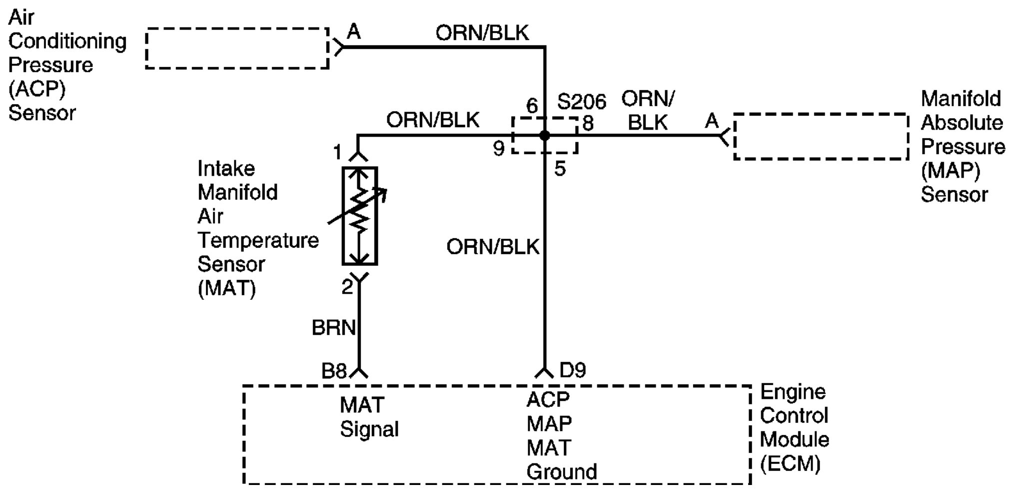


DIAGNOSTIC TROUBLE CODE (DTC) P0112
INTAKE AIR TEMPERATURE LOW VOLTAGE

Circuit Description

The Intake Manifold Air Temperature (MAT) Sensor uses a thermistor to control the signal voltage to the engine control module (ECM). The ECM supplies a 5 volt reference and a ground to the sensor. When the air is cold, the resistance is high; therefore the MAT signal voltage will be high. If the intake air is warm, resistance is low; therefore the MAT signal voltage will be low.

Conditions for Setting the DTC

- Engine run time is greater than 3 seconds.
- Vehicles speed is greater than 25 mph.
- DTC P0502 not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The Coolant fan turns on.
- The ECM will default to 60°C (140°F) for intake air temperature. The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

If the vehicle is at ambient temperature, compare the MAT sensor to the Engine Coolant Temperature (CTS) sensor. The MAT sensor and the CTS sensor should be relatively close to each other.

Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

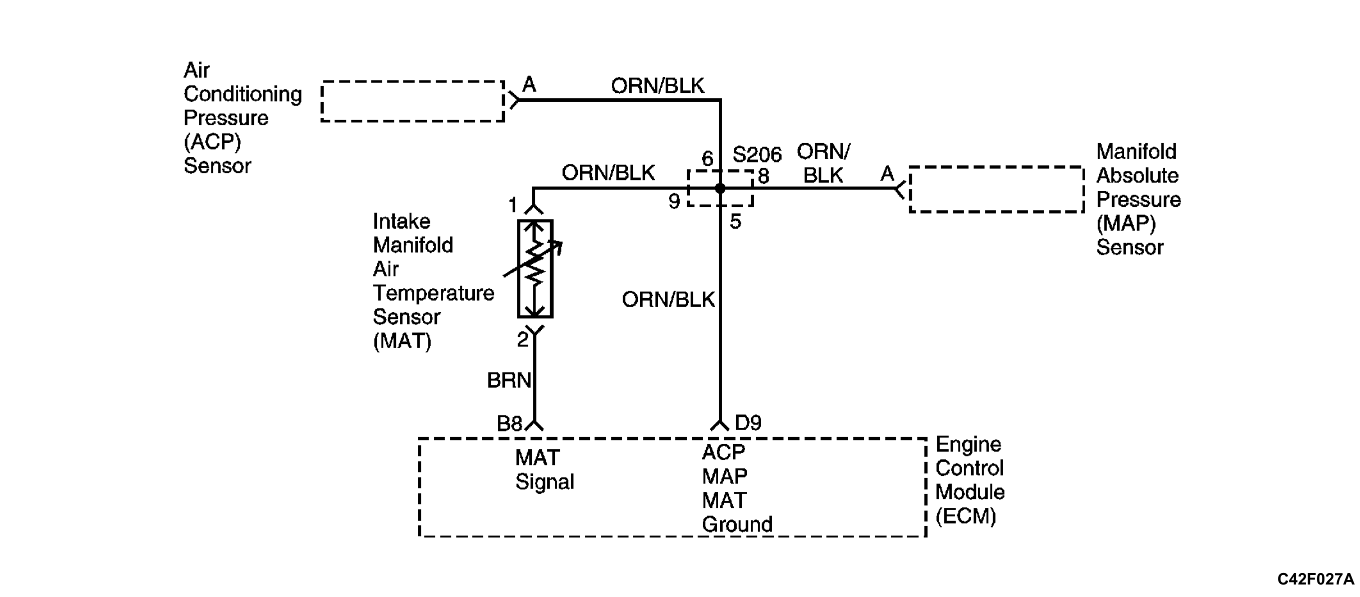
Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0113 condition. If the scan tool displays the specified value, the MAT signal circuit and the ECM are OK.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0112 Intake Air Temperature Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Turn the ignition switch ON with the engine OFF. 2. Install a scan tool Is the Intake Air Temperature (MAT) value greater than the specified value?	128°C (262°F)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF, review Freeze Frame data, and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the MAT sensor value greater than the specified value?	128°C (262°F)	Go to *Step 4*	Go to "Diagnostic Aids"
4	Disconnect the MAT sensor electrical connector. Is the MAT sensor value below the specified value?	30°C (22°F)	Go to *Step 5*	Go to *Step 6*
5	Replace the MAT sensor. Is the action complete?	-	Go to *Step 9*	-
6	With a test light connected to B+, probe the MAT sensor signal circuit, terminal 2 at the MAT sensor electrical connector. Does the test light illuminate?	-	Go to *Step 9*	-
7	Repair the short to ground in the MAT sensor signal circuit. Is the action complete?	-	Go to *Step 13*	Go to *Step 11*
8	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 9*	-
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 10*	Go to *Step 2*
10	Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to the applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0113 INTAKE AIR TEMPERATURE HIGH VOLTAGE

Circuit Description

The Intake Manifold Air Temperature (MAT) Sensor uses a thermistor to control the signal voltage to the engine control module (ECM). The ECM supplies a 5 volt reference and a ground to the sensor. When the air is cold, the resistance is high; therefore the MAT signal voltage will be high. If the intake air is warm, resistance is low; therefore the MAT signal voltage will be low.

Conditions for Setting the DTC

- Engine run time is greater than 120 seconds.
- Vehicles speed is less than 113 km/h (70 mph).
- Coolant temperature is greater than 8°C. (17.6°F).
- Airflow is less than 30 g/s.
- DTC P0502 not set.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns on.
- The ECM will default to 60°C (140°F) for MAT. The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- The DTCs can be cleared by using the scan tool.

Diagnostic Aids

- If the vehicle is at ambient temperature, compare the MAT sensor to the Engine Coolant Temperature (CTS) sensor. The MAT sensor and the CTS sensor should be relatively close to each other.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0112. If the ECM senses the change, the ECM and wiring are OK.
5. This step will determine if the reason the ECM did not sense the change was due to a open ground or signal circuit or malfunctioning ECM.
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0113 Intake Air Temperature High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a scan tool. Is the Intake Air Temperature (MAT) value less than the specified value?	30°C (22°F)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON, with the engine OFF, review Freeze Frame data and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the MAT sensor value less than the specified value?	30°C (22°F)	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Disconnect the MAT sensor electrical connector. 2. Jumper the MAT sensor signal circuit at terminal 2 and the MAT sensor ground circuit at terminal 1 together at the MAT sensor electrical connector. Is the MAT sensor value greater than the specified value?	130°C (266°F)	Go to *Step 7*	Go to *Step 8*
5	Jumper the MAT sensor signal circuit at terminal 2 to ground. Is the MAT sensor value greater than the value specified?	130°C (266°F)	Go to *Step 7*	Go to *Step 8*
6	Check for a poor connection at the MAT sensor electrical connector and replace any malfunctioning terminals if necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 10*
7	Check the MAT sensor ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 9*
8	Check the MAT sensor signal circuit for an open and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 9*
9	Check for a poor MAT sensor ground circuit at terminal D9 or a poor MAT sensor signal circuit terminal B8 connection at the engine control module (ECM) and repair if necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 11*
10	Replace the MAT sensor. Is the action complete?	-	Go to *Step 12*	-
11	Replace the ECM. Is the action complete?	-	Go to *Step 12*	-

DTC P0113 Intake Air Temperature High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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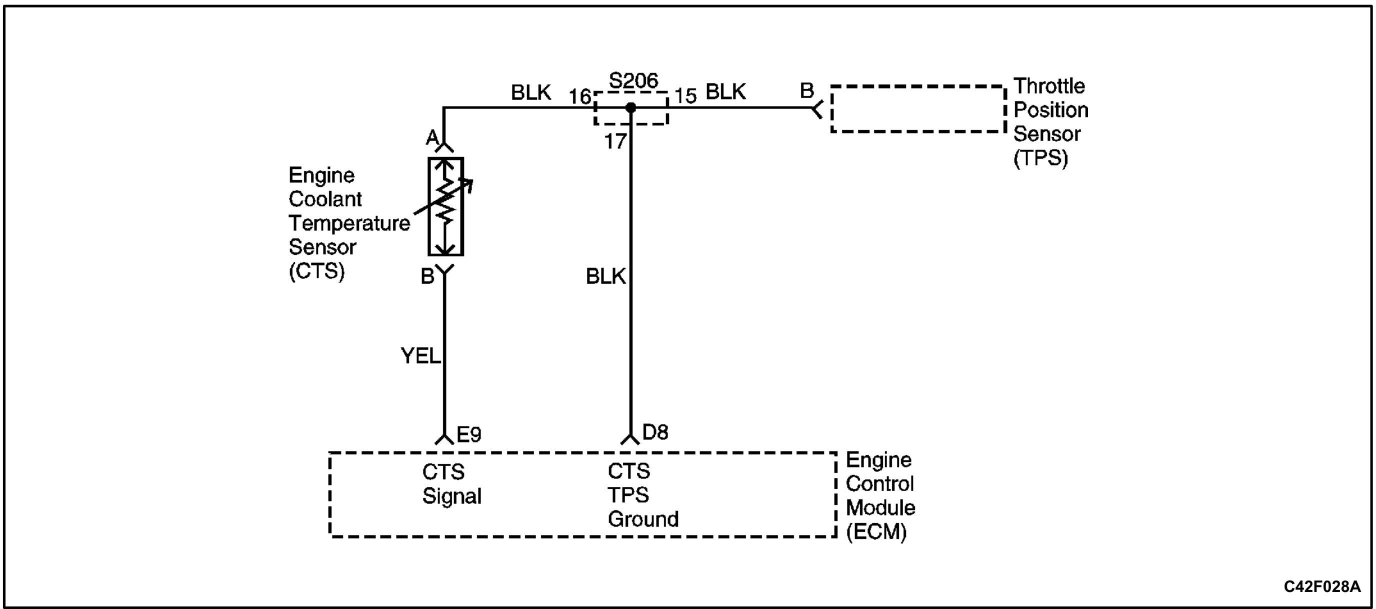


DIAGNOSTIC TROUBLE CODE (DTC) P0117
ENGINE COOLANT TEMPERATURE LOW VOLTAGE

Circuit Description

The Engine Coolant Temperature Sensor (CTS) uses a thermistor to control the signal voltage to the engine control module (ECM). The ECM supplies a voltage on the signal circuit to the sensor. When the air is cold, the resistance is high; therefore the CTS signal voltage will be high.

As the engine warms, the sensor resistance becomes less, and the voltage drops. At normal engine operating temperature, the voltage will be between 1.5 and 2.0 volts at the CTS signal terminal.

The CTS sensor is used to control the following items:

- Fuel delivery.
- Ignition
- Evaporative Emission (EVAP) canister purge valve.
- Idle Air Control (IAC) valve.
- Electric cooling fan.

Conditions for Setting the DTC

- Engine run time is greater than 120 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns on.
- The ECM will default to 20°C (68°F) for the first 60 seconds of engine run time, and then to 92°C (198°F). The scan tool may not show the defaulted value.

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

After the engine has started, the CTS should rise steadily to about 90°C (194°F) then stabilize when the thermostat opens.

Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

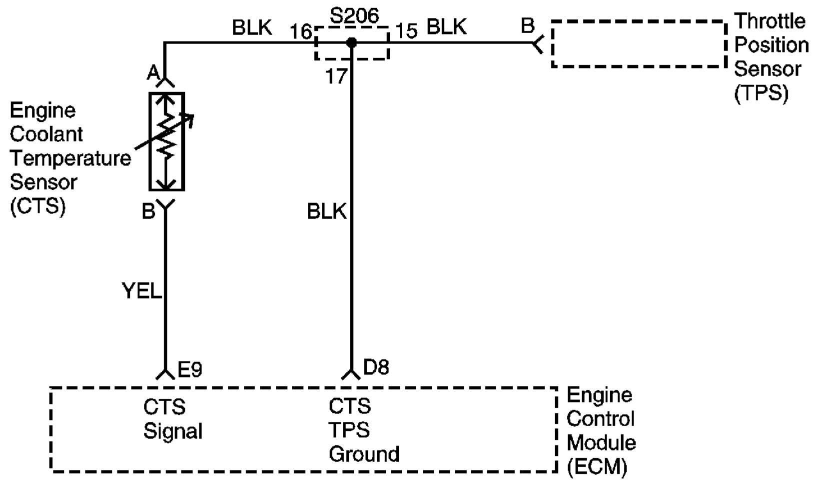
Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0118 condition. If the ECM senses the change, then the ECM and the CTS wiring are OK.
7. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0117 Engine Coolant Temperature Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a scan tool. Is the engine coolant temperature sensor (CTS) value greater than the specified value?	130°C (266°F)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF. 2. Review Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the CTS sensor value greater than the specified value?	130°C (266°F)	Go to *Step 4*	Go to "Diagnostic Aids"
4	Disconnect the CTS sensor electrical connector. Is the CTS sensor value less than the specified value?	30°C (22°F)	Go to *Step 6*	Go to *Step 5*
5	Check the CTS sensor signal circuit at terminal B for a short to ground and repair as necessary. Is a repair necessary?	-	Go to *Step 8*	Go to *Step 7*
6	Replace the CTS sensor. Is the action complete?	-	Go to *Step 8*	-
7	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 8*	-
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0118 ENGINE COOLANT TEMPERATURE HIGH VOLTAGE

Circuit Description

The Engine Coolant Temperature Sensor (CTS) uses a thermistor to control the signal voltage to the engine control module (ECM). The ECM supplies a voltage on the signal circuit to the sensor. When the air is cold, the resistance is high; therefore the CTS signal voltage will be high. As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature, the voltage will be between 1.5 and 2.0 volts at the CTS signal terminal.

The CTS sensor is used to control the following items:

- Fuel delivery.
- Ignition.
- Evaporative Emission (EVAP) canister purge valve.
- Idle Air Control (IAC) valve.
- Electric cooling fan.

Conditions for Setting the DTC

- Engine run time is greater 120 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.
- The ECM will default to 20°C (68°F) for the first 60 seconds of engine run time, and then to 92°C (198°F). The scan tool may show the defaulted value.

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

Normal operating temperature for the engine cooling system is between 90°C (194°F) and 95°C (203°F).

Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
4. This step simulates a DTC P0117 condition. If the ECM senses the change, then the ECM and the CTS wiring are OK.
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0118 Engine Coolant Temperature High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a scan tool. Is the Engine Coolant Temperature (CTS) sensor value less than the specified value?	30°C (22°F)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF. 2. Review Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the CTS sensor value less than the specified value?	30°C (22°F)	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Disconnect the CTS sensor electrical connector. 2. Jumper the CTS sensor signal circuit at terminal B and the CTS sensor ground circuit at terminal A together at the CTS electrical connector. Is the CTS sensor value greater than the specified value?	130°C (266°F)	Go to *Step 6*	Go to *Step 5*
5	Jumper the CTS sensor signal circuit at terminal B to chassis ground. Is the CTS sensor value greater than the specified value?	130°C (266°F)	Go to *Step 7*	Go to *Step 8*
6	Check for poor connections at the CTS sensor and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 10*
7	Check the CTS sensor ground circuit for an open and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 9*
8	Check the CTS sensor signal circuit for an open and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 9*
9	Check for a poor CTS sensor ground circuit at terminal D8 or a poor CTS sensor signal circuit at terminal E9 connection at the engine control module (ECM) and replace the terminals if necessary. Do any of the terminal(s) need to be replaced?	-	Go to *Step 12*	Go to *Step 11*
10	Replace the CTS sensor. Is the action complete?	-	Go to *Step 12*	-
11	Replace the ECM. Is the action complete?	-	Go to *Step 12*	-

DTC P0118 Engine Coolant Temperature High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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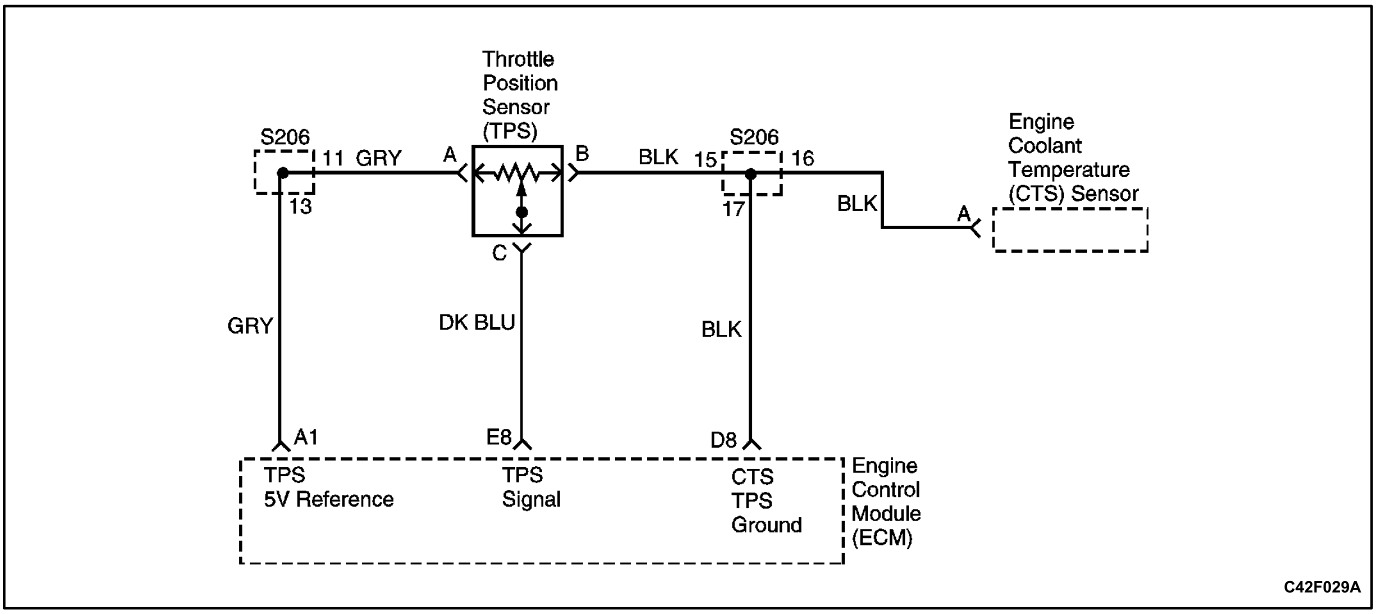

DIAGNOSTIC TROUBLE CODE (DTC) P0122 THROTTLE POSITION SENSOR LOW VOLTAGE

Circuit Description

The engine control module (ECM) supplies a 5 volt reference signal and a ground to the Throttle Position Sensor (TPS). The TPS sends a voltage signal back to the ECM relative to the throttle plate opening. The voltage signal will vary from approximately 0.1 volts at closed throttle, to over 4.9 volts at wide open throttle (WOT).

Conditions for Setting the DTC

- Ignition ON.
- TPS is less than 0.14 v.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The Coolant fan turns on.
- The TP angle will default to 0% when the vehicle speed is less than 2 mph (3 km/h) and 10% when the vehicle speed is greater than 2 mph (3 km/h). (The scan tool will display the defaulted value.)

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

If a DTC P0122 cannot be duplicated, the information included in the Freeze Frame data can be useful. Use the scan tool information data to determine the status of the DTC. If the DTC occurs intermittently, using the Diagnostic table may help isolate the problem.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. The TPS has an auto zeroing feature. If the voltage reading is between 0.2 to 0.9 volts, the ECM will assume the TPS is at a closed throttle position (0%).
4. Simulates a high voltage signal which will identify an open in the signal circuit.
5. If additional DTCs are set, check the 5 volt reference circuits for a short to ground.
6. If the test light illuminates while probing the TP signal circuit, then the TP signal circuit is shorted to ground.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
11. If no faults have been found at this point and no additional DTCs were set, refer to "Diagnostic Aids" in this section for additional checks and information.

DTC P0122 Throttle Position Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON with the engine OFF. 2. Install a scan tool. Is the throttle position sensor (TPS) voltage below the specified value?	0.2 V	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the TPS voltage below the specified value?	0.2 V	Go to *Step 4*	Go to *Step 12*
4	1. Disconnect the TPS electrical connector. 2. Jumper the 5 volt reference circuit, terminal A and the TPS signal circuit, terminal C together at the TPS electrical connector. Is the TPS voltage below the specified value.	-	Go to *Step 10*	Go to *Step 5*
5	Connect a test light between B+ and the TPS signal circuit at terminal C. Is the TPS voltage greater than the specified value?	4 V	Go to *Step 6*	Go to *Step 8*
6	Check the 5 volt reference circuit for an open or short to ground and repair as necessary. Is the action complete?	-	Go to *Step 12*	Go to *Step 7*
7	Check the 5 volt reference circuit for a poor connection at the engine control module (ECM), terminal A1 and repair the terminal as necessary. Is the action complete?	-	Go to *Step 12*	Go to *Step 11*
8	Check the TPS signal circuit, terminal E8 for an open or a short to ground and repair as necessary. Is the action complete?	-	Go to *Step 12*	Go to *Step 9*
9	Check the TPS signal circuit, terminal E8 for a poor connection at the ECM and repair as necessary. Is the action complete?	-	Go to *Step 12*	Go to *Step 11*
10	Replace the TPS. Is the action complete?	-	Go to *Step 12*	-
11	Replace the ECM. Is the action complete?	-	Go to *Step 12*	-

DTC P0122 Throttle Position Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed	-	Go to applicable DTC table	System OK

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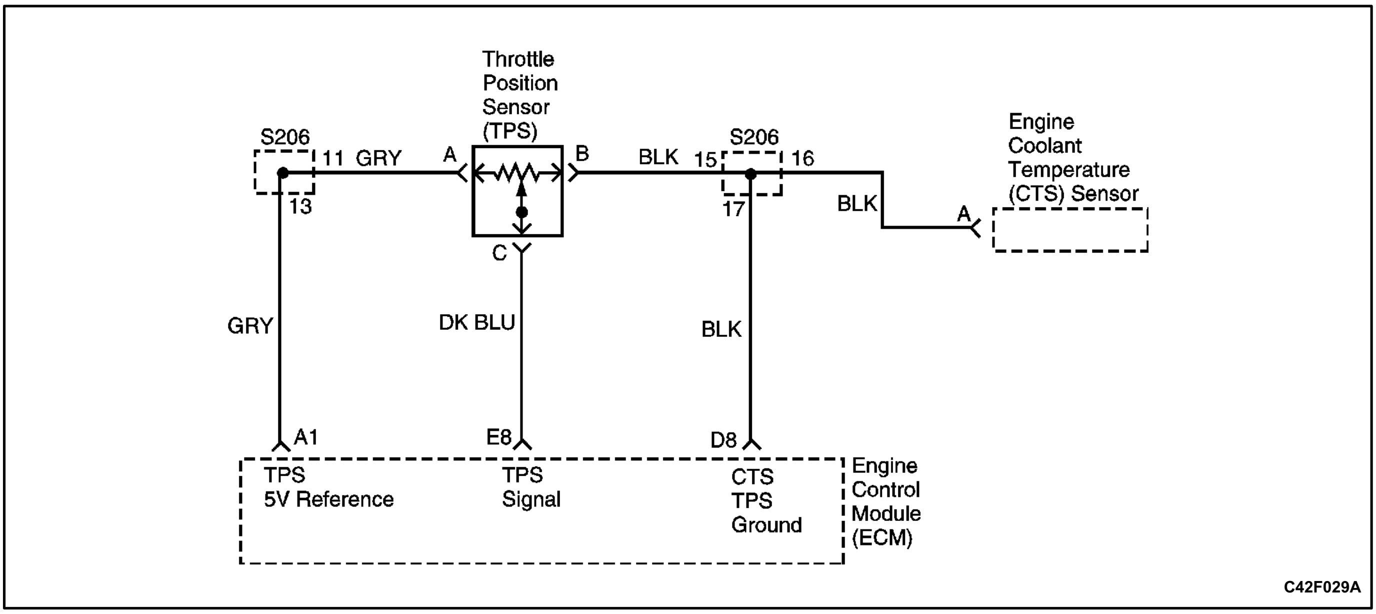

DIAGNOSTIC TROUBLE CODE (DTC) P0123
THROTTLE POSITION SENSOR HIGH VOLTAGE

Circuit Description

The engine control module (ECM) supplies a 5 volt reference signal and a ground to the Throttle Position Sensor (TPS). The TPS sends a voltage signal back to the ECM relative to the throttle plate opening. The voltage signal will vary from approximately 0.1 volts at closed throttle, to over 4.9 volts at wide open throttle (WOT).

Conditions for Setting the DTC

- The ignition is ON.
- TPS voltage is greater than 4.9 v.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The Coolant fan turns on.
- The TP angle will default to 0% when the vehicle speed is less than 2 mph (3 km/h) and 10% when the vehicle speed is greater than 2 mph (3 km/h). (The scan tool will display the defaulted value.)

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

If a DTC P0123 cannot be duplicated, the information included in the Freeze Frame data can be useful. Use the scan tool information data to determine the status of the DTC. If the DTC occurs intermittently, using the diagnostic table may help isolate the problem.

With the ignition ON and the throttle at closed position, the voltage should read between 0.20 v and 0.90 v and increase steadily to over 4.5 v at WOT.

DTCs P0123 and P0113 stored at the same time could be the result of an open sensor ground circuit.

Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. With the throttle closed, the TPS voltage should read less than 0.90 v. If the TPS voltage does not read less than 0.90 v, check for a binding or sticking throttle cable.
4. With the TPS disconnected, the TPS voltage should be less than 0.2 v if the ECM and wiring are OK.
5. Probing the ground circuit with a test light checks the circuit for high resistance which will cause a DTC P0123 to set.
7. A shorted 5 volt reference circuit will also set additional DTCs.
11. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0123 Throttle Position Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check performed?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a scan tool. Is the throttle position sensor (TPS) voltage greater than the specified value?	1 V	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Is the TPS voltage greater than the specified value?	3.9 V	Go to *Step 4*	Go to *Step 12*
4	Disconnect the TPS electrical connector. Is the TPS voltage less than the specified value?	0.2 V	Go to *Step 5*	Go to *Step 6*
5	Probe the TPS ground circuit, terminal B at the TPS harness connector with a test light connected to B+. Does the test light illuminate?	-	Go to *Step 7*	Go to *Step 9*
6	Check the TPS signal circuit, terminal C for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 11*
7	Check the 5 v reference circuit, terminal A1 for a short to B+ and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 8*
8	Check the TPS electrical connector for a poor connection and repair the terminals as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 10*
9	Check the TPS ground circuit for an open and repair as necessary?. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 11*
10	Replace the TPS. Is the action complete?	-	Go to *Step 12*	-
11	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 12*	-

DTC P0123 Throttle Position Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed	-	Go to applicable DTC table	System OK

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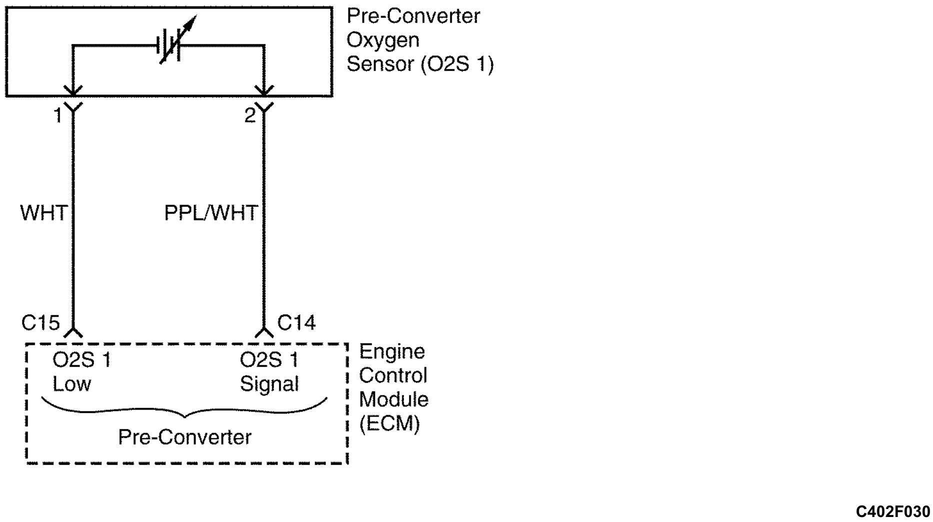

DIAGNOSTIC TROUBLE CODE (DTC) P0131
O2 BANK 1 SENSOR 1 LOW VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 0.45 volts between terminals C15 and C14 (if measured with a 10 megohm digital voltmeter, this may read as low as 0.32 volts). The Oxygen Sensor (O2S 1) varies the voltage within a range of about 1 volt if the exhaust is rich, down through about 0.10 volts if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 315°C (600°F). An open sensor circuit or cold sensor causes Open Loop operation.

If the O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the O2S 1 wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the air reference and degrade the O2S 1 performance. Refer to "Oxygen Sensor" in this section.

Conditions for Setting the DTC

- O2S 1 voltage is less than 0.1 volts or less than 0.4 volts in Power Enrichment (PE).
- Closed loop stoichiometry.
- Engine coolant temperature (CTS) is greater than 60°C (140°F).
- Air/fuel ratio is between 14.5:1 and 14.8:1.
- Throttle Position Sensor (TPS) is between 5% and 50%.
- No related malfunctions.
- Delay 2 seconds.
- After conditions met.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

Fuel pressure - The system will be lean if the fuel pressure is too low. It may be necessary to monitor the fuel pressure while driving the vehicle at various road speeds and/or loads to confirm. Refer to "Fuel System Diagnosis" in this section.

MAP sensor - An output that causes the ECM to sense a lower than normal manifold pressure (high vacuum) can cause the system to go lean. Disconnecting the Manifold Absolute Pressure (MAP) sensor will allow the ECM to substitute a fixed (default) value for the MAP sensor. If the lean condition is gone when the sensor is disconnected, substitute a known good sensor and recheck.

Fuel contamination - Water, in even small amounts near the in-tank fuel pump inlet can be delivered to the injector. The water causes a lean exhaust and can set DTC P0131.

Sensor harness - The O2S 1 sensor pigtail may be mispositioned and contacting the exhaust manifold.

Engine misfire - A misfiring cylinder will result in unburned oxygen in the exhaust, which could cause DTC P0131 to set. Refer to DTC P0300 Engine Misfire in this section.

Cracked Oxygen sensor - A cracked O2S 1 or poor ground at the sensor could cause DTC P0131. Refer to "Symptoms Diagnosis" in this section.

Plugged fuel filter - A plugged fuel filter can cause a lean condition and cause a DTC P0131 to set.

Plugged Oxygen Sensor - A plugged reference port on the O2S 1 will indicate a lower than normal voltage output from the O2S 1.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0131 is the result of a hard failure or an intermittent condition. It may be necessary to operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC in order to duplicate the malfunction detected by the ECM.
4. This step simulates DTC P0134. If the ECM senses the change, the ECM and the wiring are OK.
6. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
8. If no malfunctions have been found at this point and no additional DTCs were set, refer to "Diagnostic Aids" for additional checks and information.

DTC P0131 O2 Bank 1 Sensor 1 Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Turn the ignition ON with the engine OFF. 2. Install a scan tool. 3. Engine at operating temperature. Does the Oxygen Sensor (O2S 1) voltage remain below the specified value?	44 mV	Go to *Step 4*	Go to *Step 3*
3	1. Review the Freeze Frame data and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions and Conditions For Setting The DTC as noted? Does the O2S 1 voltage stay below the specified value?	44 mV	Go to *Step 4*	Go to *Step 7*
4	1. Turn the ignition switch ON, with the engine OFF. 2. Disconnect the O2S 1 electrical connector. Does the scan tool indicate the O2S 1 voltage within the specified values?	407-509 mV	Go to "Diagnostic Aids"	Go to *Step 5*
5	Check the O2S 1 sensor signal circuit, terminal 2 for a short to ground and repair as necessary. Is a repair necessary.	-	Go to *Step 7*	Go to *Step 6*
6	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 7*	-
7	1. If disconnected, reconnect the O2S 1 electrical connector. 2. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle at normal operating temperature. 4. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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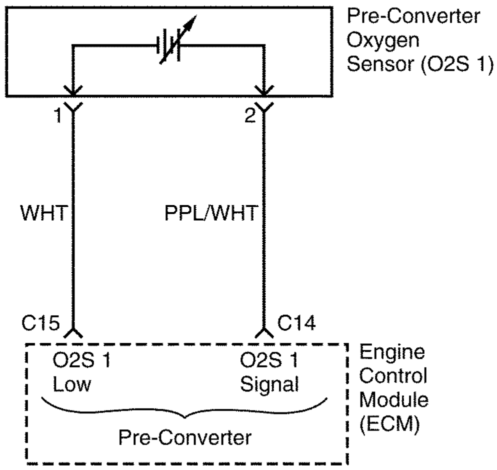

DIAGNOSTIC TROUBLE CODE (DTC) P0132
O2 BANK 1 SENSOR 1 HIGH VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 0.45 volts between terminals C15 and C14 (if measured with a 10 megohm digital voltmeter, this may read as low as 0.32 volts). The Oxygen Sensor (O2S 1) varies the voltage within a range of about 1 volt if the exhaust is rich, down through about 0.10 volts if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 315°C (600°F). An open sensor circuit or cold sensor causes Open Loop operation.

If the O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the O2S 1 wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the O2S 1 performance. Refer to "Oxygen Sensor" in this section.

Conditions for Setting the DTC

- O2S 1 voltage is less than 0.952 volts or greater than 0.448 volts in Decel Fuel Cutoff (DFCO) mode.
- Closed loop stoichiometry.
- Engine coolant temperature (CTS) is greater than 60°C (140°F).
- Air/fuel ratio is between 14.5:1 and 14.8:1.
- Throttle Position Sensor (TPS) is between 0% and 95%.
- No related malfunctions.
- 2 second delay in decel for DFCO.
- 2 second delay for closed loop.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

The DTC P0132 or rich exhaust is most likely caused by one of the following items:

Fuel pressure - System will go rich if fuel pressure is too high. The ECM can compensate for some increase, but if it gets too high, a DTC P0132 will be set.

Leaking injector - A leaking or malfunctioning injector can cause the system to go rich causing a DTC P0132.

Manifold absolute pressure (MAP) sensor - An output that causes the ECM to sense a higher than normal manifold pressure (low vacuum) can cause the system to go rich. Disconnecting the MAP sensor will allow the ECM to substitute a fixed value for the MAP sensor. Substitute a different a MAP sensor, if the rich condition is gone while the sensor is disconnected.

Pressure regulator - Check for a leaking fuel pressure regulator diaphragm by checking for the presence of liquid fuel in the vacuum line to the regulator.

TPS - An intermittent TPS output will cause the system to go rich due to a false indication of the engine accelerating.

O2S 1 contamination - Inspect the O2S 1 for silicone contamination from fuel or the use of improper room temperature vulcanizing (RTV) sealant. The sensor may have a white powdery coating which may result in a high but false voltage signal (rich exhaust indication). The ECM will then reduce the amount of fuel delivered to the engine, causing a severe surge or driveability problem.

Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0132 is the result of a hard failure or an intermittent condition. It may be necessary to operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC in order to duplicate the malfunction detected by the ECM.
4. This step simulates a DTC P0131. If the ECM senses the change, the ECM and the wiring are OK.
6. The replacement ECM must be programmed. Refer to the latest Techline procedure for ECM reprogramming.
8. If no malfunctions have been found at this point and no additional DTCs were set, refer to "Diagnostic Aids" in this section for additional checks and information.

DTC P0132 O2 Bank 1 Sensor 1 High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. With the ignition ON and the engine OFF, install a scan tool. 2. Engine at operating temperature. Does the oxygen sensor (O2S 1) voltage remain above the specified value?	1042 mV	Go to *Step 4*	Go to *Step 3*
3	1. Review the Freeze Frame data and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions and Conditions For Setting The DTC as noted? Does the O2S 1 voltage stay Above the specified value?	1042 mV	Go to *Step 4*	Go to *Step 8*
4	1. Disconnect the O2S 1 electrical connector. 2. Jumper the O2S 1 electrical connector (engine control module [ECM] side) to ground. Does the scan tool indicate the O2S 1 voltage below the specified value?	500 mV (0.50 V)	Go to "Diagnstic Aids"	Go to *Step 5*
5	Check the O2S 1 sensor signal circuit, terminal 2 for a short to voltage and repair as necessary. Is a repair necessary.	-	Go to *Step 7*	Go to *Step 6*
6	Replace the ECM. Is the action complete?	-	Go to *Step 7*	-
7	1. If disconnected, reconnect the O2S 1 electrical connector. 2. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle at normal operating temperature. 4. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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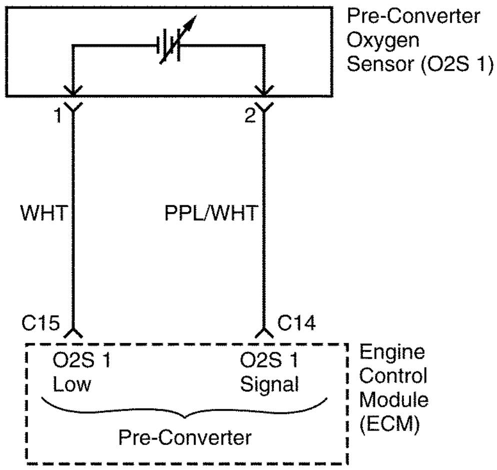

DIAGNOSTIC TROUBLE CODE (DTC) P0134
O2 BANK 1 SENSOR 1 NO ACTIVITY

Circuit Description

The engine control module (ECM) supplies a voltage of about 0.45 volts between terminals C14 and C15 (if measured with a 10 megohm digital voltmeter, this may read as low as 0.32 volts). The Oxygen Sensor (O2S 1) varies the voltage within a range of about 1 volt if the exhaust is rich, down through about 0.10 volts if the exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below 315°C (600°F). An open sensor circuit or cold sensor causes Open Loop operation.

If the O2S 1 pigtail wiring, connector, or terminal is damaged, the entire O2S 1 assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the O2S 1 wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the O2S 1 performance. Refer to "Oxygen Sensor" in this section.

Conditions for Setting the DTC

- O2S 1 voltage is between 374 mv and 522 mv.
- Engine run time is greater than 60 seconds.
- No related malfunctions.
- Oxygen sensor nat heated.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

Normal scan tool voltage varies between 150 mv to 850 mv (0.15 volts to 0.85 volts) while in Closed Loop. If DTC P0134 is intermittent, refer to "Intermittents" in this section.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. During engine warm-up, the O2S 1 should warm up, and its voltage output should vary between 150 mv and 850 mv. When the O2S 1 voltage varies, the engine will go into Closed Loop. This determines if the O2S 1 is operating properly.
4. This will determine if the sensor is malfunctioning or the wiring or ECM is the cause of the DTC P0134.
6. Use only a high impedance digital voltmeter (DVM) for this test. The test checks the continuity of the O2S 1 signal and the ground circuits; if the ground circuit is open, the ECM voltage on the circuit will be over 0.6 volts (600 mv).

DTC P0134 O2 Bank 1 Sensor 1 No Activity

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Run the engine to above the specified operating temperature. 2. Install a scan tool. 3. Operate the engine above the specified rpm for 2 minutes. Does the scan tool indicate CLOSED LOOP?	80°C (176°F) 1200 rpm	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions For Setting The DTC as noted? Does the scan tool indicate CLOSED LOOP?	-	Go to *Step 12*	Go to *Step 4*
4	Disconnect the O2S 1 electrical connector and jumper the O2S 1 sensor low circuit, terminal 1 to ground. Is the O2S 1 voltage below the specified value and does the scan tool indicate the Heated oxygen sensor (HO2S 2) voltage within the specified value?	500 mV (0.5 V)	Go to *Step 5*	Go to *Step 6*
5	Check the O2S 1 electrical connector (engine control module [ECM] side) for malfunctioning terminals or poor connection and repair as necessary. Is a repair necessary.	-	Go to *Step 12*	Go to *Step 9*
6	1. Turn the ignition switch ON with the engine OFF. 2. Remove the jumper wire. 3. Using a digital voltmeter (DVM), measure the voltage between the O2S 1 sensor signal circuit, terminal C14 and the ground. Does the O2S 1 voltage measure above the specified value?	600 mV (0.6 V)	Go to *Step 10*	Go to *Step 7*
7	Does the O2S 1 voltage measure below the specified value?	300 mV (0.3 V)	Go to *Step 11*	Go to *Step 8*
8	Replace the ECM. Is the action complete?	-	Go to *Step 12*	-
9	Replace the O2S 1 sensor. Is the action complete?	-	Go to *Step 12*	-
10	Check the O2S 1 sensor ground circuit, terminal C15 for an open or poor connection and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 8*

DTC P0134 O2 Bank 1 Sensor 1 No Activity (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check the O2S 1 sensor signal circuit, terminal C14 for an open or poor connection and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 8*
12	1. If disconnected, reconnect the O2S 1 electrical connector. 2. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 3. Start the engine and idle at normal operating temperature. 4. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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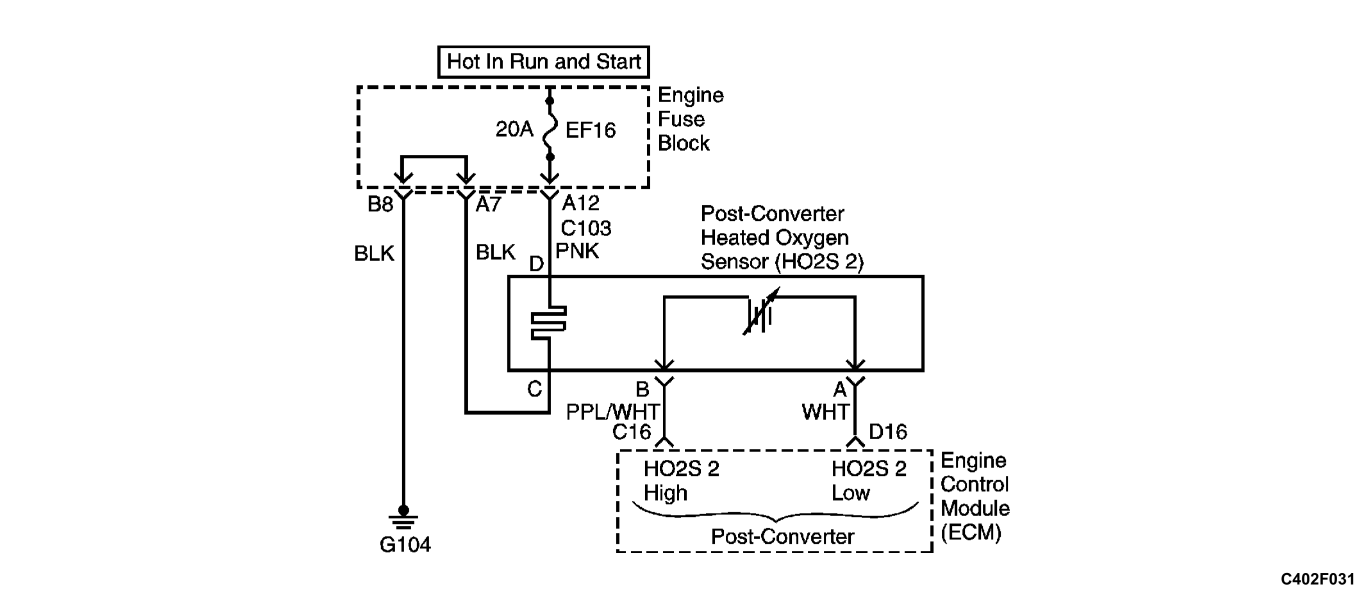

DIAGNOSTIC TROUBLE CODE (DTC) P0137
O2 BANK 1 SENSOR 2 LOW VOLTAGE

Circuit Description

In order to control emissions, a catalytic converter is used to convert harmful emissions into harmless water vapor and carbon dioxide.

The engine control module (ECM) has the ability to monitor this process by using a Heated Oxygen Sensor (HO2S 2). The HO2S 2, located in the exhaust stream past the catalytic converter, produces an output signal which indicates the storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust emissions effectively. If the catalyst is functioning properly, the HO2S 2 signal will be far less active than the signal produced by the Oxygen Sensor (O2S 1).

If the HO2S 2 pigtail wiring, connector, or terminal is damaged, the entire HO2S 2 assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the HO2S 2 wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the HO2S 2 performance.

Conditions for Setting the DTC

- O2S 2 voltage is less than 0.05 volt or less than 0.4 volt in Power Enrichment (PE) mode.
- Closed Loop stoichiometry.
- Engine coolant temperature (CTS) is greater than 60°C (140°F).
- Air/fuel ratio is between 14.5:1 and 14.8:1.
- Throttle Position Sensor (TPS) is between 5% and 50% or in PE mode.
- 2 second delay after the conditions have been met.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

An intermittent may be caused by rubbedthrough wire insulation or a wire contacting the exhaust.

Check for the following conditions:

- Exhaust system - Inspect the exhaust system for leaks. Check the exhaust between the threeway catalytic converter and the flange for leaks, corrosion, or for loose or missing hardware and repair as necessary.
- Poor connection or damaged harness - Ensure that the HO2S 2 pigtail is not contacting the exhaust. Check for the following conditions:
  - Improper mating
  - Broken locks
  - Improperly formed
  - Damaged terminals
  - Poor terminal-to-wire connection
  - Damaged harness
- Intermittent test - Observe the HO2S 2 on the scan tool while moving related connections and the wiring harness with the ignition ON. If the failure is induced,

the HO2S 2 display will change. This may help isolate the location of the malfunction.

Test Description

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

1. The OnBoard diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0137 is the result of a hard failure or an intermittent condition.
4. Jumping the HO2S 2 high circuit, terminal B to ground is necessary to allow the ECM to display the supplied bias voltage. If the voltage is between 0.35 and 0.55 volts, then the wiring and the are OK.
6. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for reprogramming.

DTC P0137 O2 Bank 1 Sensor 2 Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. Is the heated oxygen sensor (HO2S 2) voltage less than the specified value?	200 mV (0.20 V)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition ON with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions For Setting The DTC as noted? Is the HO2S 2 voltage less than the specified value?	400 mV (0.40 V)	Go to *Step 4*	Go to *Step 8*
4	1. Disconnect the HO2S 2 electrical connector 2. Connect a jumper wire between HO2S 2 terminal B and ground. Does the scan tool indicate that the HO2S 2 voltage is within the specified value?	350 mV-550 mv (0.35 V-0.55 V)	Go to *Step 7*	Go to *Step 5*
5	1. Turn the ignition switch OFF. 2. Disconnect the engine control module (ECM) electrical connectors and check the HO2S 2 high circuit, terminal C16 for a short to ground or short to the HO2S 2 low circuit terminal D16 and repair as necessary. Is a repair necessary?	-	Go to *Step 8*	Go to *Step 6*
6	Replace the ECM. Is the action complete?	-	Go to *Step 8*	-
7	Replace the HO2S 2. Is the action complete?	-	Go to *Step 8*	-
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for Setting the DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has ran and passed?	-	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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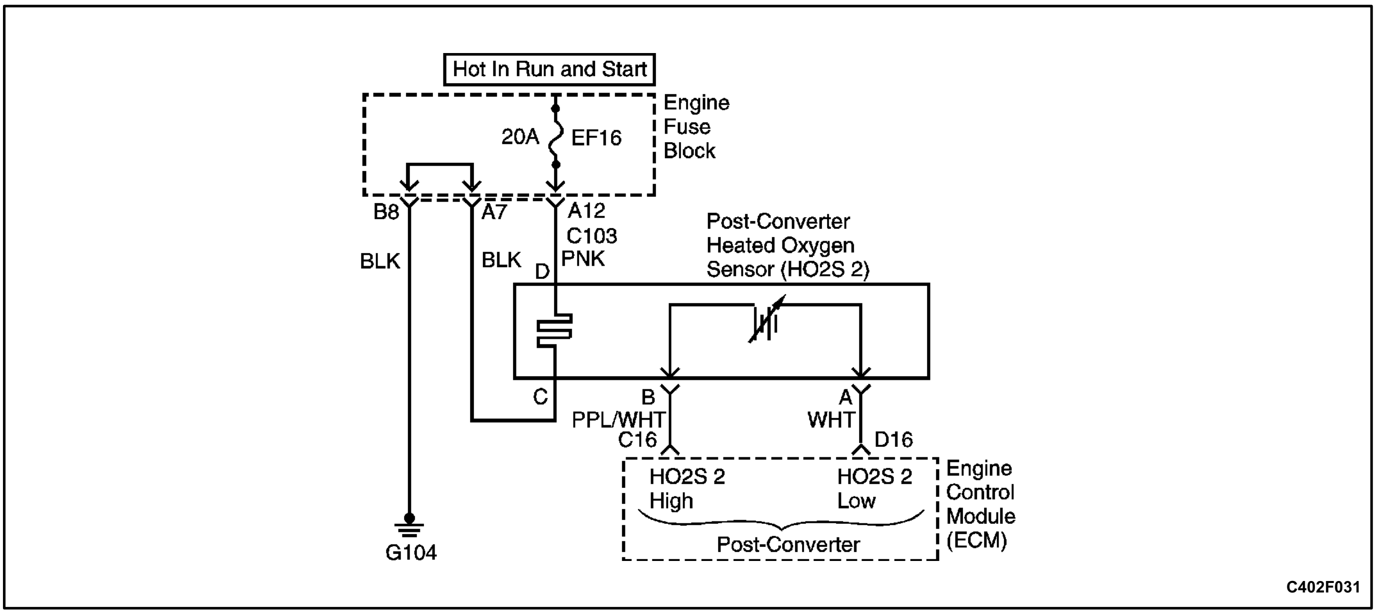

DIAGNOSTIC TROUBLE CODE (DTC) P0138 O2 BANK 1 SENSOR 2 HIGH VOLTAGE

Circuit Description

In order to control emissions, a catalytic converter is used to convert harmful emissions into harmless water vapor and carbon dioxide.

The engine control module (ECM) has the ability to monitor this process by using a Heated Oxygen Sensor (HO2S 2). The HO2S 2, located in the exhaust stream past the catalytic converter, produces an output signal which indicates the storage capacity of the catalyst. This in turn indicates the catalyst's ability to convert exhaust emissions effectively. If the catalyst is functioning properly, the HO2S 2 signal will be far less active than the signal produced by the Oxygen Sensor (O2S 1).

If the HO2S 2 pigtail wiring, connector, or terminal is damaged, the entire HO2S 2 assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the HO2S 2 wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the HO2S 2 performance.

Conditions for Setting the DTC

- HO2S voltage is above than 0.952 volt or above than 0.478 volt in Decel Fuel Cutoff (DFCO) mode.
- Closed loop stoichiometry.
- Engine coolant temperature (CTS) is greater than 60°C (140°F).
- Air/fuel ratio is between 14.5:1 and 14.8:1.
- Throttle Position Sensor (TPS) is between 0% and 95% or in Decel Fuel Cutoff (DFCO) mode.
- 2 second delay in DFCO.
- 0.2 second delay after conditions are met in closed loop.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

- Rich exhaust - An overly rich exhaust may load the catalyst, causing high HO2S 2 signal voltages.
- Silicone contamination - A false rich condition may be caused by silicone contamination of the HO2S 2. This will be indicated by a powdery white deposit on the sensor.
- Faulty HO2S 2 - If HO2S 2 is internally shorted, the HO2S 2 voltage displayed on a scan tool will be over 1 volt. Disconnect the HO2S 2 and jumper the sensor low circuit to engine ground; if the displayed voltage goes from over 1000 mv to around 450 mv, replace the HO2S 2.
- Intermittent test - Observe HO2S 2 on Tech 1 while moving related connectors and the wiring harness with the key in the ON position. If the failure is induced, the HO2S 2 display will change. This may help isolate the location of the malfunction.

Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and to store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. This step determines if DTC P0138 is the result of a hard failure or an intermittent condition.
5. Disconnecting the HO2S 2 and jumpering the sensor signal circuit and the sensor low circuit to ground should cause the scan tool to display HO2S 2 voltage below 100 mv (0.1 v). If the signal voltage is still high, the ECM is malfunctioning.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0138 O2 Bank 1 Sensor 2 High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON with the engine OFF. 2. Install a scan tool. Is the heated oxygen sensor (HO2S 2) voltage above the specified value?	1042 mV (1.042 V)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition ON with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions For Setting The DTC as noted. Is the HO2S 2 voltage above the specified value?	1042 mV (1.042 V)	Go to *Step 4*	Go to *Step 9*
4	1. Turn the ignition switch OFF. 2. Disconnect the HO2S 2 electrical connector. 3. Disconnect the engine control module (ECM) electrical connector. 4. With a digital voltmeter (DVM) connected to ground, probe the HO2S 2 high signal circuit, terminal C16. Does the DVM indicate a voltage of the specified value?	0 V (±0.5 V)	Go to *Step 5*	Go to *Step 6*
5	1. Reconnect the ECM electrical connectors. 2. Turn the ignition switch ON, with the engine OFF. 3. Jumper the high and low circuits at the HO2S 2 electrical connector, terminals A and B to ground. Does the scan tool indicate the HO2S 2 voltage below the specified value?	100 mV (0.10 V)	Go to *Step 7*	Go to *Step 8*
6	Repair the short to voltage in the HO2S 2 high circuit. Is the action complete?	-	Go to *Step 9*	-
7	Replace the HO2S 2. Is the action complete?	-	Go to *Step 9*	-
8	Replace the ECM. Is the action complete?	-	Go to *Step 9*	-
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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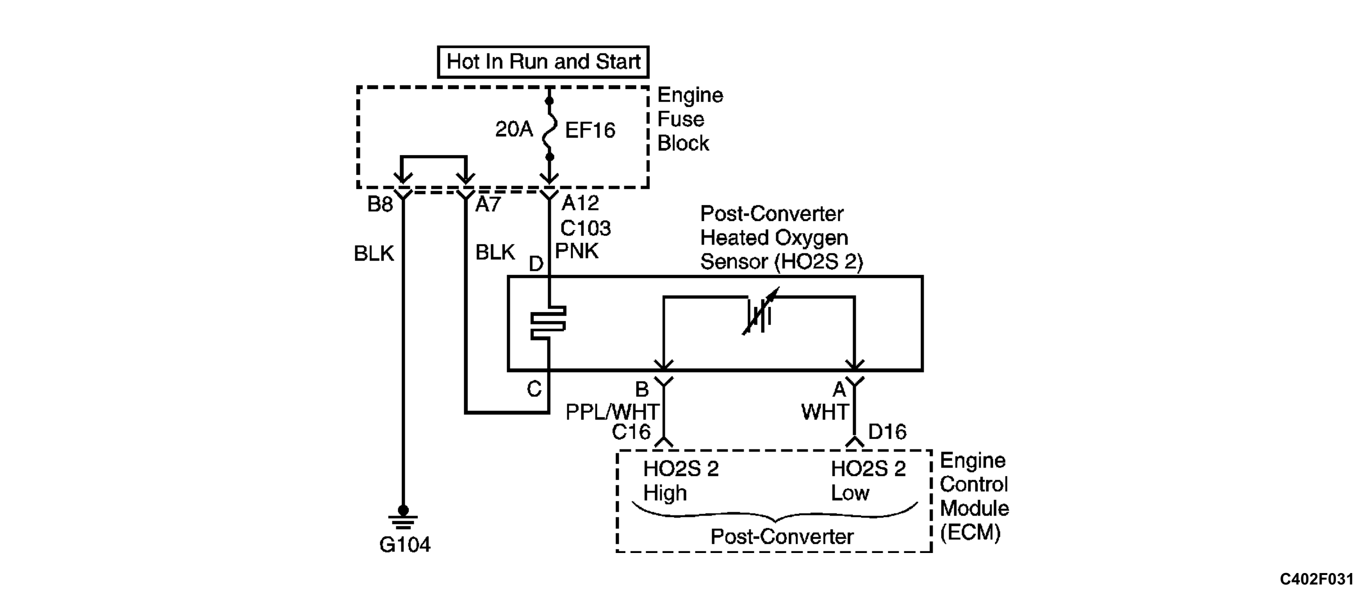

DIAGNOSTIC TROUBLE CODE (DTC) P0140
O2 BANK 1 SENSOR 2 NO ACTIVITY

Circuit Description

In order to control emissions, a catalytic converter is used to convert harmful emissions into harmless water vapor and carbon dioxide.

The engine control module (ECM) has the ability to monitor this process by using a Heated Oxygen Sensor (HO2S 2). The HO2S 2, located in the exhaust stream past the catalytic converter, produces an output signal which indicates the storage capacity of the catalyst. This in turn indicates the catalyst's ability to convert exhaust emissions effectively. If the catalyst is functioning properly, the HO2S 2 signal will be far less active than the signal produced by the Oxygen Sensor (O2S 1).

If the HO2S 2 pigtail wiring, connector, or terminal is damaged, the entire HO2S 2 assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the HO2S 2 wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the HO2S 2 performance.

Conditions for Setting the DTC

- HO2S 2 voltage is between 0.422 and 0.478 volts.
- Engine run time is greater than 60 seconds.
- Oxygen sensor heated.
- Closed loop stoichiometry.
- No related malfunctions.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

An intermittent may be caused by a rubbedthrough wire insulation or a wire contacting the exhaust.

Check for the following conditions:

- A poor connection or a damaged harness - Inspect the harness for a short to ground in the sensor signal circuit. Ensure that the HO2S 2 pigtail is not contacting the exhaust. Check for the following conditions:
  - Improper mating
  - Broken locks
  - Improperly formed
  - Damaged terminals
  - Poor terminal-to-wire connection
  - Damaged harness
- Intermittent test - Observe HO2S 2 on the scan tool while moving the related connections and the wiring harness with the ignition ON. If the failure is induced, the HO2S 2 display will change. This may help isolate the location of the malfunction.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic

checks and to store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

2. This step determines if DTC P0140 is the result of a hard failure or an intermittent condition.
4. Disconnecting the HO2S 2 and jumpering the sensor signal circuit and the sensor low circuit to ground will determine if the ECM or wiring or HO2S 2 is malfunctioning.
6. Determines which circuit the malfunction is in. If the sensor signal circuit and the sensor low circuit are OK, then the ECM connection or ECM is malfunctioning.
10. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0140 O2 Bank 1 Sensor 2 No Activity

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Install a scan tool with the engine above normal specified operating temperature. 2. Run the engine above the specified rpm for two minutes. Does the scan tool display a heated oxygen sensor (HO2S 2) voltage between the specified value?	80°C (176°F) 1200 rpm 425 mV-460 mV (0.425 V-0.460 V)	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition ON with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions For Setting The DTC as noted? Does the scan tool display the HO2S 2 voltage steady around the specified value?	425 mV-460 mV (0.425 V-0.460 V)	Go to *Step 4*	Go to *Step 11*
4	1. Turn the ignition on, with the engine OFF. 2. Disconnect the HO2S 2 electrical connector. 3. Jumper the HO2S 2 high and low circuits, terminals A and B to ground. Does the scan tool indicate the HO2S 2 voltage below the specified value?	100 mV (0.10 V)	Go to *Step 5*	Go to *Step 6*
5	1. Turn the ignition OFF. 2. Check for a malfunctioning connection at the HO2S 2 engine control module [ECM] side) and repair as necessary. Is a repair necessary?	-	Go to *Step 11*	Go to *Step 7*
6	1. Turn the ignition switch OFF. 2. Remove the jumpers and reconnect the HO2S 2 electrical connector. 3. Disconnect the ECM connector. 4. Probe the HO2S 2 low circuit, terminal D16 with a test light to B+. Does the test light illuminate?	-	Go to *Step 8*	Go to *Step 9*
7	Replace the HO2S 2 Sensor. Is the action complete?	-	Go to *Step 11*	-

DTC P0140 O2 Bank 1 Sensor 2 No Activity (Cont'd)

Step	Action	Value(s)	Yes	No
8	Check for an open in the HO2S 2 high circuit or poor connection and repair as necessary. is a repair necessary?	-	Go to *Step 11*	Go to *Step 10*
9	Repair the open in the HO2S 2 low circuit. Is the action complete?	-	Go to *Step 11*	-
10	Replace the ECM. Is the action complete?	-	Go to *Step 11*	-
11	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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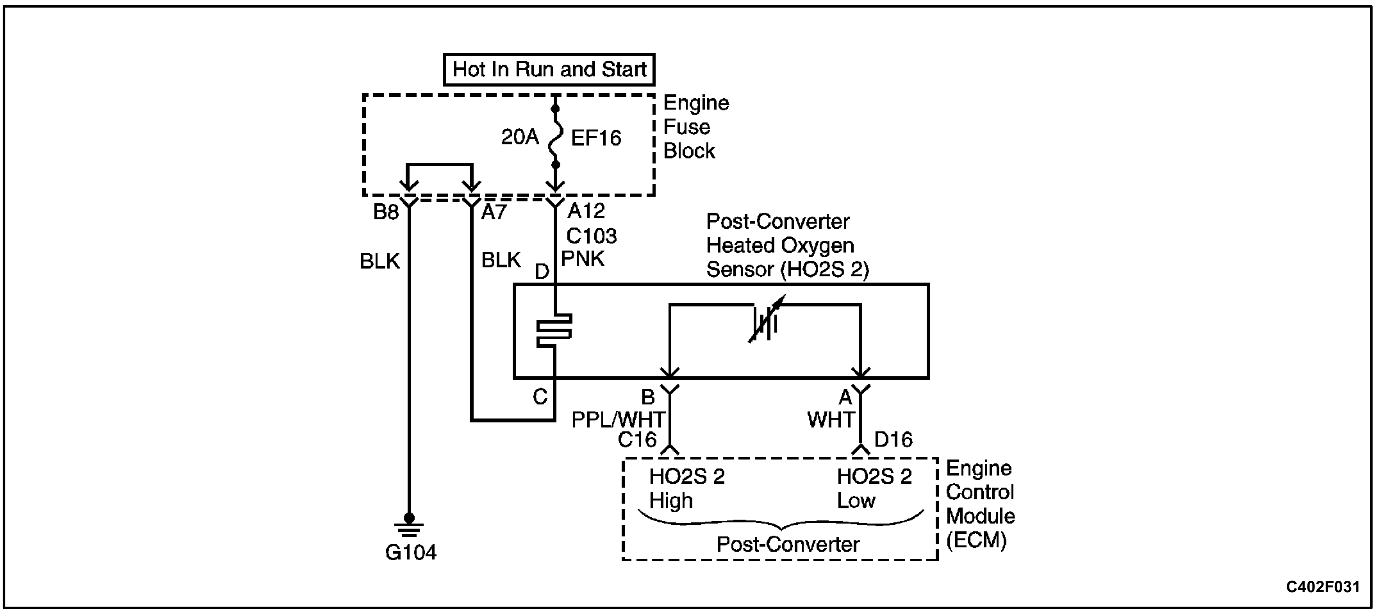

DIAGNOSTIC TROUBLE CODE (DTC) P0141
O2 BANK 1 SENSOR 2 HEATER

Circuit Description

In order to control emissions, a catalytic converter is used to convert harmful emissions into harmless water vapor and carbon dioxide.

The engine control module (ECM) has the ability to monitor this process by using a Heated Oxygen Sensor (HO2S 2). The HO2S 2, located in the exhaust stream past the catalytic converter, produces an output signal which indicates the storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust emissions effectively. If the catalyst is functioning properly, the HO2S 2 signal will be far less active than the signal produced by the Oxygen Sensor (O2S 1).

If the HO2S 2 pigtail wiring, connector, or terminal is damaged, the entire HO2S 2 assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly, it must have a clean air reference provided to it. This clean air reference is obtained by way of the HO2S 2 wire(s). Any attempt to repair the wires, connector, or terminals could result in the obstruction of the air reference and degrade the HO2S 2 performance.

Conditions for Setting the DTC

- Engine coolant temperature (CTS) is less than -40°C (-40°F).
- Intake Air Temperature (MAT) less than -40°C (-40°F).
- Ignition voltage is between 11 and 16 volts.
- Average airflow is less than 16 g/sec.
- Test between 400 mv and 500 mv.
- Throttle Position Sensor (TPS) is greater than 40% with a 0.4 second delay.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

An intermittent may be caused by a rubbed-through wire insulation or a wire contacting the exhaust.

Check for a poor connection or a damaged harness - inspect the harness connectors for the following conditions:

- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection
- Damaged harness

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and to store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the

malfunction occurred. The information is then stored on the scan tool for later reference.

2. This step determines if DTC P0141 is the result of a hard failure or an intermittent condition. With the ignition ON, engine OFF, the HO2S 2 voltage displayed on the scan tool should change within several minutes towards 0 or 1 volt, indicating that the heater is working properly.
3. Probing terminal D of the HO2S 2 connector verifies if voltage is available to the HO2S 2 heater.
4. If voltage is available at the connector, it becomes a good voltage source to check for a ground at terminal C.
5. Determines if voltage is not available at the HO2S 2 due to an open O2 fuse or open ignition feed circuit. If the fuse is open, determine if it was due to a short in the ignition feed circuit before replacing the fuse.

DTC P0141 O2 Bank 1 Sensor 2 Heater

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	**Notice:** If the engine has just been operating, allow the engine to cool for about one-half hour before proceeding. 1. Turn the ignition switch ON with the engine OFF. 2. Install a scan tool. Does the Heated Oxygen Sensor (HO2S 2) voltage gradually change towards the specified voltage?	0 V or 1 V	Go to *Step 13*	Go to *Step 3*
3	1. Disconnect the HO2S 2 electrical connector. 2. With a test light connected to ground, probe the ignition feed circuit, terminal D of the connector. Does the test light illuminate?	-	Go to *Step 4*	Go to *Step 5*
4	Connect a test light between the ignition feed and ground circuits, terminals D and C of the connector. Does the test light illuminate?	-	Go to *Step 6*	Go to *Step 6*
5	Inspect the fuse in the Instrument Panel (I/P) fuse block. Is the fuse open?	-	Go to *Step 8*	Go to *Step 9*
6	Check the connections at the HO2S 2 connector and repair as necessary. Is a repair necessary?	-	Go to *Step 13*	Go to *Step 10*
7	Check the connections at the HO2S 2 connector and repair as necessary. Is a repair necessary?	-	Go to *Step 13*	Go to *Step 11*
8	1. Check for a short to ground in the HO2S 2 ignition feed circuit and repair as necessary? 2. Replace open fuse. Is the action complete?	-	Go to *Step 13*	-
9	Check the connections at the HO2S 2 connector and repair as necessary. Is a repair necessary?	-	Go to *Step 13*	Go to *Step 12*
10	Replace the HO2S 2 sensor. Is the action complete?	-	Go to *Step 13*	-
11	Repair the open in the ground circuit. Is the action complete?	-	Go to *Step 13*	-

DTC P0141 O2 Bank 1 Sensor 2 Heater (Cont'd)

Step	Action	Value(s)	Yes	No
12	Repair the open in the ignition feed circuit. Is the action complete?	-	Go to *Step 13*	-
13	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 14*	Go to *Step 2*
14	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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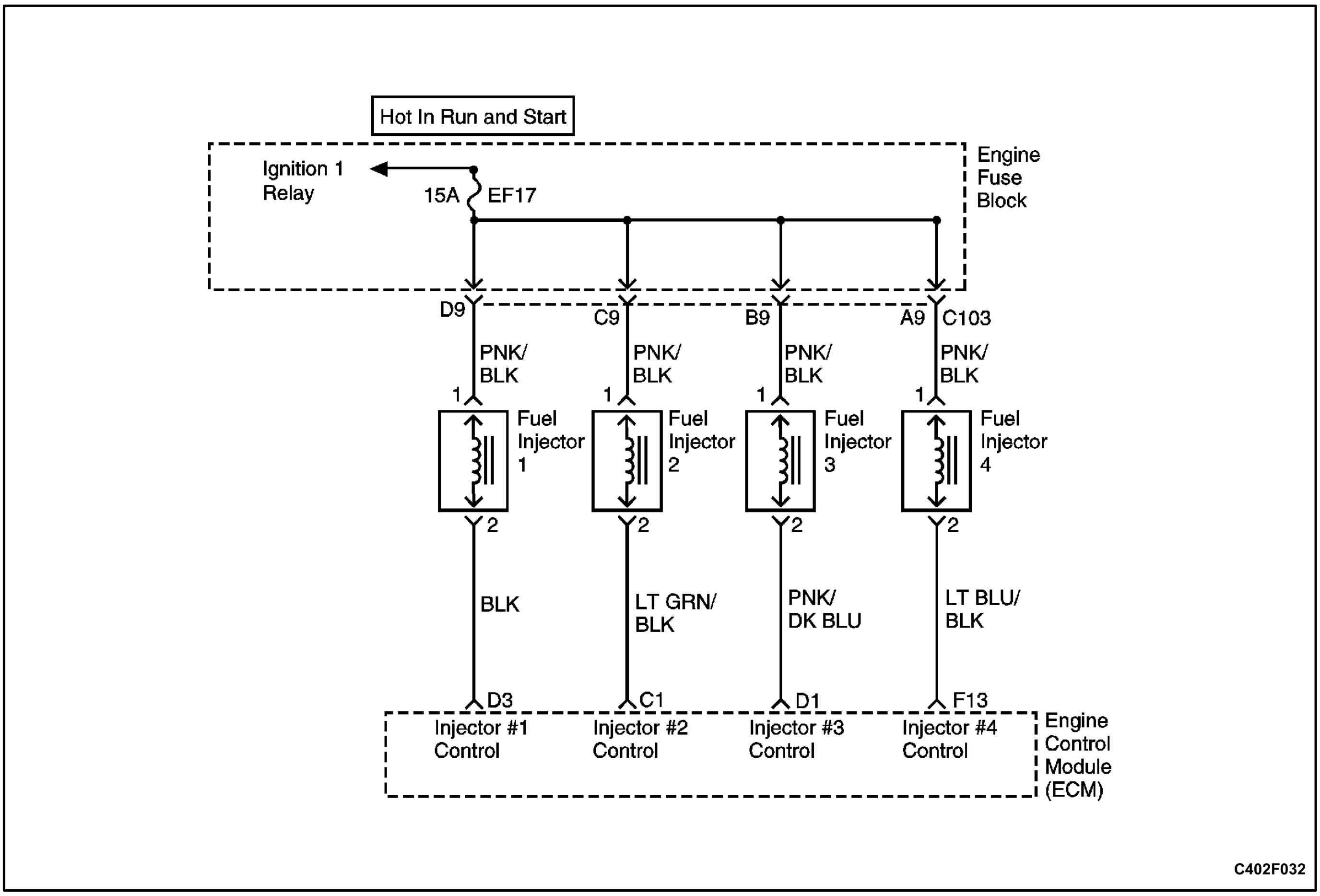

DIAGNOSTIC TROUBLE CODE (DTC) P0201 INJECTOR 1 CIRCUIT FAULT

Circuit Description

The engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a short to ground and/or an open circuit and short to battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Engine is in run mode.
- Battery voltage is more than 9 volts.
- Above conditions are met for 5 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The ECM will turn off the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0201 will clear after 40 consecutive warm-up cycles without a fault.
- DTC P0201 can be cleared by using the scan tool Clear Info function or by disconnecting the ECM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0201 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-term fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to "Fuel Injector Balance Test" in this section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than if tested directly at the injector

because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. This step determines if DTC P0201 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
7. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.
9. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0201 Injector 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Will the engine start?	-	Go to *Step 3*	Go to "Engine Cranks But Will Not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minute. Does DTC P0201 reset?	-	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does DTC P0201 reset?	-	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Disconnect the engine control module (ECM) connector for injector 1. 2. With a test light connected to ground, probe the driver circuit, terminal D3. Does the test light illuminate?	-	Go to *Step 7*	Go to *Step 6*
6	Repair the short to ground or open in the injector driver circuit. Is the action complete?	-	Go to *Step 10*	-
7	1. Disconnect the injector 1 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	-	Go to *Step 8*	Go to *Step 9*
8	Repair the short to voltage in the injector driver circuit. Is the repair complete?	-	Go to *Step 10*	-
9	Replace the ECM. Is the action complete?	-	Go to *Step 10*	-
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 11*	Go to *Step 3*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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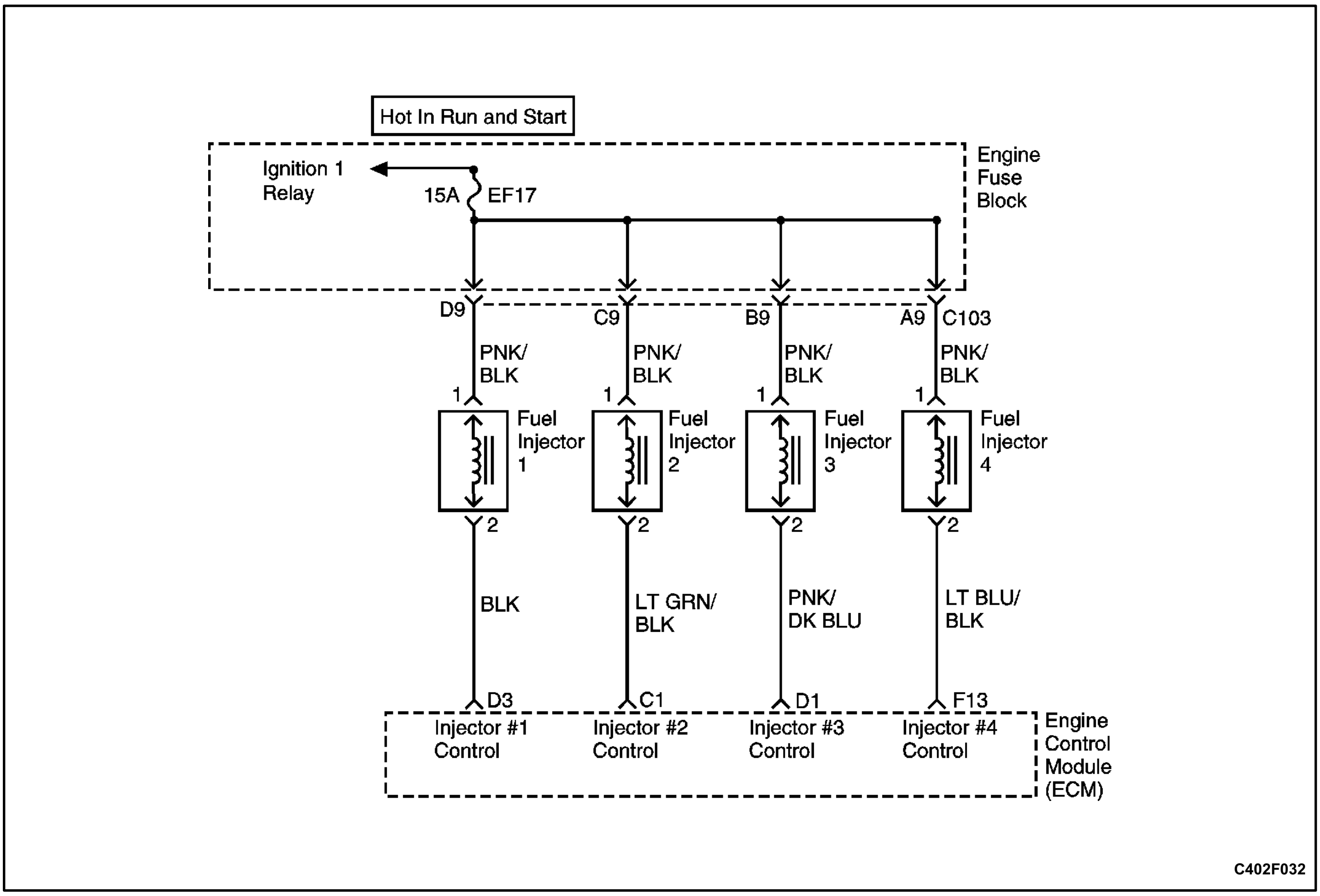

DIAGNOSTIC TROUBLE CODE (DTC) P0202 INJECTOR 2 CIRCUIT FAULT

Circuit Description

The engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a short to ground and/or an open circuit and a short to battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Engine is in run mode.
- Battery voltage is more than 9 volts.
- Above conditions are met for 5 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The ECM will turn off the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0202 will clear after 40 consecutive warmup cycles without a fault.
- DTC P0202 can be cleared by using the scan tool Clear Info function or by disconnecting the ECM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0202 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-term fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Use Fuel Injector Balance Test to check for malfunctioning injectors.

Injector resistance tested at the ECM connection is slightly more than if tested directly at the injector

because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. This step determines if DTC P0202 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
7. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.
9. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0202 Injector 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Will engine start?	-	Go to *Step 3*	Go to "Engine Cranks But Will Not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTC). 2. Idle the engine for one minute. Does DTC P0202 reset?	-	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does DTC P0202 reset?	-	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Disconnect the engine control module (ECM) connector for injector 2. 2. With a test light connected to ground, probe the driver circuit, terminal C1. Does the test light illuminate?	-	Go to *Step 7*	Go to *Step 6*
6	Repair the short to ground or open in the injector driver circuit. Is the action complete?	-	Go to *Step 10*	-
7	1. Disconnect the injector 2 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	-	Go to *Step 8*	Go to *Step 9*
8	Repair the short to voltage in the injector driver circuit. Is the repair complete?	-	Go to *Step 10*	-
9	Replace the ECM. Is the action complete?	-	Go to *Step 10*	-
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 11*	Go to *Step 3*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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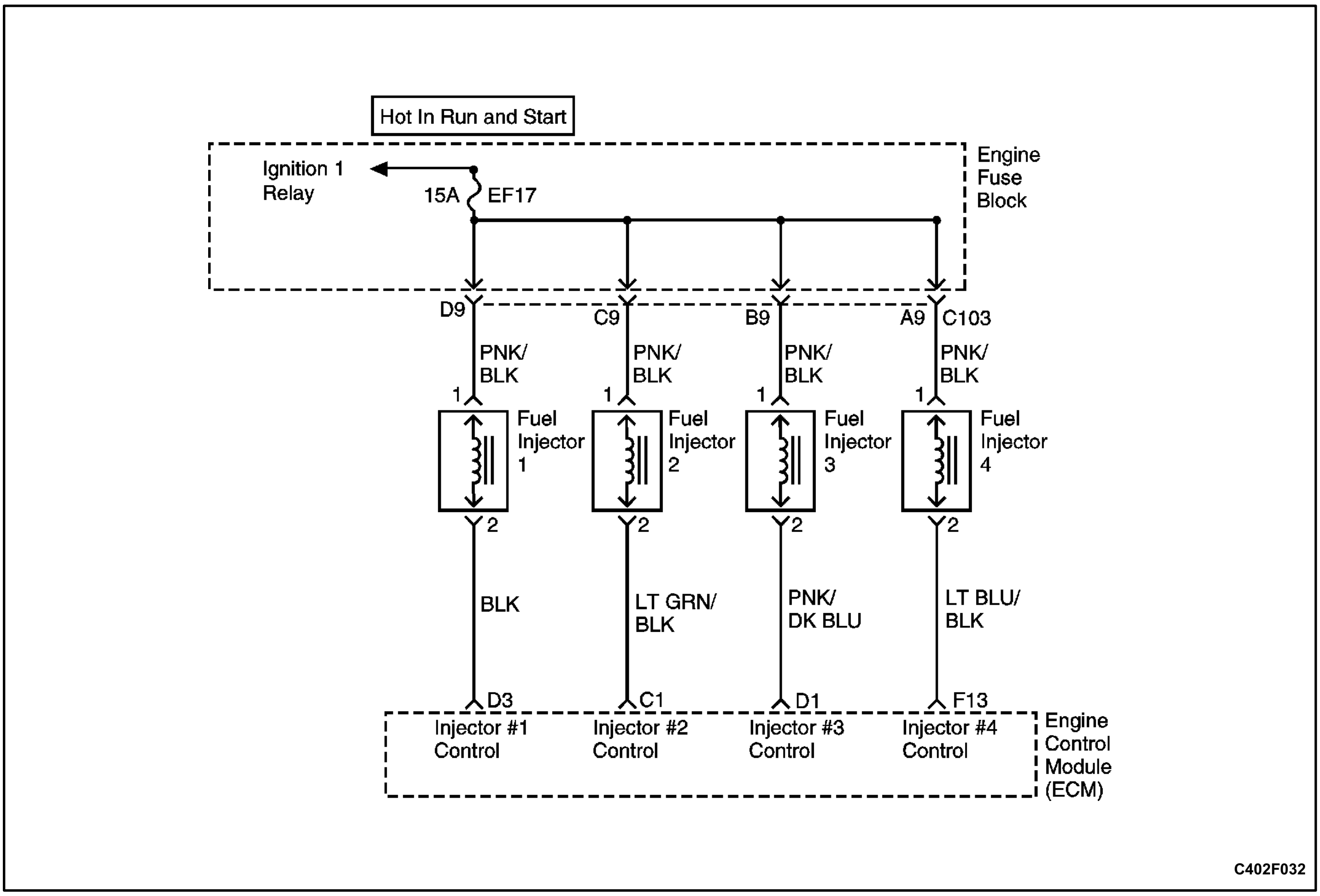

DIAGNOSTIC TROUBLE CODE (DTC) P0203 INJECTOR 3 CIRCUIT FAULT

Circuit Description

The engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a short to ground and/or an open circuit and a short to battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Engine is in run mode.
- Battery voltage is more than 9 volts.
- Above conditions are met for 5 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The ECM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0203 will clear after 40 consecutive warm-up cycles without a fault.
- DTC P0203 can be cleared by using the scan tool Clear Info function or by disconnecting the ECM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0203 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to "Fuel Injector Balance Test" in this section to check for malfunctioning injectors.

Injector resistance tested at the ECM connection is slightly more than if tested directly at the injector

because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and to store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. This step determines if DTC P0203 is the result of a hard failure or an intermittent condition.
5. This step tests the wiring harness and the ECM control of the injectors using a test light.
7. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.
9. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0203 Injector 3 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Will engine start?	-	Go to *Step 3*	Go to "Engine Cranks But Will Not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minute. Does DTC P0203 reset?	-	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does DTC P0203 reset?	-	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Disconnect the engine control module (ECM) connector for injector 3. 2. With a test light connected to ground, probe the driver circuit, terminal D1. Does the test light illuminate?	-	Go to *Step 7*	Go to *Step 6*
6	Repair the short to ground or open in the injector driver circuit. Is the action complete?	-	Go to *Step 10*	-
7	1. Disconnect the injector 3 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	-	Go to *Step 8*	Go to *Step 9*
8	Repair the short to voltage in the injector driver circuit. Is the repair complete?	-	Go to *Step 10*	-
9	Replace the ECM. Is the action complete?	-	Go to *Step 10*	-
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 11*	Go to *Step 3*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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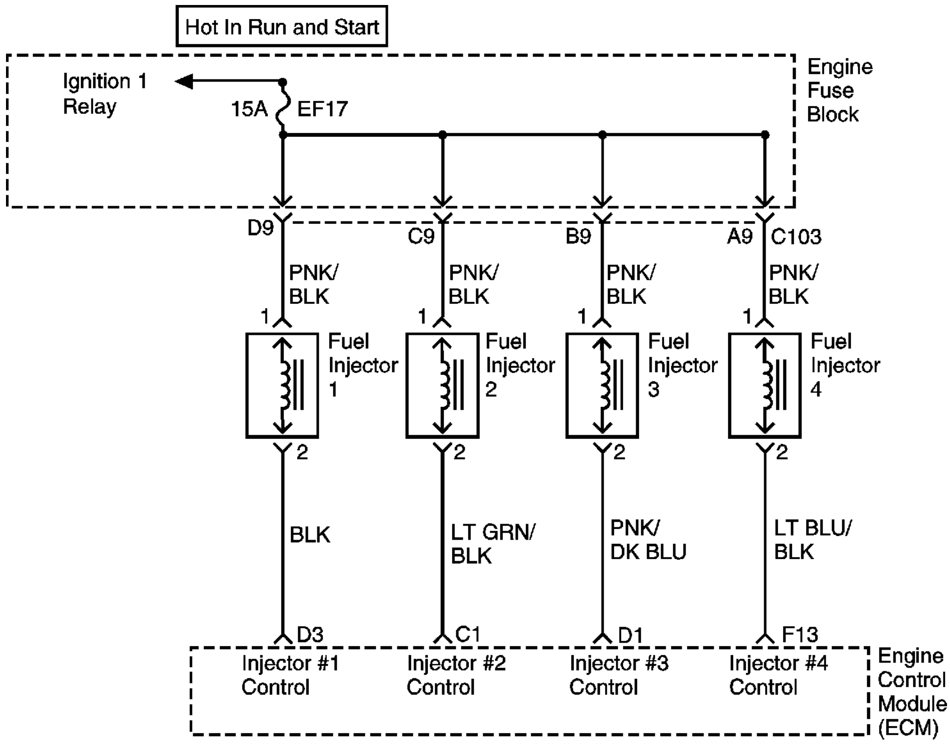

DIAGNOSTIC TROUBLE CODE (DTC) P0204 INJECTOR 4 CIRCUIT FAULT

Circuit Description

The engine control module (ECM) has four individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a short to ground and/or an open circuit and a short to battery conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- Engine is in run mode.
- Battery voltage is more than 9 volts.
- Above conditions are met for 5 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The ECM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0204 will clear after 40 consecutive warmup cycles without a fault.
- DTC P0204 can be cleared by using the scan tool Clear Info function or by disconnecting the ECM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0204 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Longterm and shortterm fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to "Fuel Injector Balance Test" in this section to check for malfunctioning injectors.

Injector resistance tested at the ECM connection is slightly more than if tested directly at the injector

because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

. This step determines if DTC P0204 is the result of a hard failure or an intermittent condition.

5. This step tests the wiring harness and ECM control of the injectors using a test light.

7. This step determines if the circuitry is shorted to voltage or if the ECM is faulty.

. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0204 Injector 4 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Will engine start?	-	Go to *Step 3*	Go to "Engine Cranks But Will Not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTC). 2. Idle the engine for one minute. Does DTC P0204 reset?	-	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does DTC P0204 reset?	-	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Disconnect the engine control module (ECM) connector for injector 4. 2. With a test light connected to ground, probe the driver circuit, terminal F13. Does the test light illuminate?	-	Go to *Step 7*	Go to *Step 6*
6	Repair the short to ground or open in the injector driver circuit. Is the action complete?	-	Go to *Step 10*	-
7	1. Disconnect the injector 4 wiring connection. 2. With a test light connected to ground, probe the driver circuit, terminal 2. Does the test light illuminate?	-	Go to *Step 8*	Go to *Step 9*
8	Repair the short to voltage in the injector driver circuit. Is the repair complete?	-	Go to *Step 10*	-
9	Replace the ECM. Is the action complete?	-	Go to *Step 10*	-
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 11*	Go to *Step 3*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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DIAGNOSTIC TROUBLE CODE (DTC) P0325

KNOCK SENSOR SNEF INTERNAL MALFUNCTION

System Description

The knock sensor (KS) system is used to detect engine detonation, allowing the engine control module (ECM) to retard the ignition control spark timing based on the KS signal being received. The KS produces an AC signal so that under a no-knock condition the signal on the KS circuit measures about 0.007 volts AC. The KS signal's amplitude and frequency depend upon the amount of knock being experienced. The ECM contains a non-replaceable knock filter module called a signal-to-noise enhancement filter (SNEF) module. This filter module in the ECM determines whether or not knock is occurring by comparing the signal level on the KS circuit with the voltage level on the noise channel. The noise channel allows the ECM to reject any false knock signal by knowing the amount of normal engine mechanical noise present. Normal engine noise varies depending on engine speed and load. When the ECM determines that an abnormally low noise channel voltage level is being experienced, Diagnostic Trouble Code (DTC) P0325 will set.

Conditions for Setting the DTC

- Vacuum is less than 10 to 50 kPa, based on rpm.
- The rpm is greater than 2500.
- SNEF A/D reading is greater than 150 for any of the 4 cylinders.
- Maximum minus the minimum A/D reading is less than 1 for one complete engine cycle.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will default to 6 degrees timing.

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

Check and correct any abnormal engine noise before using the diagnostic table.

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

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

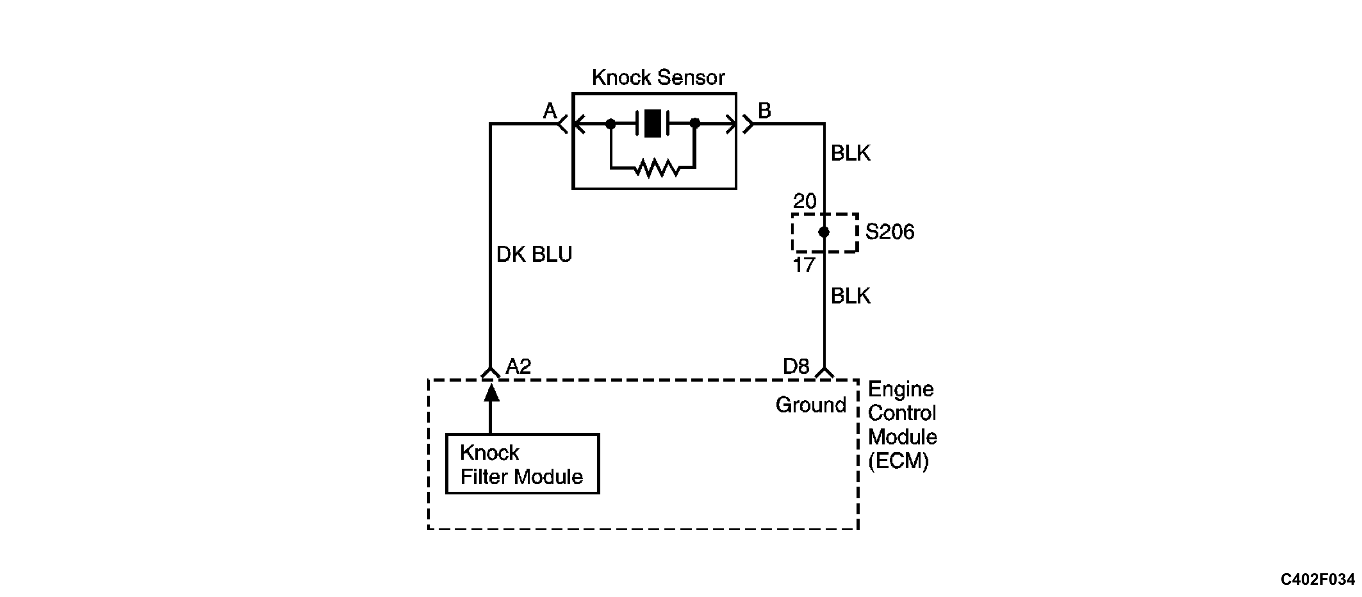
Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. If the conditions for the test as described above are met, a DTC P0325 will set and the MIL will illuminate.
4. If the engine has an internal knock or audible noise that causes a knocking type noise on the engine block, the knock sensor may be responding to the noise.
6. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0325 Knock Sensor SNEF Internal Malfunction

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Start the engine. 2. Install a scan tool. 3. Clear the Diagnostic Trouble Codes (DTCs). 4. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the Malfunction Indicator Lamp (MIL) illuminate?	120 seconds	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the Malfunction Indicator Lamp (MIL) illuminate?	-	Go to *Step 4*	Go to *Step 7*
4	Listen to the engine while raising and lowering the engine speed. Is a knock or audible noise present?	-	Go to *Step 5*	Go to *Step 6*
5	Repair the mechanical engine problem or a loose bracket or component. Is the action complete?	-	Go to *Step 7*	-
6	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 7*	-
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0327
KNOCK SENSOR CIRCUIT FAULT

System Description

The knock sensor (KS) system is used to detect engine detonation, allowing the engine control module (ECM) to retard the ignition control spark timing based on the KS signal being received. The KS produces an AC signal so that under a no-knock condition the signal on the KS circuit measures about 0.007 volts AC. The KS signal's amplitude and frequency depend upon the amount of knock being experienced. The ECM monitors the KS signal and can diagnose the KS sensor and circuitry.

Conditions for Setting the DTC

- Knock voltage on all cylinder is less than 195 volts.
- All cylinder gain is greater than 191, and the rpm is greater than 6375.
- KS voltage on all cylinders is less than 0.88 volts and all cylinder gain is greater than 191.
- Vacuum is less than 10 to 50 kPa based on rpm.
- The rpm is greater than 2000.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history Diagnostic Trouble Code (DTC) is stored.
- The ECM will use a calculated spark retard value to minimize knock during conditions when knock is likely to occur. The calculated value will vary based on engine speed and load.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault within the freeze frame conditions that the DTC failed.
- A history DTC will clear after 40 consecutive warmup cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Check and correct any abnormal engine noise before using the diagnostic table.

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

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

Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. If the conditions for the test as described above are met, a DTC P0327 will set and the MIL will illuminate.
4. If the engine has an internal knock or audible noise that causes a knocking type noise on the engine block, the KS may be responding to the noise.

6. Checking the internal resistance of the KS or the wiring to the KS is OK.
7. Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.
8. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0327 Knock Sensor Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Start the engine. 2. Install a scan tool. 3. Clear the Diagnostic Trouble Codes (DTCs). 4. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the Malfunction Indicator Lamp (MIL) illuminate?	120 seconds	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the MIL illuminate?	-	Go to *Step 4*	Go to *Step 12*
4	Listen to the engine while raising and lowering the engine speed. Is a knock or audible noise present?		Go to *Step 5*	Go to *Step 6*
5	Repair the mechanical engine problem or a loose bracket or component. Is the action complete?	-	Go to *Step 12*	-
6	1. Turn the ignition switch OFF. 2. Disconnect the engine control module (ECM) connectors at the ECM. 3. With a digital voltmeter (DVM) connected to ground, measure the resistance of the knock sensor (KS) through the KS signal circuit, terminal A2. Is the measured value within the specified value?	90K-110K Ω	Go to *Step 7*	Go to *Step 9*
7	Check for a poor connection at the ECM connector KS signal circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 8*
8	Replace the ECM. Is the action complete?	-	Go to *Step 12*	-

DTC P0327 Knock Sensor Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the KS electrical connector for a poor connection and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 10*
10	Check the KS signal circuit for an open or a short to ground or voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 11*
11	Replace the KS. Is the action complete?	-	Go to *Step 12*	-
12	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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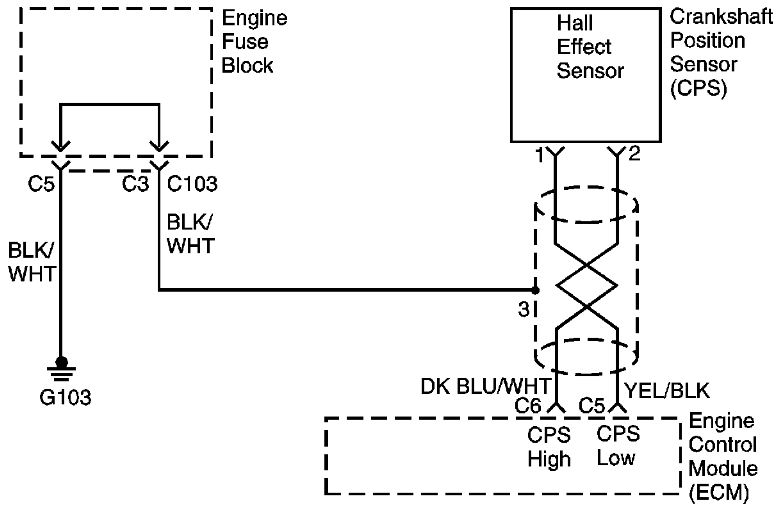

DIAGNOSTIC TROUBLE CODE (DTC) P0336
58X CRANK POSITION EXTRA/MISSING PULSES

Circuit Description

The 58X reference signal is produced by the Crankshaft Position Sensor (CPS). During one crankshaft revolution, 58 crankshaft pulses will be produced. The engine control module (ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the ECM receives and incorrect number of pulses on the 58X reference circuit, Diagnostic Trouble Code (DTC) P0336 will set.

Conditions for Setting the DTC

- Engine is running.
- Number of extra or missing teeth is greater or equal to 2 per revolution.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The ECM will turn the MIL off on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0336 will clear after 40 consecutive warmup cycles have occurred without a fault.
- DTC P0336 can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

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

- Poor connection - Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.

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

DTC P0336 58X Crank Position Extra/Missing Pulses

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Attempt to start the engine. Does the engine start?	-	Go to *Step 3*	Refer to "Engine Cranks But Will Not Run"
3	1. Review and record Failure Records information. 2. Clear Diagnostic Trouble Code (DTC) P0336. 3. Start the engine and idle for 1 minute. 4. Observe the DTCs. Is DTC P0336 set?	-	Go to *Step 4*	Refer to "Diagnostic Aids"
4	1. Disconnect the engine control module (ECM) and the crankshaft position sensor (CPS). 2. Check for an open or a short to ground in the 58X reference circuit between the CPS connector and the ECM harness connector. Is a problem found?	-	Go to *Step 5*	Go to *Step 6*
5	Repair the open or short to ground in the 58X reference circuit between the CPS connector and the ECM harness connector. Is the repair complete?	-	Go to *Step 11*	-
6	1. Reconnect the ECM and CPS. 2. Connect a digital voltmeter (DVM) to measure voltage on the 58X reference circuit, terminal C6 at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to *Step 9*	Go to *Step 7*
7	Check the connections at the CPS and replace the terminals if necessary. Do any terminals require replacement?	-	Go to *Step 11*	Go to *Step 8*
8	Replace the CPS. Is the action complete?	-	Go to *Step 11*	-
9	Check the connections at the ECM and replace the terminals if necessary. Do any terminals require replacement?	-	Go to *Step 11*	Go to *Step 10*
10	Replace the ECM. Is the action complete?	-	Go to *Step 11*	-

DTC P0336 58X Crank Position Extra/Missing Pulses (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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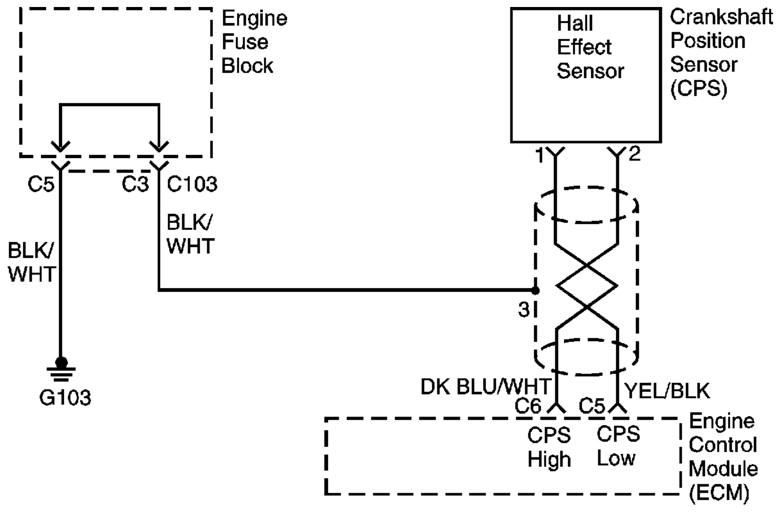

DIAGNOSTIC TROUBLE CODE (DTC) P0337 58X CRANK POSITION NO SIGNAL

Circuit Description

The 58X reference signal is produced by the Crankshaft Position Sensor (CPS). During one crankshaft revolution, 58 crankshaft pulses will be produced. The engine control module (ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the ECM receives and incorrect number of pulses on the 58X reference circuit, Diagnostic Trouble Code (DTC) P0337 will set.

Conditions for Setting the DTC

- No CMP sensor DTCs are set.
- Engine cranking.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The ECM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0337 will clear after 40 consecutive warmup cycles have occurred without a fault.
- DTC P0337 can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

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

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

and wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.

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

DTC P0337 58X Crank Position No Signal

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Disconnect the crankshaft position sensor (CPS). 2. Turn the ignition ON. 3. Using a digital voltmeter (DVM), verify that a 5 v reference and ground are being supplied at the sensor connector terminals 2 and 3. Are a 5 V and ground being supplied to the sensor?	-	Go to *Step 5*	Go to *Step 3*
3	1. Turn the ignition ON. 2. With a DVM, backprobe the engine control module (ECM) connector 5 v reference and signal connectors, terminals C6 and C5. Are a 5 V reference and ground available at the ECM?	-	Go to *Step 4*	Go to *Step 9*
4	Repair the open circuit, short to ground or short to voltage for the 5 V reference or signal between the CPS and the ECM. Is the repair complete?	-	Go to *Step 11*	-
5	1. Turn the Ignition OFF. 2. Disconnect the ECM and CPS 3. Check for an open or a short to ground in the 58X reference circuit between the CPS connector and the ECM harness connector. 4. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 11*	Go to *Step 6*
6	1. Reconnect the ECM and CPS. 2. Connect a DVM to measure voltage on the 58X reference circuit at the ECM connector, terminal C6. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to *Step 9*	Go to *Step 7*
7	Check the connections at the CPS and replace the terminals if necessary. Do any terminals require replacement?	-	Go to *Step 11*	Go to *Step 8*
8	Replace the CPS. Is the repair complete?	-	Go to *Step 11*	-
9	Check the connections at the ECM and replace the terminals if necessary. Do any terminals require replacement?	-	Go to *Step 11*	Go to *Step 10*
10	Replace the ECM. Is the action complete?	-	Go to *Step 11*	-

DTC P0337 58X Crank Position No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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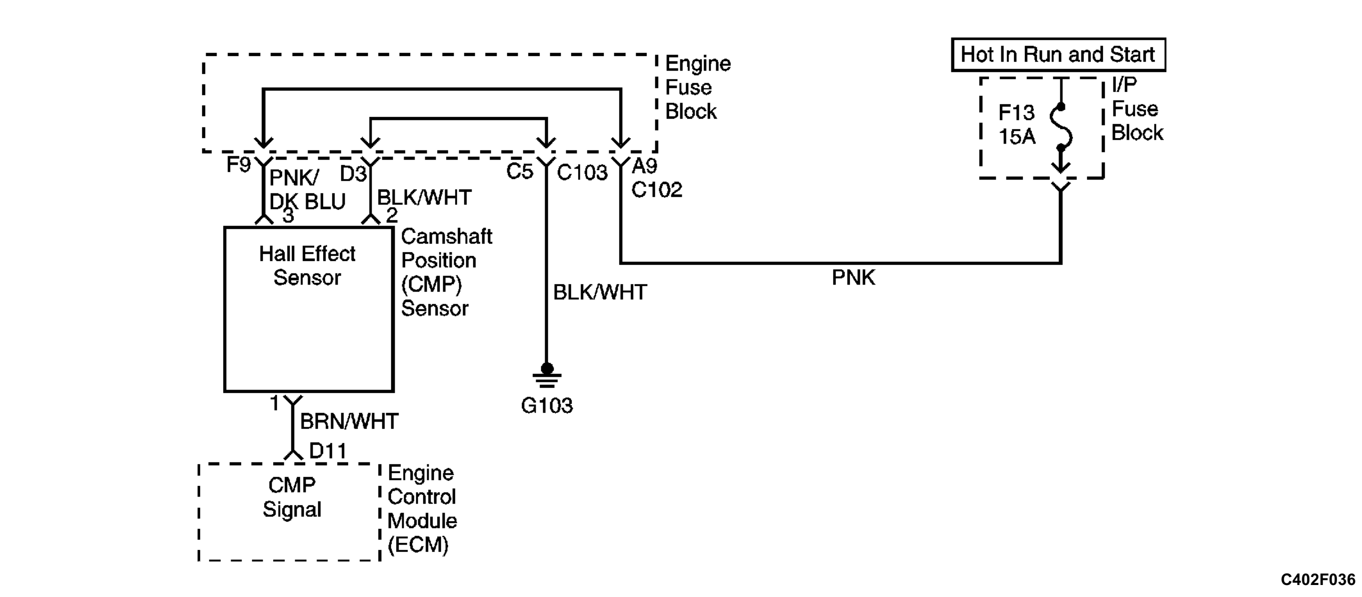

DIAGNOSTIC TROUBLE CODE (DTC) P0342
CAM POSITION NO SIGNAL

System Description

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

Conditions for Setting the DTC

- Engine is running.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

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

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

Test Description

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

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

DTC P0342 Cam Position No Signal

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

DTC P0342 Cam Position No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Disconnect the CMP electrical connector. 2. With the DVM connected to B+, probe the CMP signal circuit, terminal 1. Does the DVM display a voltage greater than the specified value?	0.5 V	Go to *Step 12*	Go to *Step 13*
12	Repair the short to ground in the CMP signal circuit. Is the action complete?	-	Go to *Step 16*	-
13	Check for a poor connection or an open in the CMP signal circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 16*	Go to *Step 14*
14	Replace the CMP. Is the repair complete?	-	Go to *Step 16*	-
15	Replace the ECM. Is the repair complete?	-	Go to *Step 16*	-
16	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 17*	Go to *Step 2*
17	Check if any additional DTCs are set. Are any DTCs displayed that have not been diag□ nosed?	-	Go to applicable DTC table	System OK

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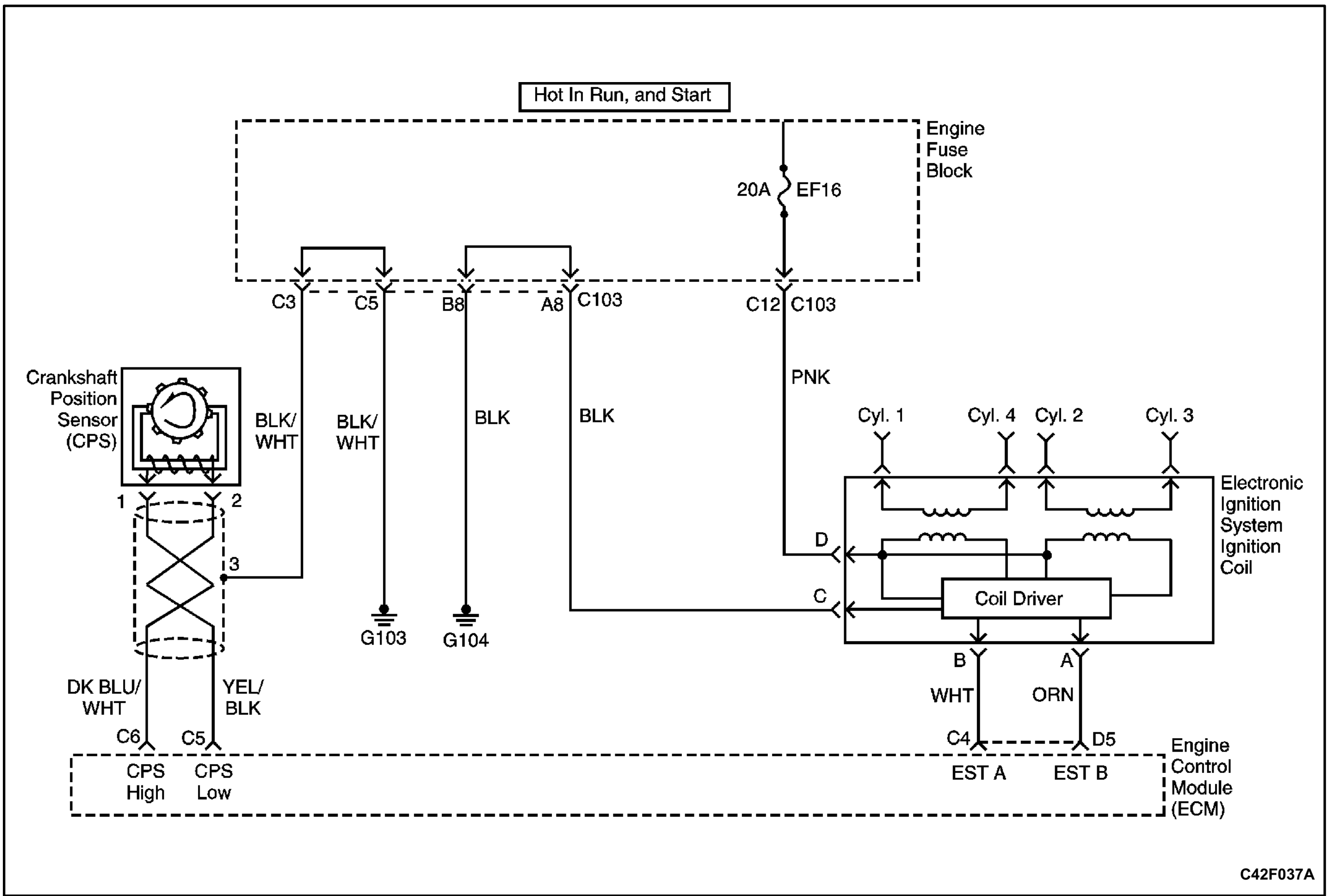


DIAGNOSTIC TROUBLE CODE (DTC) P0351 IGNITION CONTROL A CIRCUIT FAULT

Circuit Description

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

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

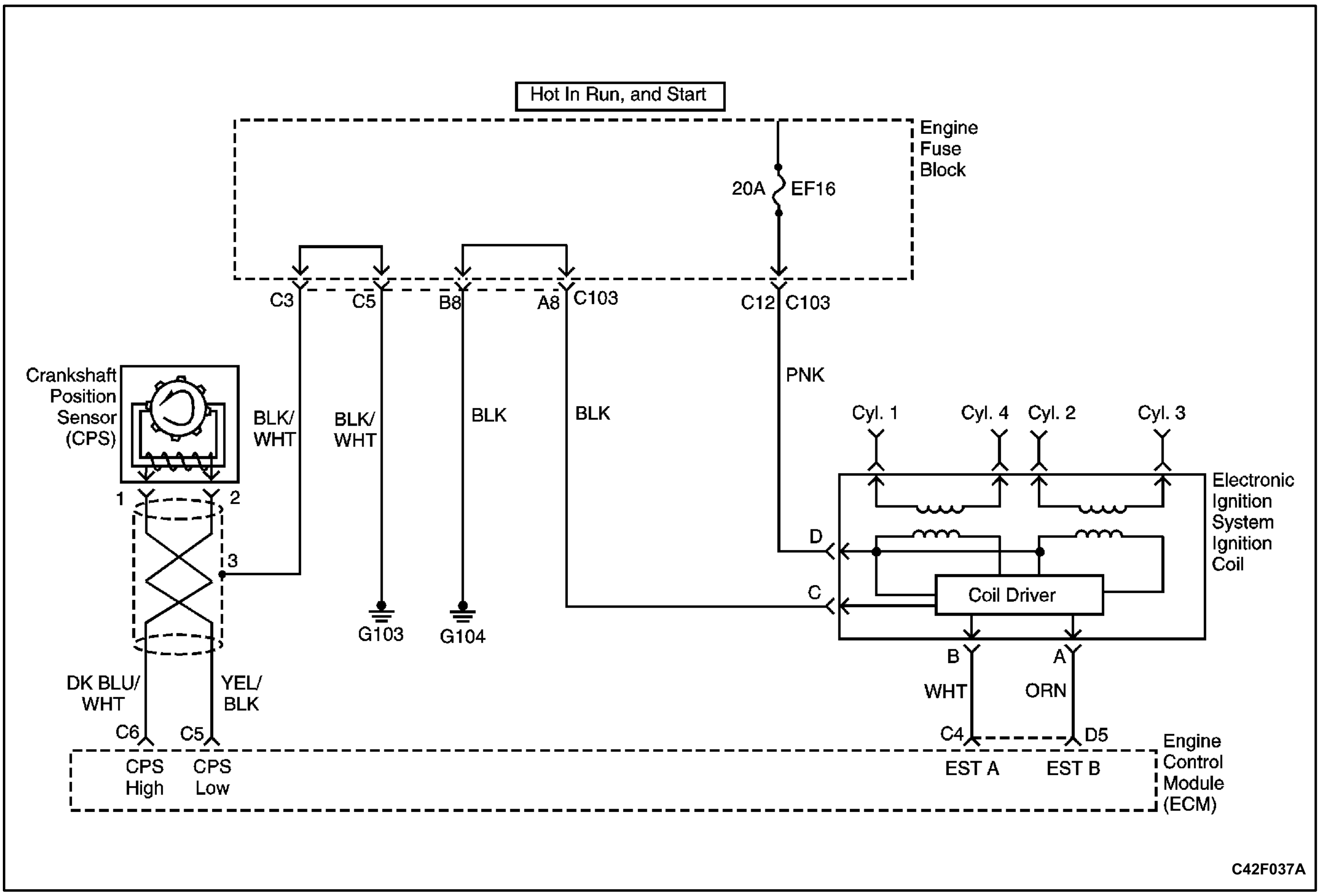
An intermittent may be caused by a poor connection, rubbedthrough wire insulation or a wire broken inside the insulation. Check for:

- Poor connection - Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on, and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving connectors and wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.

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

DTC P0351 Ignition Control A Circuit Fault

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



DIAGNOSTIC TROUBLE CODE (DTC) P0352 IGNITION CONTROL B CIRCUIT FAULT

Circuit Description

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

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

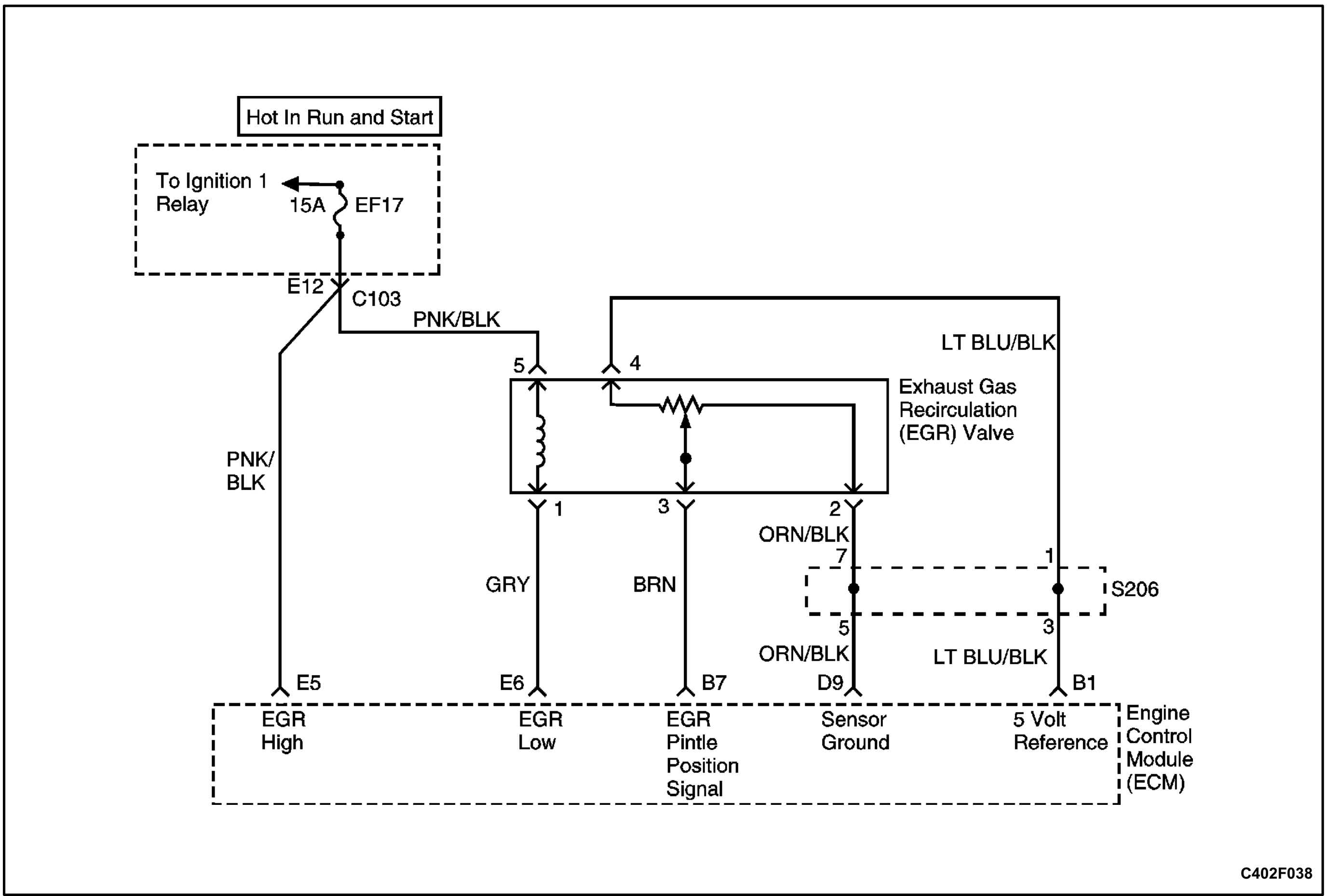
An intermittent may be caused by a poor connection, rubbedthrough wire insulation or a wire broken inside the insulation. Check for:

- Poor connection - Inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminaltowire connection.
- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition on, and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving connectors and wiring harnesses related to the ECM. A change in voltage will indicate the location of the fault.

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

DTC P0352 Ignition Control B Circuit Fault

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



DIAGNOSTIC TROUBLE CODE (DTC) P0404
EXHAUST GAS RECIRCULATION OPEN VALVE POSITION ERROR

Circuit Description

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

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

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

This DTC will detect an open valve position.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

Test Description

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

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

DTC P0404 Exhaust Gas Recirculation Open Valve Position Error

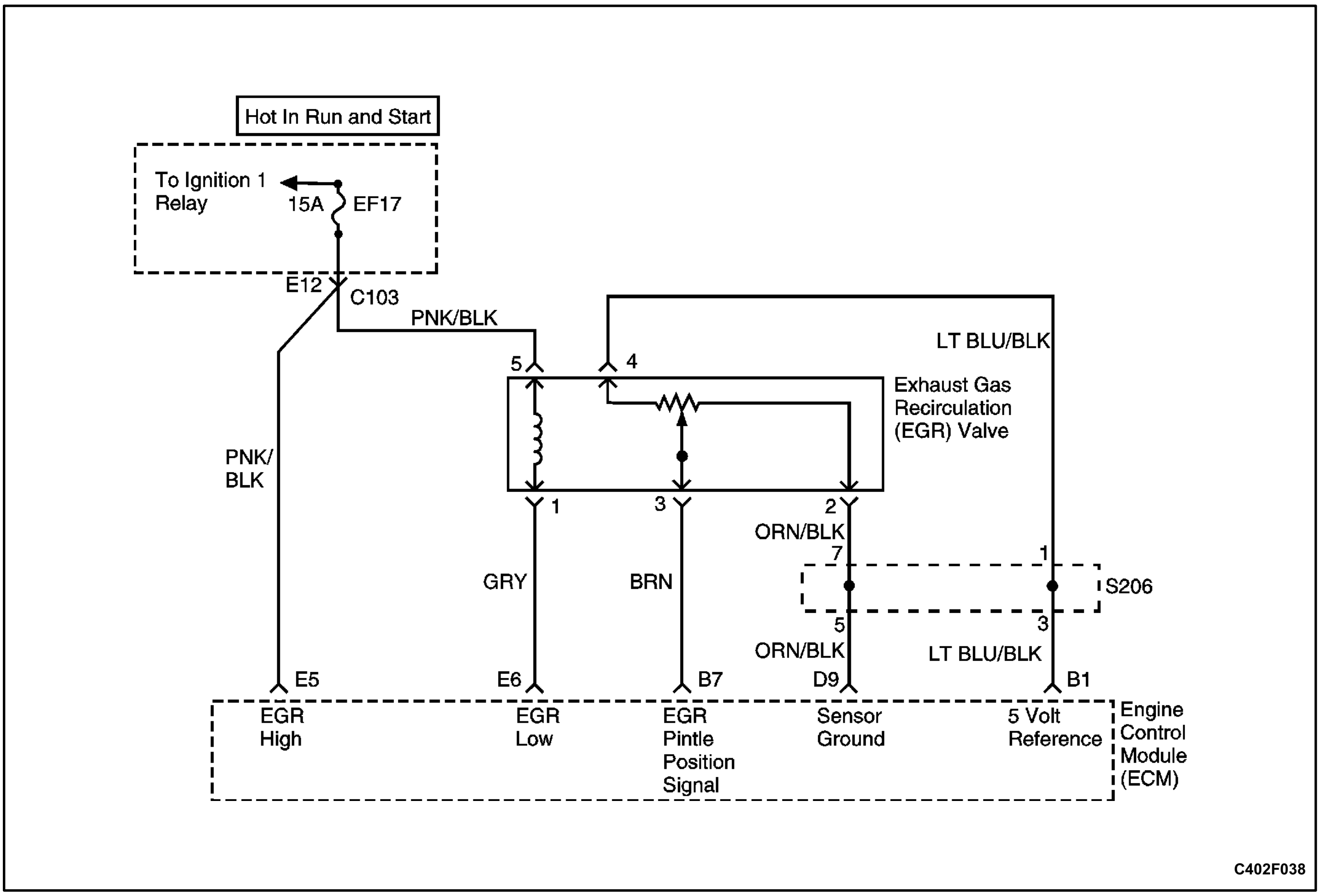
Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"

DTC P0404 Exhaust Gas Recirculation Open Valve Position Error (Cont'd)

Step	Action	Value(s)	Yes	No
2	1. Turn the ignition switch ON with the engine OFF. 2. Install a scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch ON, with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit at terminal 2 to the EGR valve. Does the test light illuminate?	-	Go to *Step 4*	Go to *Step 5*
4	1. Connect the test light to ground. 2. Probe the EGR control circuit at terminal 1 to the EGR valve. 3. Command the EGR valve to the specified values using a scan tool. After the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to *Step 6*	Go to *Step 7*
5	Repair the open or poor connection in the EGR ground circuit. Is the action complete?	-	Go to *Step 19*	-
6	With a test light still connected to ground, probe the signal circuit at terminal 3. Does the test light illuminate?	-	Go to *Step 8*	Go to *Step 9*
7	With the test light still connected to ground, again probe the control circuit without commanding the EGR valve with the scan tool. Does the test light illuminate?	-	Go to *Step 10*	Go to *Step 11*
8	Check the signal circuit for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 19*	Go to *Step 12*
9	With a digital voltmeter (DVM) connected to ground, probe the 5 v reference circuit at terminal 4. Is the voltage measured near the specified value?	5 V	Go to *Step 13*	Go to *Step 14*
10	Check the control circuit for a short to voltage and repair as necessary. Is a repair necessary.	-	Go to *Step 19*	Go to *Step 12*
11	Connect the test light to B+ and again probe the control circuit. Does the test light illuminate?	-	Go to *Step 15*	Go to *Step 16*
12	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 19*	-
13	Check the EGR ground circuit at terminal D9 for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?	-	Go to *Step 19*	Go to *Step 17*
14	Check the 5 v reference circuit for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 19*	Go to *Step 12*

DTC P0404 Exhaust Gas Recirculation Open Valve Position Error (Cont'd)

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



DIAGNOSTIC TROUBLE CODE (DTC) P0405 EXHAUST GAS RECIRCULATION PINTLE POSITION LOW VOLTAGE

Circuit Description

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

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

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

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.

- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

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

Test Description

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

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

DTC P0405 Exhaust Gas Recirculation Pintle Position Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a digital voltmeter (DVM) connected to ground, probe the 5 volt reference circuit at terminal 4 to the EGR valve. Does the DVM read near the specified value?	5 V	Go to *Step 4*	Go to *Step 5*

DTC P0405 Exhaust Gas Recirculation Pintle Position Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
4	Jumper the 5 volt reference circuit to the signal circuit at terminals 4 and 3. Does the Actual EGR Position display the specified value?	100%	Go to *Step 6*	Go to *Step 7*
5	1. Connect the test light to B+. 2. Probe the 5 volt reference circuit to the EGR valve. Does the test light illuminate?	-	Go to *Step 8*	Go to *Step 9*
6	Check the 5 volt reference and signal circuit for a poor connection or proper terminal tension and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 10*
7	1. Connect the test light to B+. 2. Probe the signal circuit at terminal 3 to the EGR valve. Does the test light illuminate?	-	Go to *Step 11*	Go to *Step 12*
8	Check for a short to ground in the EGR valve 5 volt reference circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 13*
9	Check for an open in the EGR 5 volt reference circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 14*
10	Replace the EGR valve. Is the action complete?	-	Go to *Step 15*	-
11	Check for a short to ground in the EGR valve signal circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 13*
12	Check for an open in the EGR valve signal circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 14*
13	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 19*	-
14	Check the affected circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 13*
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 7*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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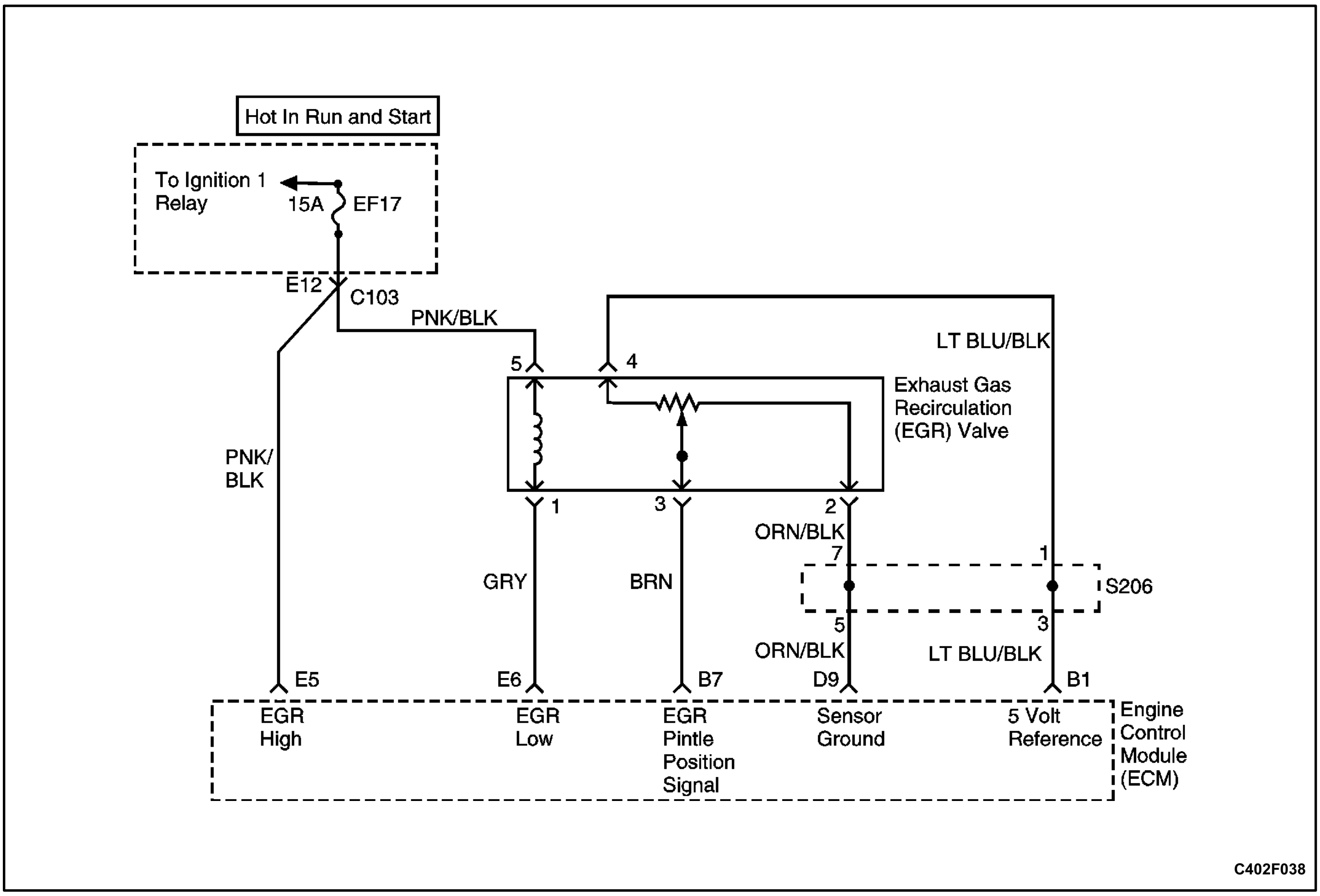

DIAGNOSTIC TROUBLE CODE (DTC) P0406
EXHAUST GAS RECIRCULATION PINTLE POSITION HIGH VOLTAGE

Circuit Description

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

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

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The MIL will turn off after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.

- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

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

Test Description

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

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

DTC P0406 Exhaust Gas Recirculation Pintle Position High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON with the engine OFF. 2. Install a scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch ON with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a digital voltmeter (DVM) connected to ground, probe the 5 V reference circuit at terminal 4 to the EGR valve. Does the DVM read near the specified value?	5 V	Go to *Step 4*	Go to *Step 5*

DTC P0406 Exhaust Gas Recirculation Pintle Position High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
4	Jumper the 5 volt reference circuit to the signal circuit at terminals 4 and 3. Does the Actual EGR Position display the specified value?	100%	Go to *Step 6*	Go to *Step 7*
5	1. Connect the test light to B+. 2. Probe the 5 V reference circuit to the EGR valve. Does the test light illuminate?	-	Go to *Step 8*	Go to *Step 9*
6	Check the 5 V reference and signal circuit for a poor connection or proper terminal tension and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 10*
7	1. Connect the test light to B+. 2. Probe the signal circuit at terminal 3 to the EGR valve. Does the test light illuminate?	-	Go to *Step 11*	Go to *Step 12*
8	Check for a short to ground in the EGR valve 5 V reference circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 13*
9	Check for an open in the EGR 5 V reference circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 14*
10	Replace the EGR valve. Is the action complete?	-	Go to *Step 15*	-
11	Check for a short to ground in the EGR valve signal circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 13*
12	Check for an open in the EGR valve signal circuit and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 14*
13	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 19*	-
14	Check the affected circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 13*
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 7*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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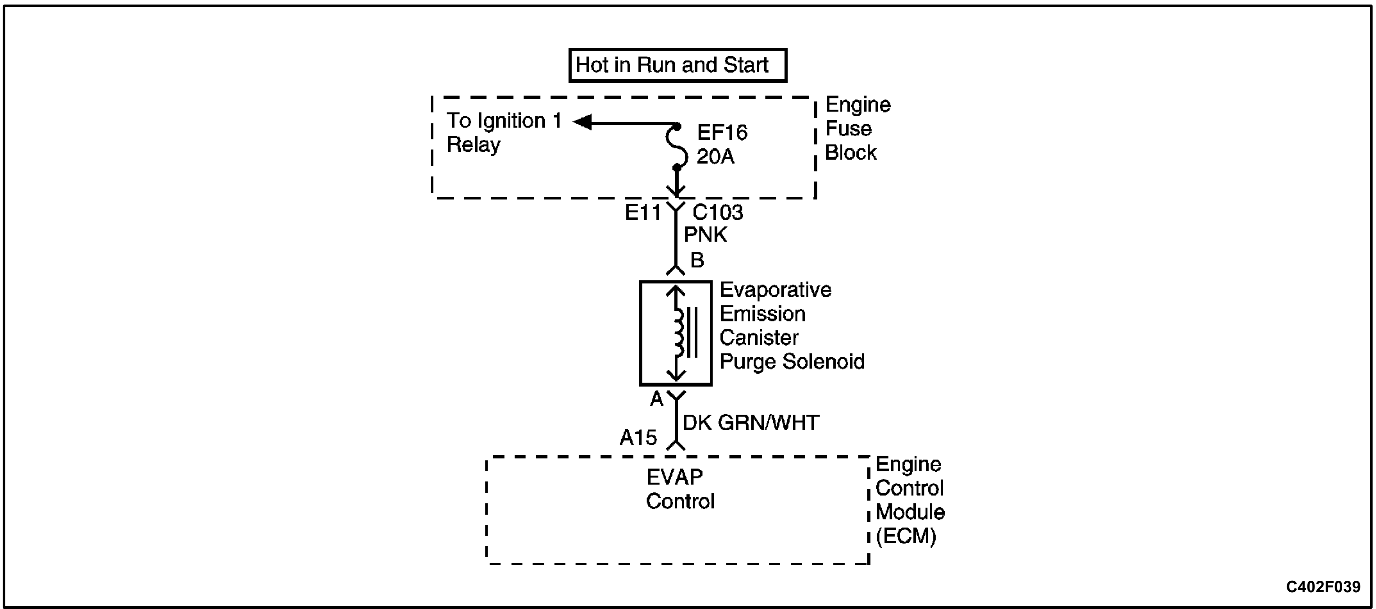

DIAGNOSTIC TROUBLE CODE (DTC) P0443 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL CIRCUIT

System Description

The evaporative emission (EVAP) system includes the following components:

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The EVAP system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The engine control module (ECM) monitors the vacuum level through the fuel tank pressure sensor signal.

At the appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned ON, allowing the engine to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system.

Conditions for Setting the DTC

- Ignition ON.
- Ignition voltage is greater than 10 v.
- Engine run time is greater than 5 sec.
- The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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 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 were noted. This will isolate when the DTC failed.

Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. 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.
3. This check can detect a partially shorted coil which would cause excessive current flow. Leaving the circuit energized for 2 minutes allows the coil to warm up. When warm, the coil may open (amps drop to 0), or short (amps go above 0.75).

13. If no trouble is found in the control circuit the connection at the ECM, the ECM may be faulty, but this is an extremely unlikely failure. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0443 Evaporative Emission System Purge Control Circuit

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Turn the ignition ON, engine OFF. 2. Install the scan tool. 3. Command the Evaporative Emission (EVAP) Purge Solenoid ON and OFF. Does the solenoid turn ON and OFF with each command?	-	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition OFF. 2. Disconnect the engine control module (ECM) connector containing the solenoid control circuit (connector 1, red). 3. Turn the ignition ON. 4. Using a digital voltmeter (DVM) on a 10 amp scale, measure the current from the solenoid control circuit, at terminal A15 in the ECM harness connector to ground for 2 minutes. Does the current draw measure less than the specified value?	0.75 amps	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the solenoid. 3. Using a DVM, measure resistance from the solenoid control circuit, at terminal A15 in the ECM harness connector to ground. Does the DVM display infinite resistance?	-	Go to *Step 12*	Go to *Step 10*
5	1. Turn the ignition OFF. 2. Disconnect the solenoid. 3. Connect a test light between the terminals A and B in the solenoid harness connector. 4. Turn the ignition ON. 5. Using the scan tool, command the solenoid ON and OFF. Does the test light turn ON and OFF with each command?	-	Go to *Step 8*	Go to *Step 6*

DTC P0443 Evaporative Emission System Purge Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
6	With the test light connected to ground, probe the ignition feed circuit, at terminal A in the solenoid harness connector. Does the test light illuminate?	-	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition OFF. 2. Reconnect the solenoid. 3. Disconnect the ECM connector containing the solenoid control circuit. 4. Turn the ignition ON. 5. With a fused jumper wire connected to ground, probe the solenoid control circuit at terminal A15 in the ECM harness. Does the solenoid operate?	-	Go to *Step 9*	Go to *Step 10*
8	Check the connections at the solenoid. Is a problem found and corrected?	-	Go to *Step 14*	Go to *Step 12*
9	Check the connections at the ECM. Is a problem found and corrected?	-	Go to *Step 14*	Go to *Step 13*
10	Repair the faulty solenoid control circuit. Is the repair complete?	-	Go to *Step 14*	-
11	Repair the faulty solenoid ignition feed circuit. Is the repair complete?	-	Go to *Step 14*	-
12	Replace the solenoid. Is the repair complete?	-	Go to *Step 14*	-
13	Replace the ECM. Is the repair complete?	-	Go to *Step 14*	-
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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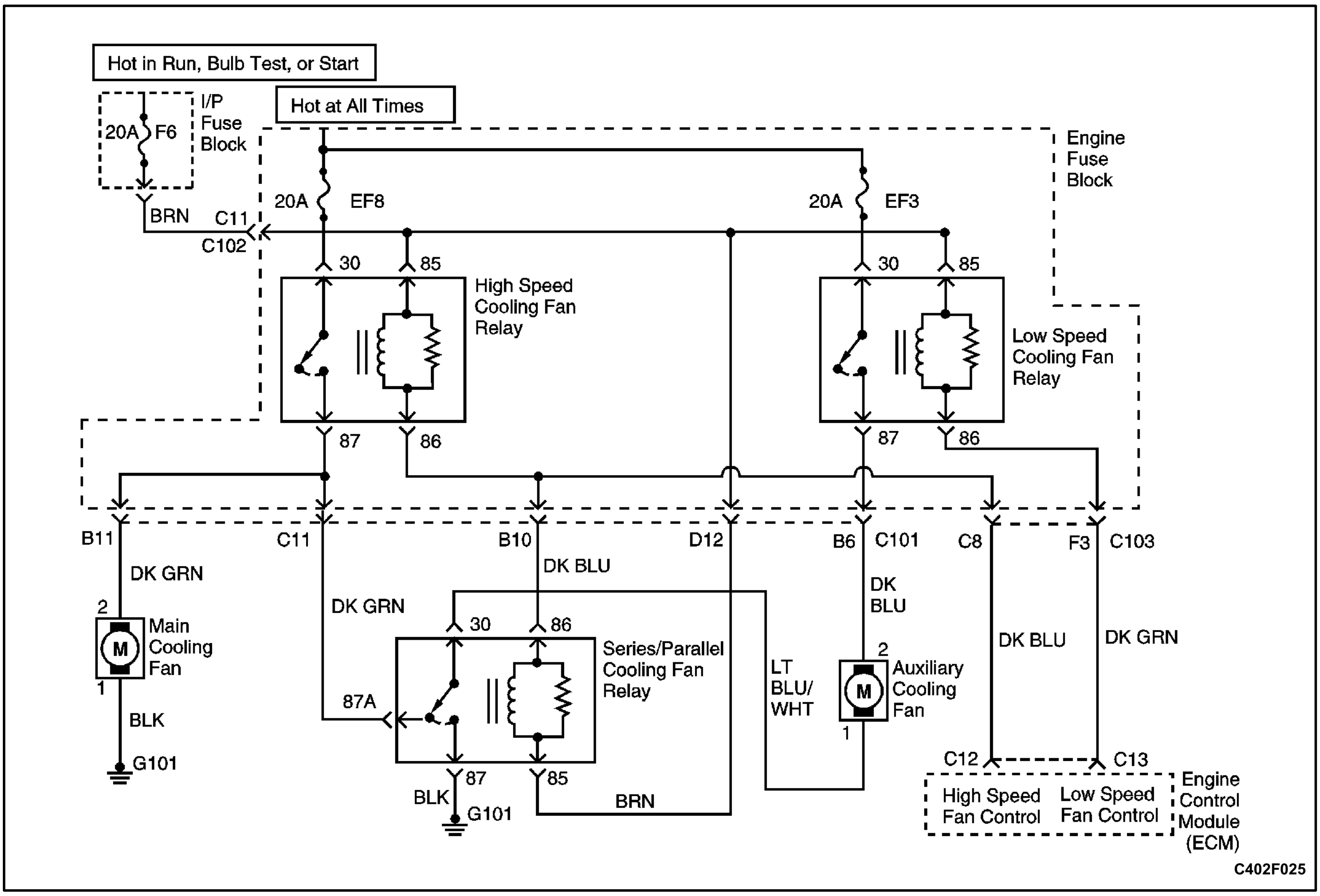

DIAGNOSTIC TROUBLE CODE (DTC) P0480
COOLING FAN RELAY 1 FAN CONTROL CIRCUIT FAULT

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module (ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is to supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0 volts). When the ECM 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 is expected, the fault line status will change causing the Diagnostic Trouble Code (DTC) to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- DTCs P0117, P0118 not set.
- Ignition ON.
- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 5 seconds.

Action Taken When the DTC Sets

- The ECM will not illuminate the Malfunction Indicator Lamp (MIL).
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and/or Failure Records.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after forty consecutive warmup cycles, if no failures are reported by this or any other emission related diagnostic.
- ECM battery voltage is interrupted.
- Using a scan tool.

Diagnostic Aids

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 fail. Operate the vehicle within the same freeze frame conditions (rpm, load, vehicle speed, temperature, etc.) that are noted. This will isolate when the DTC failed.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

2. 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.

3. This check can detect a partially shorted coil which would cause excessive current flow. Leaving the circuit energized for 2 minutes allows the coil to warm up. When warm, the coil may open or short.

5. It is important to identify and test the relay coil terminals to avoid improper diagnosis.

13. If no trouble is found in the control circuit or the connection at the ECM, the ECM may be faulty. However, this is extremely unlikely. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0480 Cooling Fan Relay 1 Fan Control Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON with engine OFF. 2. Install the scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	-	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition OFF. 2. Disconnect the engine control module (ECM) connector 2 (white) from the ECM. 3. Turn the ignition ON. 4. Using a digital voltmeter (DVM), measure the current in relay A control circuit, at terminal C13 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the relay. 3. Using a DVM, measure the resistance from the relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	-	Go to *Step 12*	Go to *Step 10*
5	1. Turn the Ignition OFF. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 86 and 85 in the relay harness connector. 4. Turn the ignition ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each command?	-	Go to *Step 8*	Go to *Step 6*

DTC P0480 Cooling Fan Relay 1 Fan Control Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
6	With the test light connected to ground, probe the ignition feed circuit in the relay harness connector. Does the test light illuminate?	-	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition OFF. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the ignition ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit at terminal C12 in the ECM harness connector. Does the relay operate?	-	Go to *Step 9*	Go to *Step 10*
8	Check the connections at the relay. Is a problem found and corrected?	-	Go to *Step 14*	Go to *Step 12*
9	Check the connections at the ECM. Is a problem found and corrected?	-	Go to *Step 14*	Go to *Step 13*
10	Repair the faulty relay control circuit. Is the repair complete?	-	Go to *Step 14*	-
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	-	Go to *Step 14*	-
12	Replace the relay. Is the repair complete?	-	Go to *Step 14*	-
13	Replace the ECM. Is the repair complete?	-	Go to *Step 14*	-
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTC)s. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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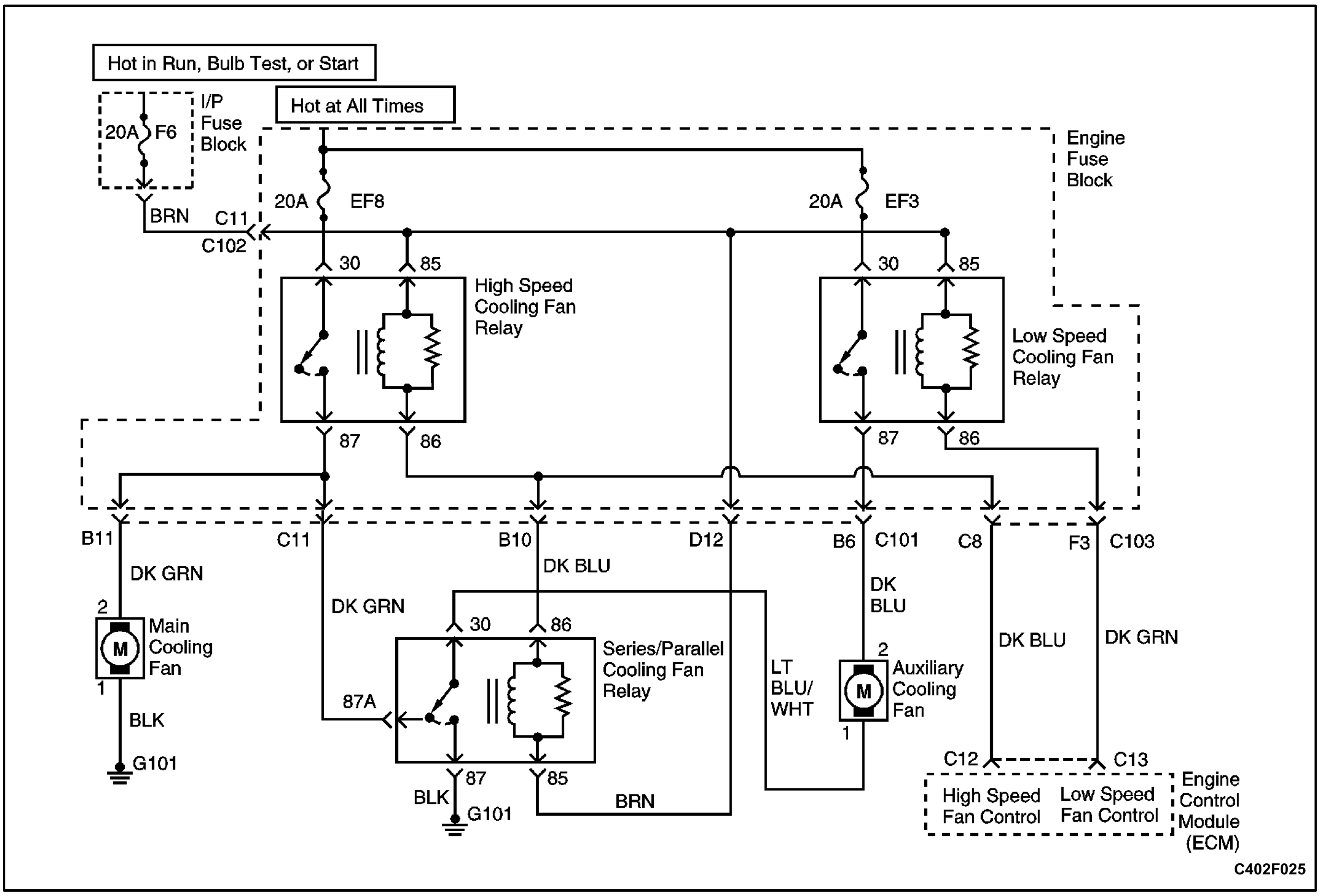

DIAGNOSTIC TROUBLE CODE (DTC) P0481
COOLING FAN RELAY 2 FAN CONTROL CIRCUIT FAULT

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module (ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is to supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0 volts). When the ECM 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 is expected, the fault line status will change causing the Diagnostic Trouble Code (DTC) to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- DTCs P0117, P0118 not set.
- Ignition ON.
- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 5 seconds.

Action Taken When the DTC Sets

- The ECM will not illuminate the Malfunction Indicator Lamp (MIL).
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and/or Failure Records.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after forty consecutive warmup cycles, if no failures are reported by this or any other emission related diagnostic.
- ECM battery voltage is interrupted.
- Using a scan tool.

Diagnostic Aids

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 fail. Operate the vehicle within the same freeze frame conditions (rpm, load, vehicle speed, temperature, etc.) that are noted. This will isolate when the DTC failed.

Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

2. 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.

3. This check can detect a partially shorted coil which would cause excessive current flow. Leaving the circuit energized for 2 minutes allows the coil to warm up. When warm, the coil may open or short.

5. It is important to identify and test the relay coil terminals to avoid improper diagnosis.

13. If no trouble is found in the control circuit or the connection at the ECM, the ECM may be faulty. However, this is extremely unlikely. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0481 Cooling Fan Relay 2 Fan Control Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON with engine OFF. 2. Install the scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	-	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition OFF. 2. Disconnect the engine control module (ECM) connector 2 (white) from the ECM. 3. Turn the ignition ON. 4. Using a digital voltmeter (DVM), measure the current in relay B control circuit, at terminal C12 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the relay. 3. Using a DVM, measure the resistance from the relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	-	Go to *Step 12*	Go to *Step 10*

DTC P0481 Cooling Fan Relay 2 Fan Control Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the Ignition OFF. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 86 and 85 in the relay harness connector. 4. Turn the ignition ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each command?	-	Go to *Step 8*	Go to *Step 6*
6	With the test light connected to ground, probe the ignition feed circuit, at terminal 86 in the relay har□ ness connector. Does the test light illuminate?	-	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition OFF. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the ignition ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit, at terminal C12 in the ECM harness connector. Does the relay operate?	-	Go to *Step 9*	Go to *Step 10*
8	Check the connections at the relay. Is a problem found and corrected?	-	Go to *Step 14*	Go to *Step 12*
9	Check the connections at the ECM. is a problem found and corrected?	-	Go to *Step 14*	Go to *Step 13*
10	Repair the faulty relay control circuit. Is the repair complete?	-	Go to *Step 14*	-
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	-	Go to *Step 14*	-
12	Replace the relay. Is the repair complete?	-	Go to *Step 14*	-
13	Replace the ECM. Is the repair complete?	-	Go to *Step 14*	-
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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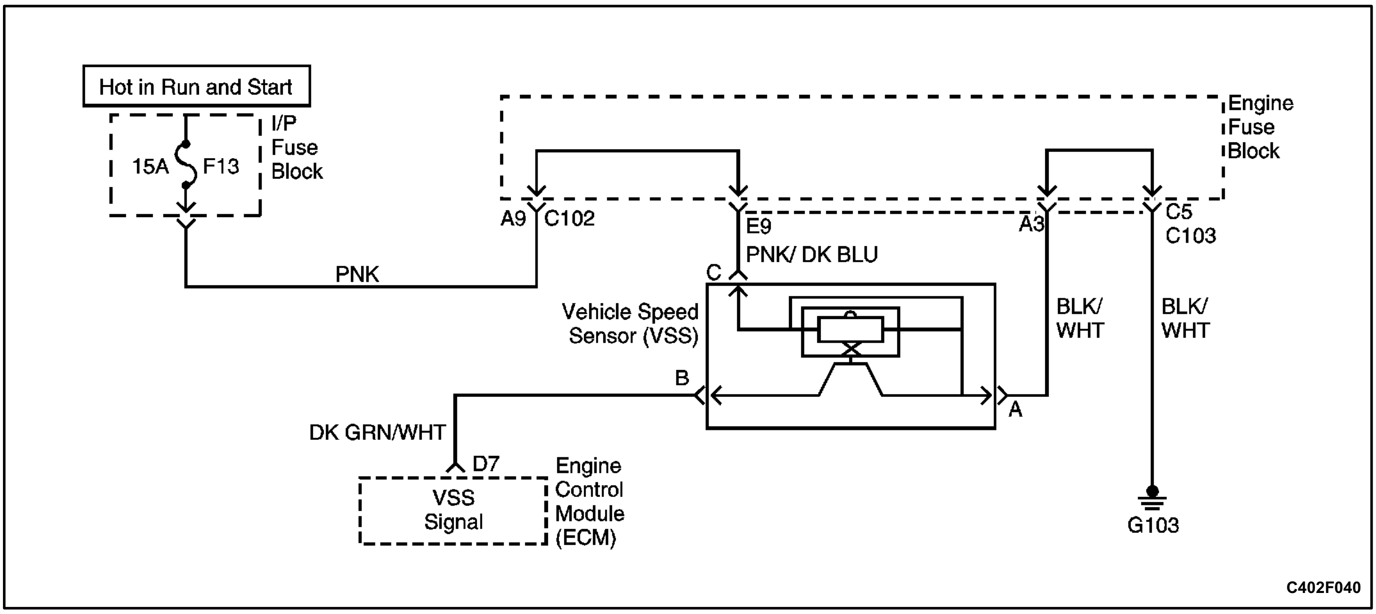

DIAGNOSTIC TROUBLE CODE (DTC) P0502
VEHICLE SPEED (ENGINE SIDE) NO SIGNAL

Circuit Description

Vehicle speed information is provided to the engine control module (ECM) by the Vehicle Speed Sensor (VSS). The VSS is a permanent magnet generator that is mounted in the transaxle and produces a pulsing voltage whenever vehicle speed is over 3 mph (5 km/h). The alternating current (AC) voltage level and the number of pulses increases with vehicle speed. The ECM converts the pulsing voltage into mph (km/h) and than supplies the necessary signal to the instrument panel for speedometer/ odometer operation and to the cruise control module and multifunction alarm module operation. This Diagnostic Trouble Code (DTC) will detect if vehicle speed is reasonable according to engine rpm and load.

Conditions for Setting the DTC

- DTC(s) P0107, P0108, P0121, P0122, P0123, P1106, P1107, P1121 and P1122 will not set.
- Voltage is between 11-16 volts.
- Coolant temperature is greater than 40°C (40°F).

Power Test

- Vehicle speed is less than 8 km/h (5 mph).
- Manifold Absolute Pressure (MAP) is greater than 60 kPa.
- Throttle Position Sensor (TPS) is between 25 and 60%.
- The rpm is between 2700 and 6000.

Deceleration Test

- Vehicle speed is less than 8 km/h (5 mph).
- MAP is less than 25 kPa.
- TPS is less than 1.0%.
- The rpm is between 1200 and 6000.
- The change of RPM is less than 90 RPM/cycle.
- P/N switch is off.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

VSS signal circuit should be thoroughly checked for the following conditions:

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

Ensure the VSS is correctly torqued to the transmission housing.

Refer to "Intermittents" in this section.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. The permanent magnet generator only produces a signal if the drive wheels are turning greater than 3 mph (5 km/h). This step determines if DTC P0502 is the result of a hard failure or an intermittent condition.
3. Proper engine loads cannot be achieved in a shop environment to properly run the vehicle within the Freeze Frame Data conditions. It will be necessary to drive the vehicle on the road to obtain the proper engine loads.
4. This step verifies that the ECM is receiving a signal from the vehicle speed sensor.
5. Refer to service bulletin information for the latest calibration update.
6. Refer to the latest Techline information for programming procedures.
8. A resistance reading that is higher than the specified value indicates that the VSS circuitry is open.
10. If the displayed resistance is less than the 1300 ohms, the VSS high and low circuits are shorted together.
11. This checks the resistance of the VSS if no opens or shorts were found on the VSS high and low circuits.
13. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0502 Vehicle Speed (Engine Side) No Signal

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	**Notice:** Running the vehicle in gear with the wheels hanging down at full travel will damage the drive axles. 1. Turn the ignition switch ON with the engine OFF. 2. Install a scan tool. 3. Raise the drive wheels. 4. Support the lower control arms so that the drive axles are in a horizontal (straight) position. 5. Allow the engine to idle in gear. Does the scan tool display vehicle speed above the specified value?	0 mph	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting this DTC. Does the scan tool display the vehicle speed above the specified value?	0 mph	Go to *Step 12*	Go to *Step 4*
4	1. Turn the ignition switch OFF. 2. Disconnect the engine control module (ECM) connector 2 (white). 3. Using a digital voltmeter (DVM) connected to ground, measure the voltage in the Vehicle Speed Sensor (VSS) signal circuit, at terminal D7 while rotating the wheels. Is the voltage greater than or equal to the specified value?	0.5 V	Go to *Step 12*	Go to *Step 5*

DTC P0502 Vehicle Speed (Engine Side) No Signal (Cont'd)

Step	Action	Value(s)	Yes	No
5	Measure the resistance in the VSS signal circuit while rotating the wheels. Is the resistance greater than the specified value?	1950 Ω	Go to *Step 6*	Go to *Step 7*
6	Check the VSS signal circuit for an open and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 9*
7	Is the resistance value within or equal to the specified value?	1300-1950 Ω	Go to *Step 8*	Go to *Step 9*
8	Check the VSS signal circuit for a short to ground or for being shorted together and repair as necessary. Is a repair necessary?	-	Go to *Step 12*	Go to *Step 9*
9	1. Remove the VSS. 2. Measure the resistance between terminals A and B. Is the resistance value within the specified value?	1300-1950 Ω	Go to *Step 11*	Go to *Step 10*
10	Replace the VSS. Is the action complete?	-	Go to *Step 12*	-
11	Replace the ECM. Is the action complete?	-	Go to *Step 12*	-
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed.?	-	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diag□ nosed?	-	Go to applicable DTC table	System OK

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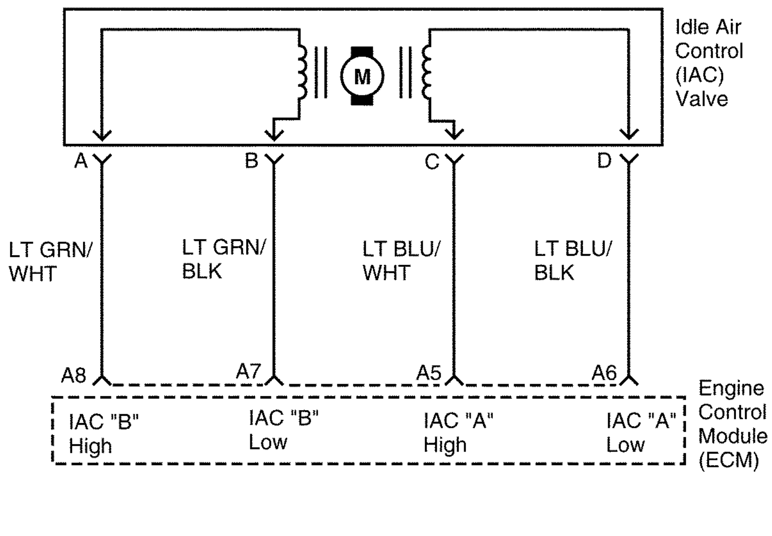

DIAGNOSTIC TROUBLE CODE (DTC) P0506
IDLE SPEED RPM LOWER THAN DESIRED IDLE SPEED

Circuit Description

The engine control module (ECM) controls the air entering into the engine with an Idle Air Control (IAC) Valve. To increase the idle rpm, the ECM commands the pintle inside the IAC valve away from the throttle body seat. This allows more air to bypass through the throttle blade. To decrease the rpm the ECM commands the pintle towards the throttle body seat. This reduces the amount of air bypassing the throttle blade. A scan tool will read the IAC valve pintle position in counts. The higher the counts, the more air that is allowed to bypass the throttle blade. This Diagnostic Trouble Code (DTC) determines if a low idle condition exists as defined as 100 rpm below the desired idle rpm.

Conditions for Setting the DTC

- DTC(s) P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0351, P0352, P0402, P0404, P0405, P0406, P0502, P1130, P1133, P1134, P1404, P1441, P1627 not set.
- Engine Coolant Temperature (CTS) is greater than 59.75°C (140°F).
- Barometric Pressure (BARO) is greater than 72.67 kPa.
- Ignition voltage is between 9.5 and 16.7 volts.
- Engine has been running more than 125 seconds.
- The Intake Air Temperature is greater than 40°C (40°F).
- All of the above must be met for greater than 5 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

Inspect the IAC valve electrical connection for proper mating.

Inspect the wiring harness for damage.

Inspect the throttle stop screw for signs of tampering.

Inspect the throttle linkage for signs of binding or excessive wear.

A slow or unstable idle may be caused by one of the following conditions:

- Fuel system too rich or too lean.
- Foreign material in the throttle body bore or in the air induction system.
- A leaking or restricted intake manifold.
- Excessive engine overloading. Check for seized pulleys, pumps, or motors on the accessory drive,
- Overweight engine oil.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic

checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

2. A normal operating IAC system will be able to be extended and retracted by a scan tool and change the engine idle rpm. Valve movement is verified by an engine rpm change.
3. If the scan tool was able to command the IAC valve smoothly, a malfunction may still exist internally within the IAC valve. This can be checked by checking the IAC valves internal resistance.
5. The IAC circuits always have ground or voltage signals on them in pairs. If the test light illuminates on more or less than 2 terminals, 1 of the circuits is shorted to voltage or open.
6. The IAC circuits always have ground or voltage signals on them in pairs. If the test light illuminates on more or less than 2 terminals, 1 of the circuits is shorted to ground or open,
8. The IAC circuits are constantly switched between ground and voltage so the test light should blink on all circuits when connected to ground.
10. Any circuitry, that is suspected as causing the intermittent complaint, should be thoroughly checked for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.
12. A test light that remains ON constantly indicates that the circuit is shorted to voltage.
14. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
16. If no malfunctions have been found at this point and no additional DTCs were set, refer to "Diagnostic Aids" in this section for additional checks and information.

DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON with the engine OFF. 2. Engine at normal operating temperature. 3. Transmission in park or neutral and the parking brake set. 4. A/C is Off. 5. Install a scan tool and command the Idle Air Control (IAC) valve up and down between the specified values. Does the engine rpm change smoothly when commanded by the scan tool?	900-2000 rpm	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition switch OFF. 2. Disconnect the IAC valve electrical connector. 3. Measure the resistance across the IAC valve terminals A and B. 4. Measure the resistance across the IAC terminals C and D. Is the resistance across terminals A and B and terminals C and D within the specified value?	40-80 Ω	Go to *Step 4*	Go to *Step 13*
4	1. Measure the resistance across the IAC valve terminals B and C. 2. Measure the resistance across the IAC terminals A and D. Is the resistance across terminals B and C and terminals A and D infinite?	-	Go to *Step 15*	Go to *Step 13*

DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the Ignition switch ON with the engine OFF. 2. Disconnect the IAC valve electrical connector. 3. With a test light connected to ground, probe the IAC electrical connector terminals. Does the test light illuminate on 2 terminals.	-	Go to *Step 6*	Go to *Step 7*
6	With a test light connected to B+, probe the IAC electrical connector terminals. Does the test light illuminate on 2 terminals?	-	Go to *Step 8*	Go to *Step 9*
7	Check for an open or short to ground in the IAC valve high and low circuits and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 10*
8	1. Idle the engine. 2. Connect a test light to ground, probe the IAC electrical connector terminals. Does the test light flash ON and OFF for all terminals?	-	Go to *Step 11*	Go to *Step 12*
9	Check for an open or a short to voltage in the IAC valve high and low circuits and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 10*
10	Check the engine control module (ECM) electrical connector for poor connections and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 14*
11	Inspect the IAC valve passages. Is a problem found?	-	Go to *Step 15*	Go to *Step 13*
12	Check the test light. Does the test light remain ON constantly for the terminals that did not blink?	-	Go to *Step 9*	Go to *Step 7*
13	Replace the IAC valve. Is the action complete?	-	Go to *Step 15*	-
14	Replace the ECM. Is the action complete?	-	Go to *Step 15*	-
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 16*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC Table	System OK

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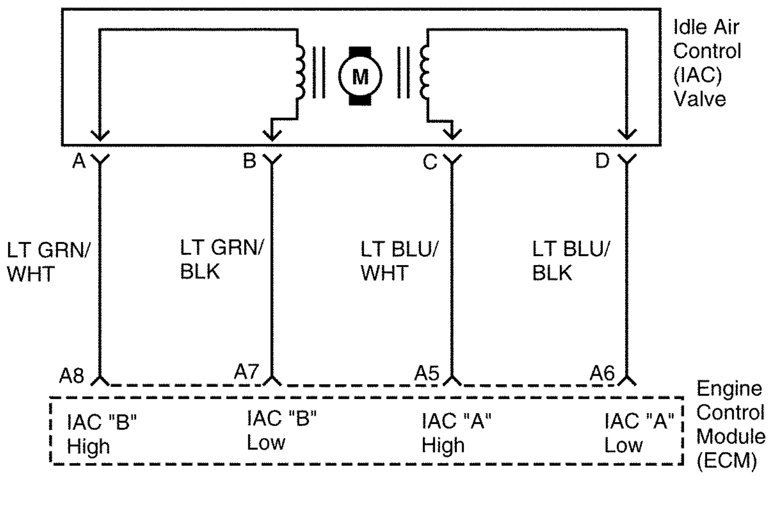

DIAGNOSTIC TROUBLE CODE (DTC) P0507 IDLE SPEED RPM HIGHER THAN DESIRED IDLE SPEED

Circuit Description

The engine control module (ECM) controls the air entering into the engine with an Idle Air Control (IAC) Valve. To increase the idle rpm, the ECM commands the pintle inside the IAC valve away from the throttle body seat. This allows more air to bypass through the throttle blade. To decrease the rpm the ECM commands the pintle towards the throttle body seat. This reduces the amount of air bypassing the throttle blade. A scan tool will read the IAC valve pintle position in counts. The higher the counts, the more air that is allowed to bypass the throttle blade. This Diagnostic Trouble Code (DTC) determines if a high idle condition exists as defined as 200 rpm above the desired idle rpm.

Conditions for Setting the DTC

- DTC(s) P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0351, P0352, P0402, P0404, P0405, P0406, P0443, P0502, P1130, P1133, P1134, P1171, P1404, P1441, P1627 not set.
- Engine Coolant Temperature (CTS) is greater than 59.75°C (140°F).
- Barometric Pressure (BARO) is greater than 72.67 kPa.
- Ignition voltage is between 9.5 and 16.7 volts.
- Engine has been running more than 125 seconds.
- The Idle Air Temperature is greater than 40°C (40°F).
- All of the above must be met for greater than 5 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

Inspect the IAC valve electrical connection for proper mating.

Inspect the wiring harness for damage.

Inspect throttle stop screw for signs of tampering.

Inspect throttle linkage for signs of binding or excessive wear.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. A normally operating IAC system will be able to be extended and retracted by a scan tool and change the engine idle rpm. Valve movement is verified by an engine rpm change.

3. If the scan tool was able to command the IAC valve smoothly, a malfunction may still exist internally within the IAC valve. This can be checked by checking the IAC valves internal resistance.
5. The IAC circuits always have ground or voltage signals on them in pairs. If the test light illuminates on more or less than 2 terminals, 1 of the circuits is shorted to voltage or open.
6. The IAC circuits always have ground or voltage signals on them in pairs. If the test light illuminates on more or less than 2 terminals, 1 of the circuits is shorted to ground or open
8. The IAC circuits are constantly switched between ground and voltage so the test light should blink on all circuits when connected to ground.
10. Any circuitry, that is suspected as causing the intermittent complaint, should be thoroughly checked for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wiring connections or physical damage to the wiring harness.
12. A test light that remains ON constantly indicates that the circuit is shorted to voltage.
14. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
16. If no malfunctions have been found at this point and no additional DTCs were set, refer to "Diagnostic Aids" in this section for additional checks and information.

DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON, with the engine OFF. 2. Engine at normal operating temperature. 3. Transmission in park or neutral and the parking brake set. 4. A/C is Off. 5. Install a scan tool and command the Idle air control (IAC) valve up and down between the specified values. Does the engine rpm change smoothly when commanded by the scan tool?	900-2000 rpm	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition switch OFF. 2. Disconnect the IAC valve electrical connector. 3. Measure the resistance across the IAC valve terminals A and B. 4. Measure the resistance across the IAC terminals C and D. Are the resistance across terminals A and B and terminals C and D within the specified value?	40-80 Ω	Go to *Step 4*	Go to *Step 13*
4	1. Measure the resistance across the IAC valve terminals B and C. 2. Measure the resistance across the IAC terminals A and D. Is the resistance across terminals B and C and terminals A and D infinite?	-	Go to *Step 15*	Go to *Step 13*

DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the Ignition switch ON with the engine OFF. 2. Disconnect the IAC valve electrical connector. 3. With a test light connected to ground, probe the IAC electrical connector terminals. Does the test light illuminate on 2 terminals.	-	Go to *Step 6*	Go to *Step 7*
6	With a test light connected to B+, probe the IAC electrical connector terminals. Does the test light illuminate on 2 terminals?	-	Go to *Step 8*	Go to *Step 9*
7	Check for an open or short to ground in the IAC valve high and low circuits and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 10*
8	1. Idle the engine. 2. Connect a test light to ground, probe the IAC electrical connector terminals. Does the test light flash ON and OFF for all terminals?	-	Go to *Step 11*	Go to *Step 12*
9	Check for an open or a short to voltage in the IAC valve high and low circuits and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 10*
10	Check the engine control module (ECM) electrical connector for poor connections and repair as necessary. Is a repair necessary?	-	Go to *Step 15*	Go to *Step 14*
11	Inspect the IAC valve passages. Is a problem found?	-	Go to *Step 15*	Go to *Step 13*
12	Check the test light. Does the test light remain ON constantly for the terminals that did not blink?	-	Go to *Step 9*	Go to *Step 7*
13	Replace the IAC valve. Is the action complete?	-	Go to *Step 15*	-
14	Replace the ECM. Is the action complete?	-	Go to *Step 15*	-
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 16*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC Table	System OK

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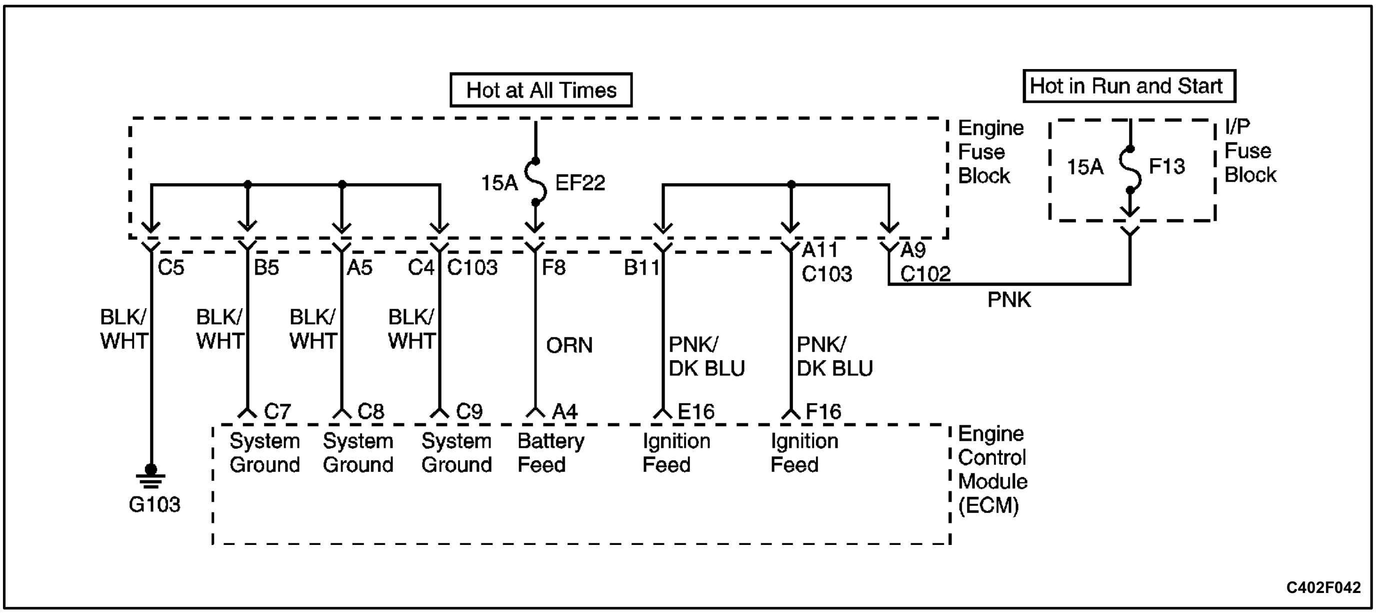


DIAGNOSTIC TROUBLE CODE (DTC) P0562 SYSTEM VOLTAGE (ENGINE SIDE) TOO LOW

Circuit Description

The engine control module (ECM) monitors the ignition voltage on the ignition feed circuit to terminal F16 at the ECM. A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- Ignition ON.
- The system voltage is less than 11 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

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

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

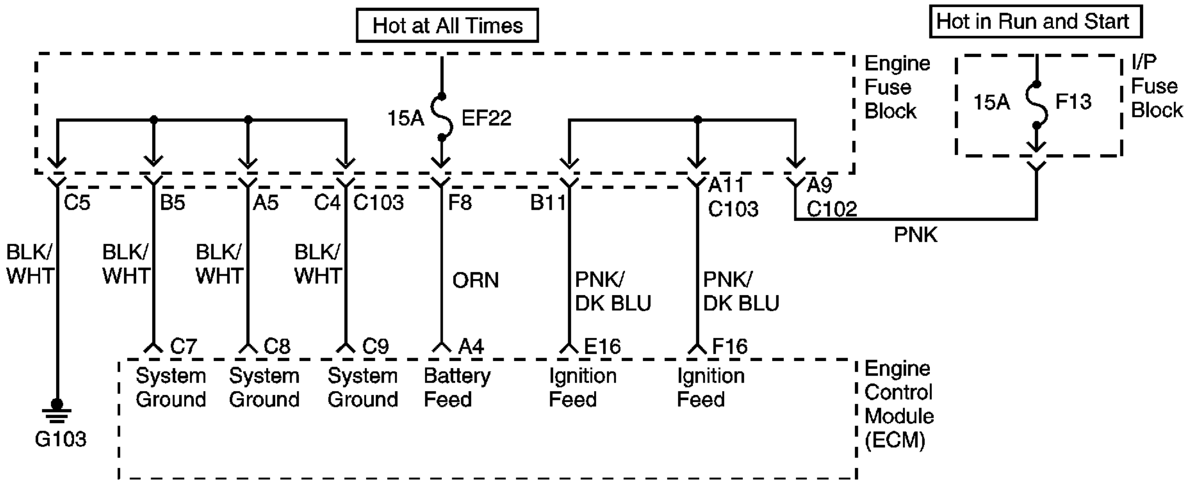
Test Description

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

1. The OnBoard Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. This checks if the generator is malfunctioning under load conditions.
4. Checks the ignition feed circuit for excessive resistance. An open circuit will cause a no-start condition.
7. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
9. If no malfunctions have been found at this point and no additional DTCs were set, refer to "Diagnostic Aids" in this section for additional checks and information.

DTC P0562 System Voltage (Engine Side) Too Low

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and raise the engine speed to the specified value. 3. Load the electrical system by turning on the headlights, high blower motor, etc. Is the ignition voltage less than the specified value?	1400 rpm 10 V	Go to *Step 3*	Go to *Step 8*
3	1. With the engine still running at the specified value. 2. Using a digital voltmeter (DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	1400 rpm 12 V	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition switch OFF. 2. Disconnect the engine control module (ECM) connector at the ECM. 3. Turn the ignition switch ON with the engine OFF. 4. Using a DVM, measure the ignition voltage at the ignition feed circuit, terminal F16. Is the ignition voltage greater than the specified value?	10 V	Go to *Step 5*	Go to *Step 6*
5	Check for a malfunctioning connection at the ECM harness terminals and repair as necessary. Is a repair necessary?	-	Go to *Step 8*	Go to *Step 7*
6	Repair the poor connection (high resistance) in the ignition feed circuit. Is the action complete?	-	Go to *Step 8*	-
7	Replace the ECM. Is the action complete?	-	Go to *Step 8*	-
8	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to Step 9	Go to Step 2
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0563 SYSTEM VOLTAGE (ENGINE SIDE) TOO HIGH

Circuit Description

The engine control module (ECM) monitors the ignition voltage on the ignition feed circuit to terminal F16 at the ECM. A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- Ignition ON.
- The system voltage is greater than 16 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

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

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

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. This checks if the generator is malfunctioning under load conditions.

4. Checks the ignition feed circuit 140 for excessive resistance. An open circuit will cause a no start condition.

7. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

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

DTC P0563 System Voltage (Engine Side) Too High

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and raise the engine speed to the specified value. 3. Load the electrical system by turning on the headlights, high blower motor, etc. Is the ignition voltage less than the specified value?	1400 rpm 10 V	Go to *Step 3*	Go to *Step 8*
3	1. With the engine still running at the specified value. 2. Using a digital voltmeter (DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	1400 rpm 12 V	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition switch OFF. 2. Disconnect the engine control module (ECM) connector at the ECM. 3. Turn the ignition switch ON, with the engine OFF. 4. Using a DVM, measure the ignition voltage at the ignition feed circuit, terminal F16. Is the ignition voltage greater than the specified value?	10 V	Go to *Step 5*	Go to *Step 6*
5	Check for a malfunctioning connection at the ECM harness terminals and repair as necessary. Is a repair necessary?	-	Go to *Step 8*	Go to *Step 7*
6	Repair the poor connection (high resistance) in the ignition feed circuit. Is the action complete?	-	Go to *Step 8*	-
7	Replace the ECM. Is the action complete?	-	Go to *Step 8*	-
8	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to Step 9	Go to Step 2
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC Table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0601 ECM (ENGINE SIDE) CHECKSUM FAULT

Circuit Description

The engine control module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL) (Check Engine), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An Electrically Erasable Programmable Read Only Memory (EEPROM) is used to house the program information and the calibrations required for engine, transmission, and powertrain diagnostics operation. The ECM uses a value called a checksum for error detection of the software. The checksum is a value that is equal to all the numbers in the software added together. The ECM adds all the values in the software, and if that value does not equal the checksum value, a checksum error is indicated.

Conditions for Setting the DTC

- The ECM detects more than 3 incorrect checksums.
- Ignition ON.
- Program ID not equal to value in S/W ($A9)

Action Taken When the DTC Sets

- MIL will illuminate.
- The ECM will attempt to record operating conditions at the time the failure is detected. However, since this is an internal ECM failure, this information may or may not be reliable. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

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

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P0601 ECM (Engine Side) Checksum Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 3*	-
3	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	-	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC Table	System OK

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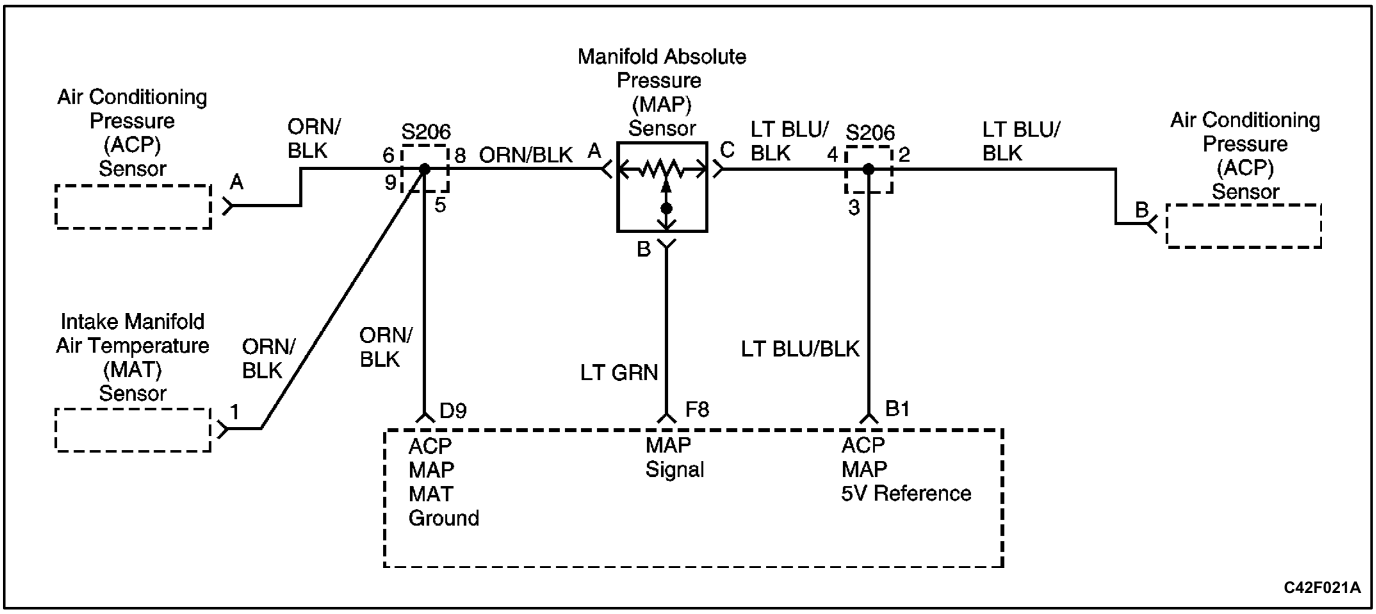


DIAGNOSTIC TROUBLE CODE (DTC) P1106 MANIFOLD ABSOLUTE PRESSURE INTERMITTENT HIGH VOLTAGE

Circuit Description

The Manifold Absolute Pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP signal voltage to the engine control module (ECM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the key in the ON position, engine not running or at wide open throttle (WOT) (low vacuum).

A speed density" method of determining engine load is used. This is calculated using inputs from the MAP sensor, the rpm (58X), and the Intake Manifold Air Temperature (MAT)sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function.

The MAP sensor is also used to determine manifold pressure changes while the linear Exhaust Gas Recirculation (EGR) flow test diagnostic is being run (refer to DTC P0401). This determines the engine vacuum level for some other diagnostics and determines barometric pressure (BARO). The ECM compares the MAP sensor signal to calculated MAP based on throttle position (TP) and various other engine load factors. If the ECM detects a MAP signal voltage that is intermittently above the calculated value, DTC P1106 will set.

Conditions for Setting the DTC

- No TPS DTCs are present.
- TPS is less than 37% if rpm is less than or equal to 2500.
- TPS less than 56% if rpm is greater than 2500.
- The MAP is greater than 103 kPa.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC P1106 can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

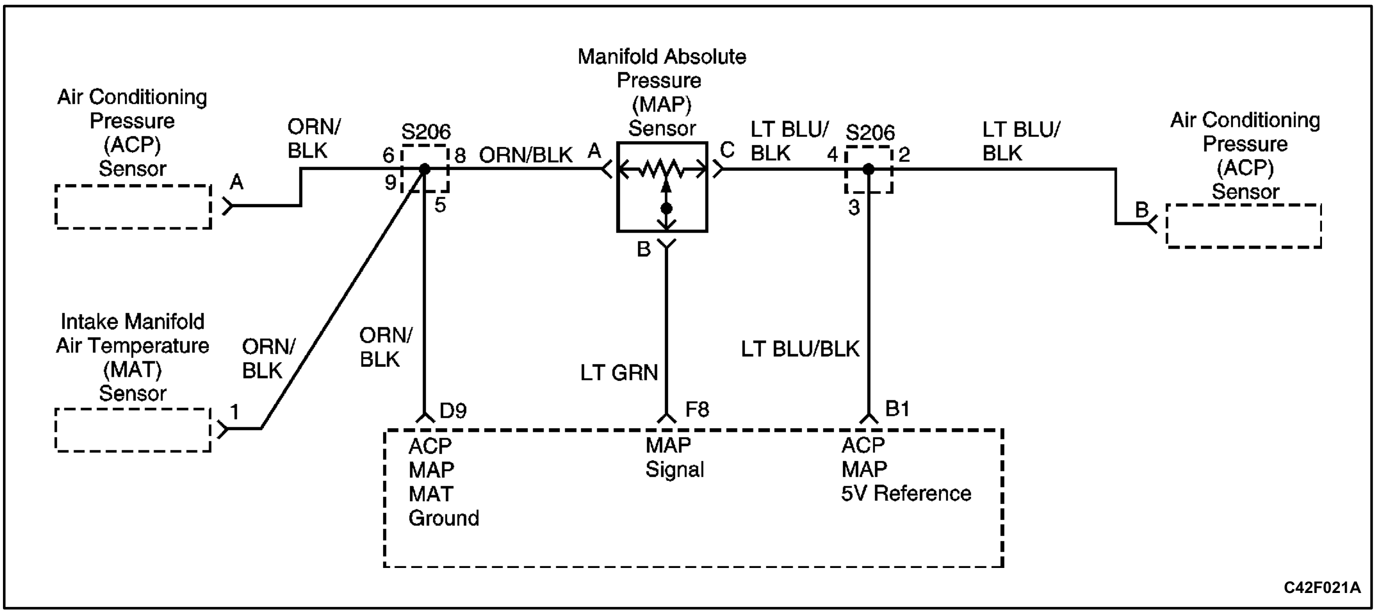
Check for the following conditions:

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

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

DTC P1106 Manifold Absolute Pressure Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Select Diagnostic Trouble Code (DTC) information. 2. Check Last Test Fail and note any other DTCs set. Is DTC P0108 also set.	-	Go to applicable DTC table	Go to *Step 3*
3	Check for a poor sensor ground circuit terminal A connection at the Manifold Absolute Pressure (MAP) sensor. Is a repair necessary?	-	Go to *Step 8*	Go to *Step 4*
4	Check the MAP signal circuit between the MAP sensor connector and the engine control module (ECM) for an intermittent short to voltage. Is a problem found.	-	Go to *Step 9*	Go to *Step 7*
5	Check for an intermittent short to voltage on the 5 volt reference B1 circuit between the ECM and the MAP Sensor Is a problem found?	-	Go to *Step 9*	Go to *Step 6*
6	Check for a poor sensor ground circuit terminal D9 connection at the ECM. Is a problem found?	-	Go to *Step 8*	Go to *Step 7*
7	Check for an intermittent open or a faulty splice in the sensor ground circuit. Is a problem found?	-	Go to *Step 10*	Go to "Diagnostic Aids"
8	Replace the faulty harness connector terminal for sensor ground circuit. Is the repair complete?	-	Go to *Step 10*	-
9	Locate and repair intermittent open/short circuit in the wiring harness as necessary. Is the repair complete?	-	Go to *Step 10*	-
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 11*	Go to *Step 2*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1107
MANIFOLD ABSOLUTE PRESSURE INTERMITTENT LOW VOLTAGE

Circuit Description

The Manifold Absolute Pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP signal voltage to the engine control module (ECM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the key in the ON position, engine not running or at wide open throttle (WOT) (low vacuum).

A "speed density" method of determining engine load is used. This is calculated using inputs from the MAP sensor, the rpm (58X), and the Intake Manifold Air Temperature (MAT)sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function.

The MAP sensor is also used to determine manifold pressure changes while the linear Exhaust Gas Recirculation (EGR) flow test diagnostic is being run (refer to DTC P0401). This determines engine vacuum level for some other diagnostics and determines barometric pressure (BARO). The ECM compares the MAP sensor signal to calculated MAP based on throttle position (TP) and various other engine load factors. If the ECM detects a MAP signal voltage that is intermittently above the calculated value, DTC P1107 will set.

Conditions for Setting the DTC

- Engine running.
- No TPS DTCs are present.
- The MAP is less than 103 kPa.
- TPS is greater than or equal to 2% if rpm is less than or equal to 2000.
- TPS is greater than 5% if rpm is greater than 2000.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC P1107 can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

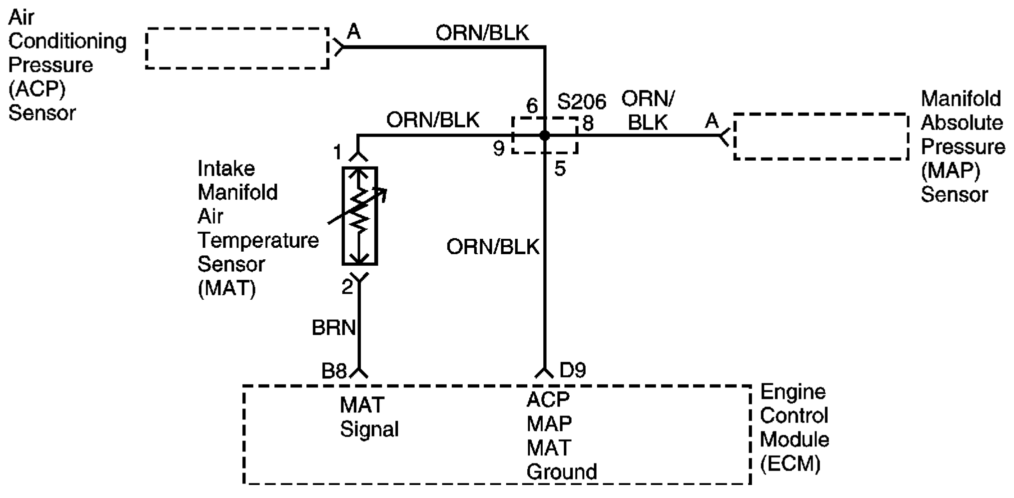
Check for the following conditions:

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

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

DTC P1107 Manifold Absolute Pressure Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Select Diagnostic Trouble Code (DTC) information. 2. Check Last Test Fail and note any other DTCs set. Is DTC P0107 also set.	-	Go to applicable DTC table	Go to *Step 3*
3	Check for a poor 5 volt reference circuit or Manifold Absolute Pressure (MAP) signal circuit terminal connection at the MAP sensor. Is a repair necessary?	-	Go to *Step 5*	Go to *Step 4*
4	Check the MAP signal circuit between the MAP sensor connector and the engine control module (ECM) for an intermittent short to voltage. Is a problem found.	-	Go to *Step 6*	Go to *Step 7*
5	Replace the faulty harness connector terminal for the 5 volt reference circuit and/or the MAP signal circuit. Is the repair complete?	-	Go to *Step 7*	-
6	Repair intermittent open/short circuit in the wiring harness. Is the repair complete?	-	Go to *Step 7*	-
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1111 INTAKE AIR TEMPERATURE INTERMITTENT HIGH VOLTAGE

Circuit Description

The Intake Manifold Air Temperature (MAT)sensor is a thermistor which measures the temperature of the air entering the engine. The engine control module (ECM) applies 5 volts through a pull-up resistor to the MAT sensor. When the intake air is cold, the resistance is high, and the ECM will monitor a high signal voltage on the MAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the ECM to monitor a lower voltage. Diagnostic Trouble Code (DTC) P1111 will set when the ECM detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- DTC P0502 not set
- Engine has been running for over 120 seconds.
- Vehicles speed is less than 113 km/h (70 mph).
- Calculated air flow is less than 30 g/second.
- Engine Coolant Temperature (CTS) is above 8° C (18° F).

Action Taken When the DTC Sets

- The ECM will substitute a default value for MAT.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- DTC P1111 does not illuminate the Malfunction Indicator Lamp (MIL).

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC P1111 can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAT display on the scan tool while moving connectors and wiring harnesses related to the MAT sensor. A change in the MAT display will indicate the location of the fault.
- Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

Intake Air Temperature Sensor

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

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

DTC P1111 Intake Air Temperature Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON. 2. Install the scan tool. Is DTC P0113 set?	-	Go to applicable DTC table	Go to *Step 3*
3	Check the scan tool. Is DTC P1106 set?	-	Go to *Step 6*	Go to *Step 4*
4	1. Check for a poor sensor ground circuit terminal 1 connection at the Idle Air Temperature (MAT) sensor. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 5*
5	1. Check for a poor MAT signal circuit terminal 2 connection at the MAT sensor. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 6*
6	1. Check the MAT signal circuit between the MAT sensor connector and the engine control module (ECM) for an intermittent open. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 7*
7	1. Check the MAT signal circuit between the MAT sensor connector and the ECM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 8*

DTC P1111 Intake Air Temperature Intermittent High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Check for a poor sensor ground circuit terminal D9 connection at the ECM. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 9*
9	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to "Diagnostic Aids"
10	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 11*	Go to *Step 2*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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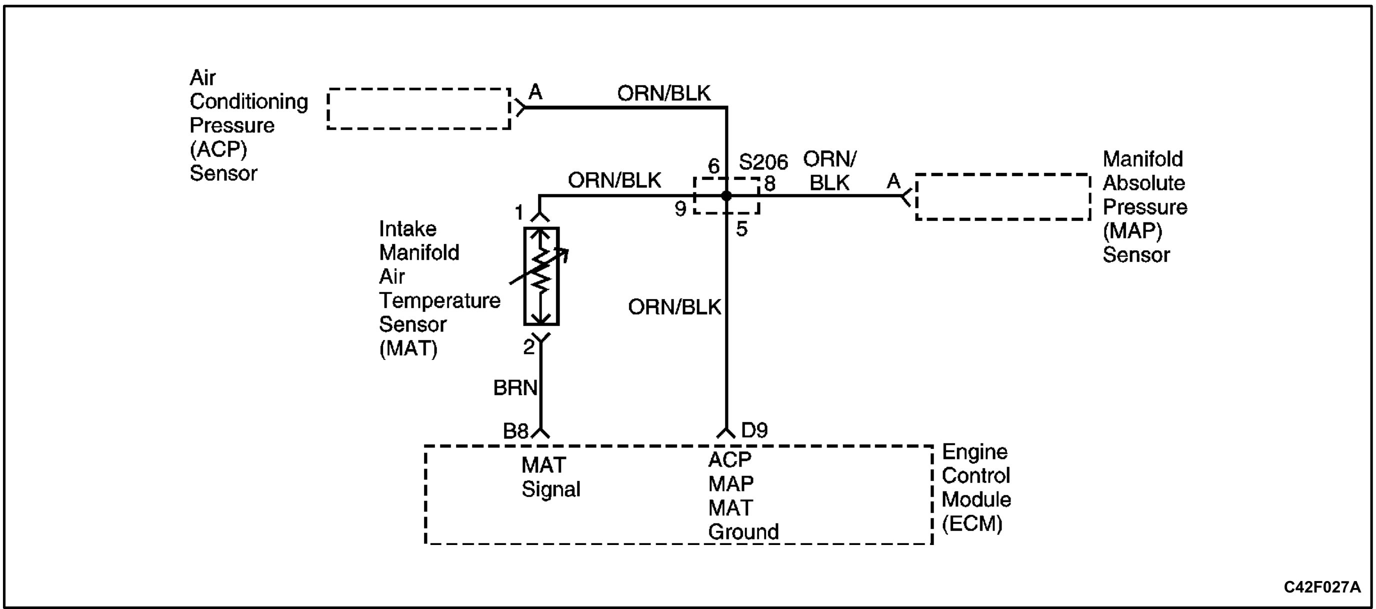


DIAGNOSTIC TROUBLE CODE (DTC) P1112 INTAKE AIR TEMPERATURE INTERMITTENT LOW VOLTAGE

Circuit Description

The Intake Manifold Air Temperature (MAT)sensor is a thermistor which measures the temperature of the air entering the engine. The engine control module (ECM) applies 5 volts through a pull-up resistor to the MAT sensor. When the intake air is cold, the resistance is high, and the ECM will monitor a high signal voltage on the MAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the ECM to monitor a lower voltage. Diagnostic Trouble Code (DTC) P1112 will set when the ECM detects an intermittently low signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- DTC P0502 not set
- Engine has been running for over 120 seconds.
- Vehicle speed is greater than 25 mph.

Action Taken When the DTC Sets

- The ECM will substitute a default value for intake air temperature.
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.
- DTC P1111 does not illuminate the MIL.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAT display on the scan tool while moving connectors and wiring harnesses related to the MAT sensor. A change in the MAT display will indicate the location of the fault.
- Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

Intake Air Temperature Sensor

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

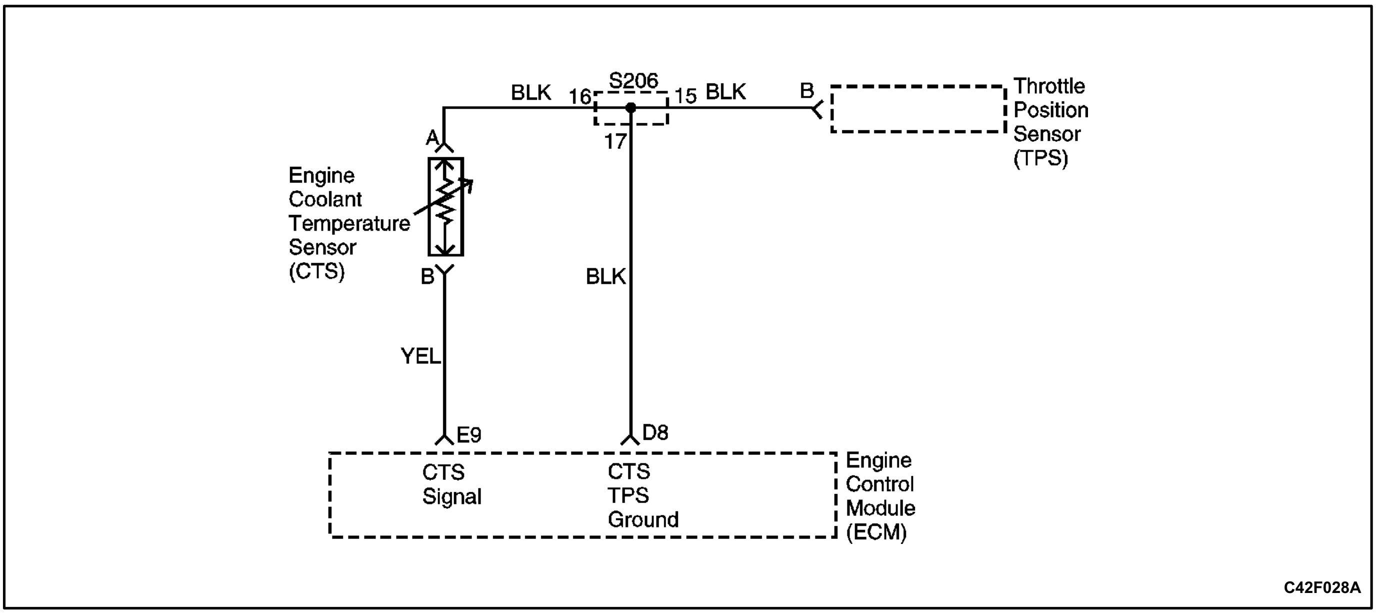
Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. Verifies the fault is present.
3. If DTC P1112 can be repeated only by duplicating the Fail Records conditions, refer to the Temperature Vs. Resistance Value Chart. The chart may be used to test the MAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the MAT sensor.

DTC P1112 Intake Air Temperature Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the Ignition ON. 2. Install the scan tool. Is DTC P0112 also set?	-	Go to applicable DTC table	Go to *Step 3*
3	1. Check the Idle Air Temperature (MAT) signal circuit between the MAT sensor connector and the engine control module (ECM) for an intermittent short to ground. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 5*	Refer to "Diagnostic Aids"
4	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 5*	Go to *Step 2*
5	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1114
ENGINE COOLANT TEMPERATURE INTERMITTENT LOW VOLTAGE

Circuit Description

The Engine Coolant Temperature (CTS) sensor is a thermistor mounted in the engine coolant stream. The engine control module (ECM) applies a voltage (about 5.0 volts) through a pull-up resistor to the CTS signal circuit. When the engine coolant is cold, the sensor resistance is high, and the ECM will monitor a high signal voltage. As the engine coolant warms, the sensor resistance is less, and the CTS signal voltage measured at the ECM drops. With a fully warmed up engine, the CTS signal voltage should measure about 1.5 to 2.0 volts. If the ECM detects an CTS signal that is intermittently below the range of the CTS sensor, Diagnostic Trouble Code (DTC) P1114 will set.

Conditions for Setting the DTC

- Engine run time is longer than 2 minute.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the CTS display on the scan tool while moving connectors and wiring harnesses related to the CTS sensor. A change in the CTS display will indicate the location of the fault.
- Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

Engine Coolant Temperature Sensor

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

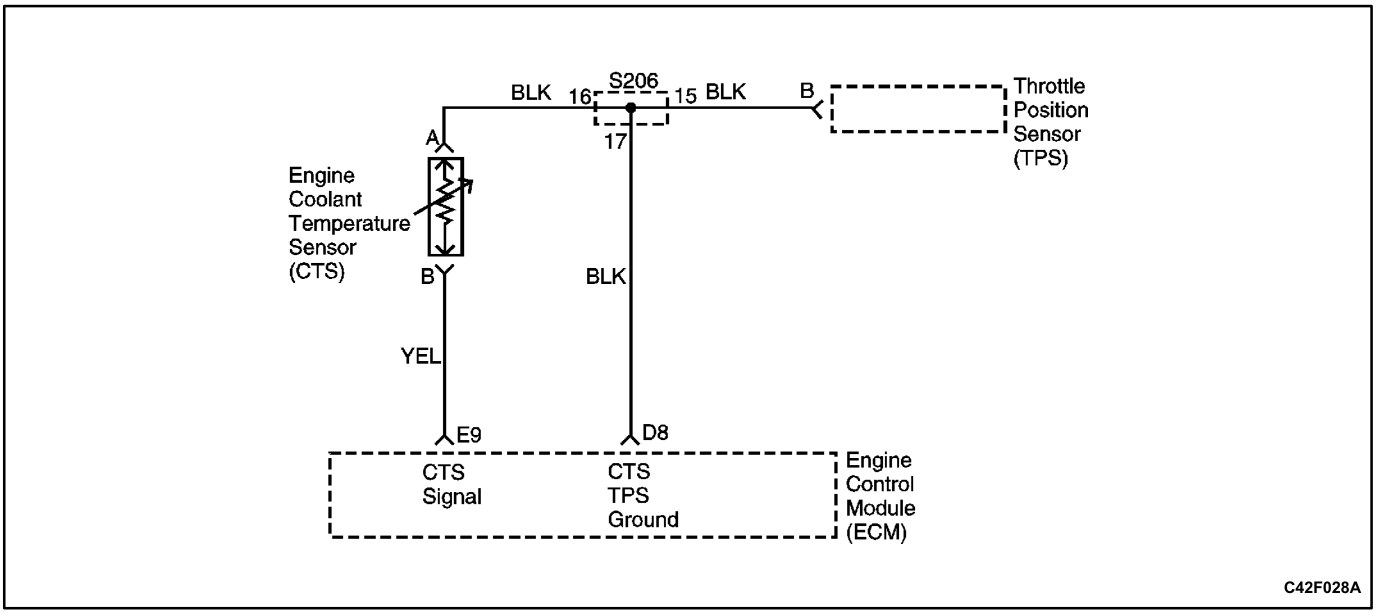
Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference

DTC P1114 Engine Coolant Temperature Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the Ignition ON. 2. Install the scan tool. Is Diagnostic Trouble Code (DTC) P0117 set?	-	Go to applicable DTC table	Go to *Step 3*
3	1. Check the Engine Coolant Temperature (CTS) signal circuit between the CTS sensor connector and the engine control module (ECM) for an intermittent short to ground. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 5*	Refer to "Diagnostic Aids"
4	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 5*	Go to *Step 2*
5	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1115 ENGINE COOLANT TEMPERATURE INTERMITTENT HIGH VOLTAGE

Circuit Description

The Engine Coolant Temperature (CTS) sensor is a thermistor mounted in the engine coolant stream. The engine control module (ECM) applies a voltage (about 5.0 volts) through a pull-up resistor to the CTS signal circuit. When the engine coolant is cold, the sensor resistance is high, and the ECM will monitor a high signal voltage. As the engine coolant warms, the sensor resistance is less, and the CTS signal voltage measured at the ECM drops. With a fully warmed up engine, the CTS signal voltage should measure about 1.5 to 2.0 volts. If the ECM detects an CTS signal that is intermittently above the range of the CTS sensor, Diagnostic Trouble Code (DTC) P1115 will set.

Conditions for Setting the DTC

- Engine run time is greater than 2 minutes.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM. Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the CTS display on the scan tool while moving connectors and wiring harnesses related to the CTS sensor. A change in the CTS display will indicate the location of the fault.
- Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.
- Use the Temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to "Temperature vs. Resistance" in this section.

Engine Coolant Temperature Sensor

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

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

DTC P1115 Engine Coolant Temperature Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to On-Board Diagnostic System Check"
2	1. Turn the ignition ON. 2. Install the scan tool. Is Diagnostic Trouble Code (DTC) P0118 set?	-	Go to applicable DTC Table	Go to *Step 3*
3	Check the scan tool. Is DTC P1121 also set?	-	Go to *Step 8*	Go to *Step 4*
4	1. Check for a poor sensor ground circuit terminal A connection at the Engine Coolant Temperature (CTS) sensor. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 5*
5	1. Check for a poor CTS signal circuit terminal B connection at the CTS sensor. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 6*
6	1. Check the CTS signal circuit between the CTS sensor connector and the engine control module (ECM) for an intermittent open. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 7*
7	1. Check the CTS signal circuit between the CTS sensor connector and the ECM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 8*

DTC P1115 Engine Coolant Temperature Intermittent High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Check for a poor sensor ground circuit terminal D8 connection at the ECM. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to *Step 9*
9	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Is a problem found?	-	Go to *Step 10*	Go to "Diagnostic Aids"
10	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 11*	Go to *Step 2*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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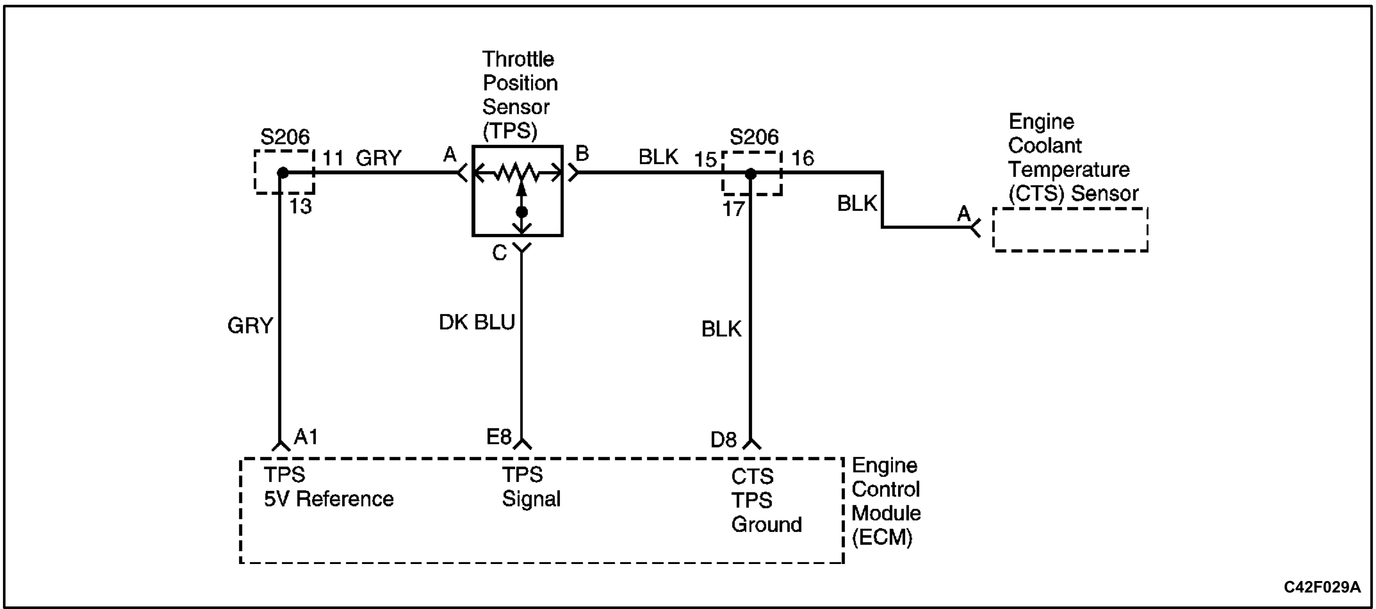


DIAGNOSTIC TROUBLE CODE (DTC) P1121
THROTTLE POSITION SENSOR INTERMITTENT HIGH VOLTAGE

Circuit Description

The Throttle Position Sensor (TPS) circuit provides a voltage signal that changes relative to throttle blade angle. The TPS sends a voltage signal back to the engine control module (ECM) relative to the throttle plate opening. The voltage signal will vary from approximately 1 volt at closed throttle, to over 4.9 v at wide open throttle (WOT).

The TP signal is used by the ECM for fuel control and for most of the ECM controlled outputs. The TP signal is one of the most important inputs used by the ECM for fuel control and most of the ECM controlled outputs. If the ECM detects a TP signal that is intermittently above the range of the TPS, Diagnostic Trouble Code (DTC) P1121 will be set.

Conditions for Setting the DTC

- The ignition is ON.
- TPS voltage indicates a throttle voltage intermittently greater than 4.9 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The history DTC P1121 will clear after 40 consecutive warm-up cycles in which the diagnostic runs without a fault.
- DTC(s) can be cleared by using the scan tool CLEAR INFO function or be disconnecting the ECM power feed.

Diagnostic Aids

Check for the following conditions:

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

If DTC P1121 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

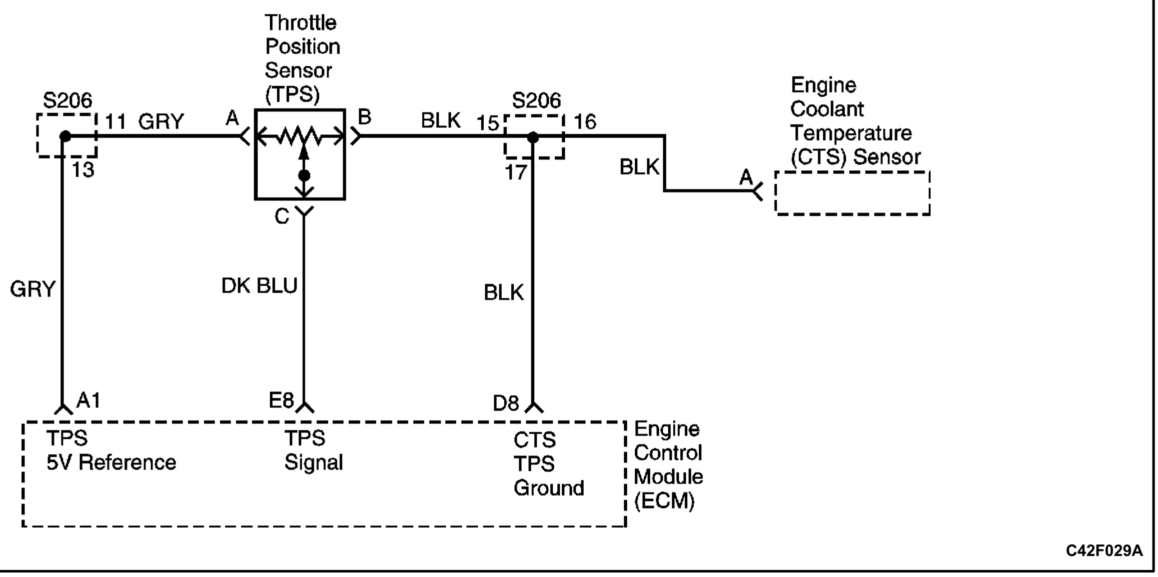
Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

DTC P1121 Throttle Position Sensor Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an OnBoard Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "OnBoard Diagnostic System Check"
2	1. Turn the ignition ON. 2. Install the scan tool. Is Diagnostic Trouble Code (DTC) P0123 also set?	-	Go to applicable DTC table	Go to *Step 3*
3	Check for a poor sensor ground circuit terminal B connection at the Throttle Position Sensor (TPS). Is a problem found?	-	Go to *Step 7*	Go to *Step 4*
4	Check the Throttle Position (TP) signal circuit between the TPS connector and the engine control module (ECM) for an intermittent short to voltage. Is a problem found?	-	Go to *Step 8*	Go to *Step 6*
5	Check for a poor sensor ground terminal D8 connection at the ECM. Is a problem found?	-	Go to *Step 7*	Go to *Step 6*
6	Check for an intermittent open or a faulty splice in the sensor ground circuit. Is a problem found?	-	Go to *Step 8*	Go to "Diagnostic Aids"
7	Replace the faulty harness connector terminal for sensor ground circuit. Is action complete?	-	Go to *Step 9*	-
8	Repair the intermittent open/short circuit in wiring harness as necessary. Is the action complete?	-	Go to *Step 9*	-
9	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1122 THROTTLE POSITION SENSOR INTERMITTENT LOW VOLTAGE

Circuit Description

The Throttle Position Sensor (TPS) circuit provides a voltage signal that changes relative to throttle blade angle. The TPS sends a voltage signal back to the engine control module (ECM) relative to the throttle plate opening. The voltage signal will vary from approximately 1 volt at closed throttle, to over 4.9 v at wide open throttle (WOT). The TP signal is used by the ECM for fuel control and for most of the ECM controlled outputs. The TP signal is one of the most important inputs used by the ECM for fuel control and most of the ECM controlled outputs. If the ECM detects a TP signal that is intermittently above the range of the TPS, Diagnostic Trouble Code (DTC) P1122 will be set.

Conditions for Setting the DTC

- The ignition is ON.
- TPS indicates a throttle position signal intermittently less than 0.14 volt.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The history DTC P1122 will clear after 40 consecutive warm-up cycles in which the diagnostic runs without a fault.
- DTC P1122 can be cleared by using the scan tool CLEAR INFO function or by disconnecting the ECM battery feed.

Diagnostic Aids

Check for the following conditions:

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

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

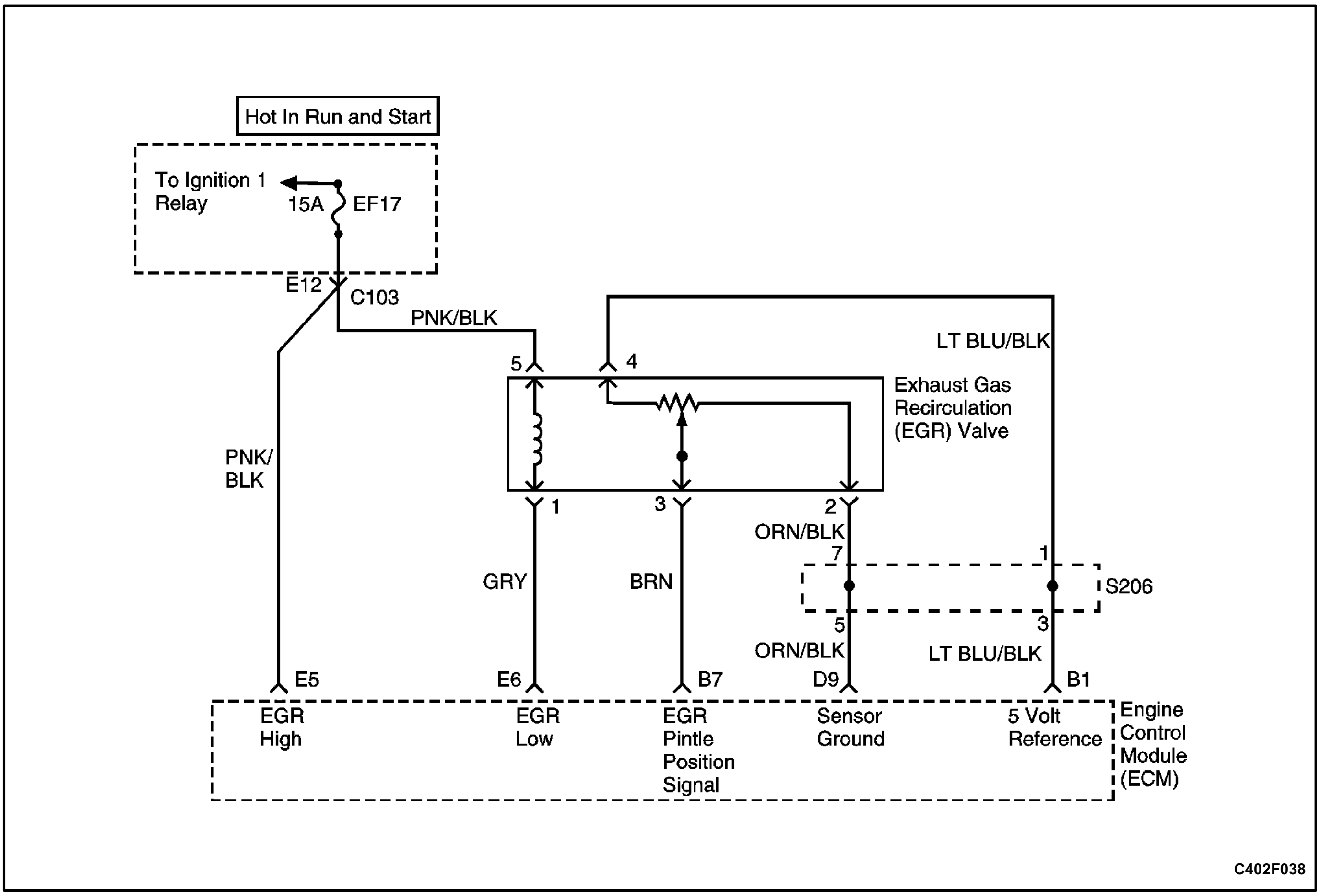
Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

DTC P1122 Throttle Position Sensor Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON. 2. Install the scan tool. Is Diagnostic Trouble Code (DTC) P0122 also set?	-	Go to applicable DTC table	Go to *Step 3*
3	Check for a poor 5 volt reference circuit terminal A connection at the Throttle Position Sensor (TPS). Is a problem found?	-	Go to *Step 9*	Go to *Step 5*
4	Check the TP signal circuit between the TPS connector and the engine control module (ECM) for an intermittent open or short to ground. Is a problem found?	-	Go to *Step 8*	Go to *Step 6*
5	Check for a poor 5 volt reference circuit terminal A1 connection at the ECM. Is a problem found?	-	Go to *Step 7*	Go to *Step 6*
6	Check for an intermittent open or a faulty splice in the 5 volt reference circuit. Is a problem found?	-	Go to *Step 18*	Go to "Diagnostic Aids"
7	Replace the faulty harness connector terminal for the 5 volt reference circuit and/or the TP signal circuit as necessary. Is the repair complete?	-	Go to *Step 9*	-
8	Repair the intermittent open/short circuit in wiring harness as necessary. Is the repair complete?	-	Go to *Step 9*	-
9	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1404
EXHAUST GAS RECIRCULATION CLOSED VALVE PINTLE ERROR

Circuit Description

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

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

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

Conditions for Setting the DTC

- Engine running.
- Ignition voltage is between 11 and 16 volts.
- Desired EGR position is equal to 0.
- Difference between current and learned low position is greater than 16 A/D counts.
- Failed conditions exist for more than 6.3 seconds for 3 EGR cycles each separated by 5 seconds at the desired position of greater than or equal to 30%.
- Coolant temperature is greater than 2°C (35.6°F).

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
2. Commanding the EGR valve open determines whether the EGR system can control the EGR valve accurately and if the fault is present.
3. When the EGR valve electrical connector is disconnected, the scan tool should display the Actual EGR Position as 0%. If it does not, the fault lies either in the EGR signal circuit or the ECM.
5. If the ERG valve 5 volt reference is shorted to voltage, the digital voltmeter (DVM) will read battery voltage and additional DTCs may be set and engine performance will be poor.
6. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.
10. An open or poor connection condition may have caused this DTC to set. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
11. All circuits to the EGR valve are OK at this point. The fault lies internally in the EGR valve and therefore must be replaced. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a DTC P0401 to set.
12. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.
13. Clearing DTCs is a very important step for this diagnostic. The clearing function allows the EGR valve to relearn a new pintle position as the old pintle position was inaccurate due to the failure that caused the DTC. The DTC must be cleared with the ignition ON, engine OFF or when the engine is idling. If the ECM sees a EGR command, the new pintle will not be learned.
14. If no malfunctions have been found at this point and no additional DTCs were set, refer to "Diagnostic Aids" in this section for additional checks and information.

DTC P1404 Exhaust Gas Recirculation Closed Valve Pintle Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch ON with the engine OFF. 2. Install a scan tool. 3. Command the Exhaust Gas Recirculation (EGR) valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to *Step 13*	Go to *Step 3*
3	Disconnect the EGR valve electrical connector. Is the Actual EGR Position near the specified value?	100%	Go to *Step 4*	Go to *Step 5*
4	Check the signal circuit terminal 3 for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 13*	Go to *Step 6*
5	With a digital voltmeter (DVM) connected to ground, probe the 5 volt reference circuit terminal 4 to the EGR valve. Does the DVM read near the specified value?	5 V	Go to *Step 7*	Go to *Step 8*
6	Replace the engine control module (ECM). Is the action complete?	-	Go to *Step 13*	-
7	1. Connect a test light to ground. 2. Probe the EGR control circuit to the EGR valve. Does the test light illuminate?	-	Go to *Step 9*	Go to *Step 10*
8	Check the 5 volt reference circuit for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 13*	Go to *Step 6*
9	Check the control circuit for a short to voltage and repair as necessary. Is a repair necessary?	-	Go to *Step 13*	Go to *Step 6*
10	Check the EGR sensor ground circuit for an open or poor connection at the EGR valve electrical connector and repair as necessary. Is a repair necessary.	-	Go to *Step 13*	Go to *Step 12*
11	Replace the EGR valve. Is the action complete?	-	Go to *Step 13*	-
12	Check the ECM electrical connector for a poor connection and repair as necessary. Is a repair necessary?	-	Go to *Step 13*	Go to *Step 6*
13	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 14*	Go to *Step 2*
14	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

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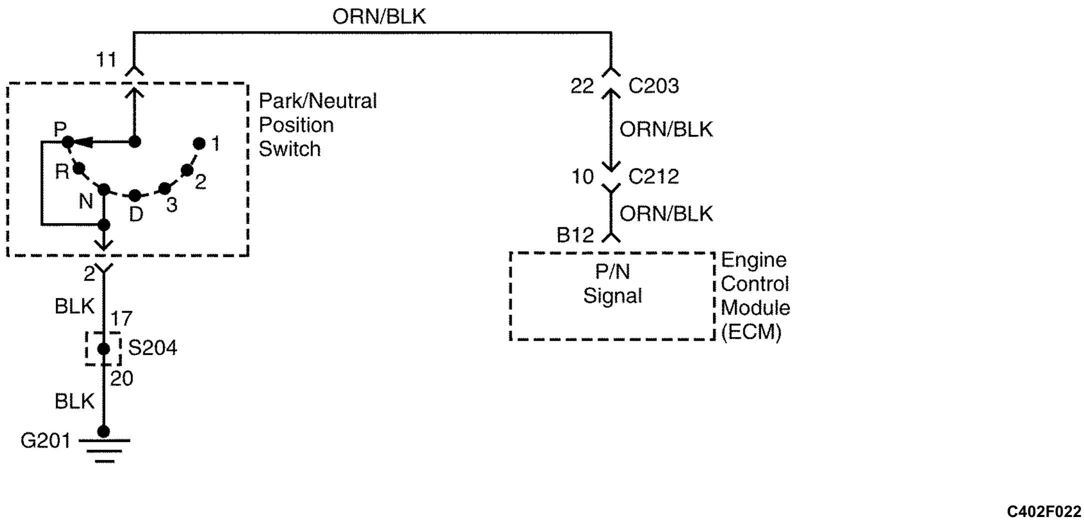


DIAGNOSTIC TROUBLE CODE (DTC) P1520 PARK/NEUTRAL DISCRETE FAULT

Circuit Description

The Park/Neutral Position (PNP) Switch contacts close the input circuit from the engine control module (ECM) to ground when the transmission range switch is in the park or neutral position. The PNP switch is open when a transaxle drive range is selected. The ECM uses the P/N position switch information to perform the following functions:

- Control idle speed using the Idle Air Control (IAC).
- Vehicle speed sensor (VSS) output.
- Speed sensor diagnostics.
- Ignition coil spark advance.

The ECM supplies 12 volts to the PNP switch signal circuit. The ECM senses a closed switch (PARK or NEUTRAL selected) when the voltage on the PNP signal switch drops below 1 volt.

Conditions for Setting the DTC

- DTCs P0106, P0107, P0108, P0121, P0122, P0123, P0336, P0337, P0502, P1106, P1121, P1122, P1336 not set.

In park (PNP Switch is on)

- Vehicle speed is greater than 48 km/h (30 mph).
- Engine speed is greater than 2000 rpm.
- Throttle position sensor is greater than 10%.
- Manifold Absolute Pressure (MAP) is greater than 45 kPa.

In gear (PNP Switch is OFF)

- Vehicle speed is greater than 3 km/h (2 mph).
- Engine speed is greater than 1100 rpm.
- Throttle position sensor is greater than 0.4%.
- MAP is greater than 40 kPa.

Action Taken When the DTC Sets

The ECM will not illuminate the Malfunction Indicator Lamp (MIL).

The ECM will store conditions which were present when the DTC set as Fail Records data only. This information will be not stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

A history DTC P1520 will clear after 40 consecutive warmup cycles have occurred without a fault.

DTC P1520 can be cleared by using the scan tool or disconnecting the ECM.

Diagnostic Aids

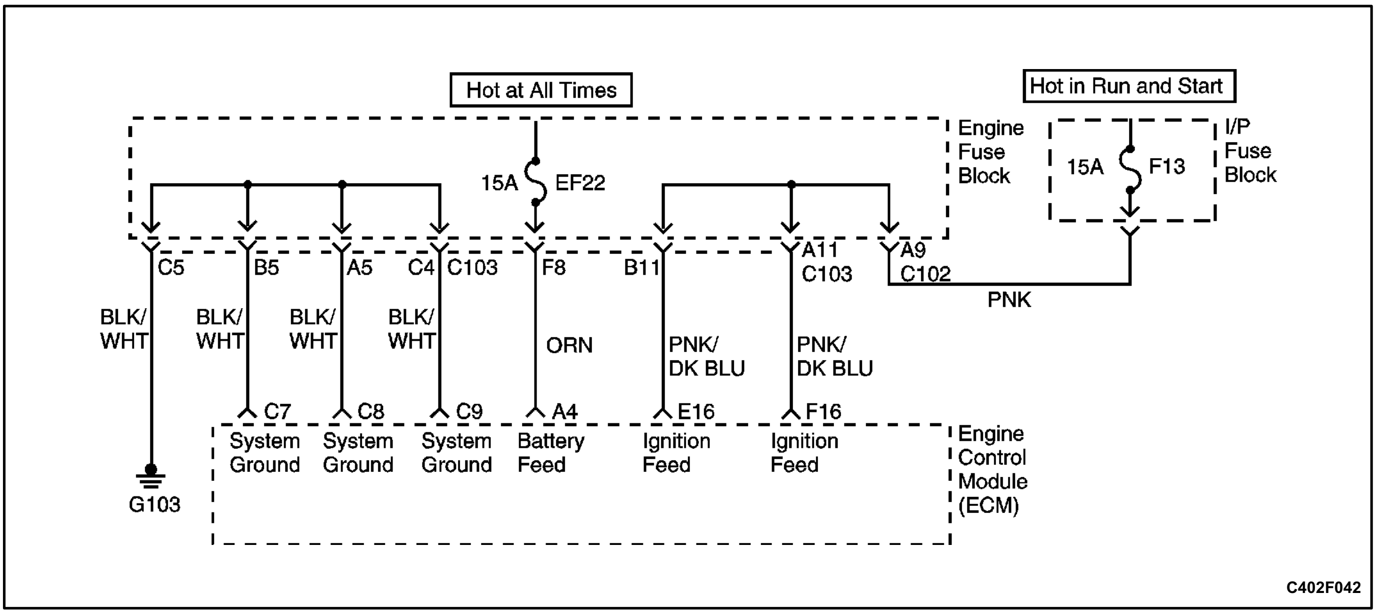
An intermittent may be caused by a poor wire connection, rubbed through wire insulation or a wire broken inside the insulation. Check for the following conditions:

- Misadjusted PNP switch.
- Poor connection with the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged wiring harnesses.

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

DTC P1520 Park/Neutral Discrete Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Place the transmission range switch in PARK 2. Disconnect connector 1 from the engine control module (ECM). 3. Turn the ignition ON. 4. Connect a digital voltmeter (DVM) from terminal B12 to ground and measure the resistance of the Park/Neutral position (PNP) signal circuit. Is the resistance near the specified value?	0Ω	Go to *Step 5*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the PNP switch connector. 3. Measure the resistance across the PNP switch at terminals 11 and 2. Is the resistance near the specified value?	0Ω	Go to *Step 4*	Go to *Step 6*
4	Measure the resistance of the PNP signal circuit between terminal 11 at the PNP switch connector and terminal B12 on the ECM connector. Is the resistance near the specified value?	0Ω	Go to *Step 8*	Go to *Step 7*
5	Replace the engine control module (ECM). Is the repair complete?	-	Go to *Step 9*	-
6	Replace the PNP switch. Is the repair complete?	-	Go to *Step 9*	-
7	Repair the open or short to ground in the PNP signal circuit between terminal 11 at the PNP switch connector and terminal B12 on the ECM connector. Is the repair complete?	-	Go to *Step 9*	-
8	Repair the open in the PNP signal circuit between terminal 2 at the PNP switch connector and ground. Is the repair complete?	-	Go to *Step 9*	-
9	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P1625 ECM INTERNAL SYSTEM RESET

Circuit Description

The engine control module (ECM) has a memory area where it stores certain data it needs to save when the ignition is OFF. This diagnostic test monitors this memory for a loss or unintended change of data. If such a condition occurs, Diagnostic Trouble Code (DTC) P1625 will set.

Conditions for Setting the DTC

- Clock reset or COP reset.
- Ignition ON.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- No message will be displayed.
- Clear keep alive memory locations.

Conditions for Clearing the DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- ECM battery voltage is interrupted.

Diagnostic Aids

If the battery has been disconnected for any reason DTC P1625 will set. The ECM keeps a running check on the memory. If the memory changes, it will reset. An intermittent loss of power or ground to the ECM will cause a reset.

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.

DTC P1625 ECM Internal System Reset

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Check the scan tool. Are any other Diagnostic Trouble Codes (DTCs) set?	-	Go to applicable DTC table	Go to *Step 3*
3	1. Start the engine and idle at normal operating temperature. 2. Operate the vehicle within the Conditions for Setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	System OK	Go to *Step 4*
4	Repair the open or shorts in the battery feed, ignition feed or ground circuits. Is the repair complete?	-	System OK	-

DIAGNOSTIC TROUBLE CODE (DTC) P1640

ODM INTERNAL SPI COMMUNICATION

Circuit Description

Output Driver Modules (ODMs) are used by the engine control module (ECM) to turn on the current driven devices that are needed to control various engine functions. The ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the ECM is commanding on. ODMs are capable of diagnosing each output circuit individually. This Diagnostic Trouble Code (DTC) detects a short to ground or open circuit and short to battery for the 7 low-side output devices of the ODM.

Since A/C is an option, NO A/C will cause the A/C clutch relay output to always fault. If a fault is seen on the A/C clutch relay output, it will not be logged as a fault until the A/C request input interrupts a high voltage, indicating that A/C has been installed.

Conditions for Setting the DTC

- Ignition ON.
- Ignition voltage is greater than or equal to 10 volts.
- Engine run time is greater than or equal to 5 seconds.
- DTC P1618 not set.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- A history DTC P1640 will clear after 40 consecutive warm-up cycles occur without a fault.
- The DTC P1640 can be cleared with a scan tool or disconnecting the ECM.

Diagnostic Aids

Check for the following conditions:

- Poor connection at the ECM - Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the MIL driver circuit at the ECM harness connector while moving connectors and wiring harnesses related to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component - Examine for damaged connectors, unplugged connectors or damaged terminals at the various ODM controlled components.

The following ECM terminals are controlled by the ODM:

- C4 - EST A
- D5 - EST B
- A15 - Evaporative Emission (EVAP) Canister Purge Control
- C13 - Cooling Fan Relay 1
- C12 - Cooling Fan Relay 2
- B14 - A/C Clutch Output

Test Description

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

1. The On-Board Diagnostic (OBD) System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the scan tool if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the scan tool for later reference.
3. Normally, ignition feed voltage is present on the output driver circuit with the ECM disconnected and the ignition turned ON.
4. Checks for a shorted component or a short B+ on the output driver circuit. Either condition would result in a measured current of over 1.5 amps. Also checks for a component that is going open while being operated, resulting in a measured current of 0 amps.
5. Checks for a fault component.
14. The replacement ECM must be reprogrammed. Refer to the latest Techline procedure for ECM reprogramming.

DTC P1640 ODM Internal SPI Communication

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (OBD) System Check. Is the system check complete?	-	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install the scan tool and clear the Diagnostic Trouble Code (DTC). 2. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions as noted. Does DTC P1640 reset?	-	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Turn the ignition OFF 2. Disconnect the engine control module (ECM). 3. Turn the ignition ON. 4. Using a digital voltmeter (DVM), measure the voltage between one of the output driver circuits at the ECM harness connector and ground. Is the voltage near the specified value?	11-14 V	Go to *Step 4*	Go to *Step 7*
4	Measure the current between one of the output driver circuits and ground for at least 2 minutes. Does the current reading remain between the specified values?	0.05-1.5 amps	Go to "Diagnostic Aids"	Go to *Step 5*
5	1. Turn the ignition OFF and disconnect the ignition feed circuit. 2. Turn the ignition ON. 3. Using a DVM, measure the voltage between the output driver circuit and ground. Is the voltage at the specified value?	0 V	Go to *Step 11*	Go to *Step 6*
6	Locate and repair short to voltage in the component output driver circuit. Is the repair complete?	-	Go to *Step 15*	-
7	Check the ignition feed fuse for the component. Does the fuse need to be replaced?	-	Go to *Step 8*	Go to *Step 9*
8	1. Locate and repair the short to ground in the ignition feed circuit. 2. Replace the fuse. Is the repair complete?	-	Go to *Step 15*	-
9	1. Disconnect the ignition feed circuit. 2. With the ignition ON, measure the voltage between the ignition feed circuit and ground. Is the voltage near the specified value?	11-14 V	Go to *Step 10*	Go to *Step 13*
10	1. Check the output driver circuit for an open or short to ground. 2. If a problem is found, repair the output driver circuit. Is a problem found?	-	Go to *Step 15*	Go to *Step 11*

DTC P1640 ODM Internal SPI Communication (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Check the output driver circuit and the ignition feed circuit for a poor connection at the component and at the ECM. 2. If a problem is found, replace the faulty terminal(s). Is a problem found?	-	Go to *Step 15*	Go to "Diagnostic Aids"
12	1. Check the output driver circuit for a poor connection at the ECM 2. If a problem is found, replace the faulty terminal. Is a problem found?	-	Go to *Step 15*	Go to *Step 14*
13	Locate and repair open in the ignition feed circuit to the component. Is the repair complete?	-	Go to *Step 15*	-
14	Replace the ECM. Is the repair complete?	-	Go to *Step 15*	-
15	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	-	Go to *Step 16*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	-	Go to applicable DTC table	System OK

SYMPTOM DIAGNOSIS

IMPORTANT PRELIMINARY CHECKS

Important: Several symptom procedures call for a careful visual/physical inspection. Always perform the visual/physical test first. Visual inspections may lead to correcting a problem without further checks and can save valuable time.

Step	Action	Value(s)	Yes	No
1	Perform the Diagnostic System Check for 2.0L SOHC/DOHC and the On-Board Diagnostic (OBD) system check for 2.2L DOHC. Are any diagnostic trouble code(s) (DTCs) stored in the electronic control module (ECM) memory?	-	Go to Appropriate DTC Table	Go to *Step 2*
2	1. Inspect all of the ECM ground connections. 2. Inspect all of the vacuum hoses for splits, kinks, and proper connections. 3. Check for air leaks at all of the mounting areas of the intake manifold sealing surfaces. 4. Inspect the ignition wires for cracking, hardness, proper routing, and carbon tracking. 5. Inspect the wiring for proper connections, pinches, and cuts. Are all checks complete?	-	Go to Appropriate Symptom Table	-

INTERMITTENTS

Definition: The problem may or may not turn on the Malfunction Indicator Lamp (MIL) or store a diagnostic trouble code (DTC).

Important: Do not use the diagnostic trouble code (DTC) tables for intermittent problems. A fault must be present in order to locate the problem. If a fault is intermittent, use of diagnostic trouble code tables may result in the replacement of good parts.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks"
2	1. Perform a careful inspection of any suspect circuits. 2. Inspect for poor mating of the connector halves, or terminals not fully seated into the connector body. 3. Inspect for improperly formed or damaged terminals. 4. Inspect for poor terminal-to-wire connections. This requires removing the terminal from the connector body to inspect it. Are any problems present?	-	Go to *Step 3*	Go to *Step 4*
3	Repair the electrical connections as needed. Is the repair complete?	-	System OK	-
4	Road test the vehicle with a voltmeter connected to a suspected circuit or a scan tool connected to the assembly line diagnostic link (ALDL) or data link connector (DLC). Did the voltmeter or the scan tool indicate an abnormal voltage or scan reading?	-	Go to *Step 5*	Go to *Step 6*

Intermittents (Cont'd)

Step	Action	Value(s)	Yes	No
5	Replace the sensor in the affected circuit, if a diagnostic trouble code (DTC) was stored for this circuit (except for the DTCs 44 and 45) for 2.0L SOHC/DOHC and DTCs P0171 and P0172 for 2.2L DOHC. Is the repair complete?	-	System OK	-
6	Does an intermittent Malfunction Indicator Lamp (MIL) or DTC occur?	-	Go to *Step 7*	Go to *Step 8*
7	1. Check for a faulty relay, electronic control module (ECM) driven solenoid, or switch. 2. Check for improper installation of electrical devices, such as lights, two-way radios, electric motors, etc. 3. Inspect the ignition control wires for proper routing (away from ignition wires, ignition system components, and the generator). 4. Check for a short to ground in the MIL circuit or the ALDL (or DLC) „test" terminal. 5. Inspect the ECM ground connections. 6. Correct or repair the affected circuits as needed. Is the repair complete?	-	System OK	-
8	1. Check for a loss of DTC memory. 2. Disconnect the throttle position sensor. 3. Run the engine at idle until the MIL comes on. 4. Turn the ignition OFF. Is DTC 22 (or P0122) stored in memory?	-	Go to *Step 10*	Go to *Step 9*
9	Replace the electronic control module. Is the repair complete?	-	System OK	-
10	Does the vehicle stall while driving?	-	Go to *Step 11*	Go to *Step 12*
11	Monitor the oxygen sensor and the injector base pulse width with the scan tool. Does the scan tool display a steady low voltage (about 0 mv) for the oxygen sensor with the control module commanding an injector base pulse width of the value specified?	8 ms	Go to *Step 9*	Go to *Step 12*
12	1. Check for an open diode across the A/C clutch and for other open diodes. 2. Repair or replace any components as needed. Is the repair complete?	-	System OK	-

HARD START

Definition: The engine cranks OK, but does not start for a long time. The engine eventually runs or may start and immediately die.

Important: Ensure that the driver is using the correct starting procedure. Before diagnosing, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to ``Important Preliminary Checks”
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL) or data link connector (DLC). 2. Check the coolant temperature sensor (CTS) and the manifold air temperature (MAT) sensor using the scan tool. 3. Compare the coolant temperature and the manifold air temperature with the ambient temperature when the engine is cold. Does the CTS and the MAT readings differ from the ambient temperature by more than the value specified?	3°C (5°F)	Go to *Step 3*	Go to *Step 4*
3	1. Measure the resistance of the CTS and the MAT sensor. 2. Compare the resistance value to specifications using the Temperature Vs. Resistance tables for DTCs 14 and 23 (or P0118 and P0113). 3. If the resistance is not the same, replace the faulty sensor. Is the repair complete?	-	System OK	-
4	1. Check for a sticking throttle shaft or a binding linkage that may cause a high throttle position sensor (TPS) voltage. Repair or replace as needed. 2. Check the TPS voltage reading with the throttle closed. Does the voltage measure within the value specified?	0.4-0.8 V	Go to *Step 5*	Go to *Step 26*
5	1. Check the manifold absolute pressure (MAP) sensor response and accuracy. 2. Replace the MAP sensor as needed. Is the repair complete?	-	System OK	Go to *Step 6*
6	Check the fuel pump operation. Does the fuel pump operate for the specified time when the ignition switch is turned ON?	2 sec	Go to *Step 7*	Go to „Fuel Pump Relay Circuit Check”
7	Check the fuel system pressure. Is the fuel pressure within the specifications?	284-325 kPa (41-47 psi)	Go to *Step 29*	Go to *Step 8*
8	Check for water contamination in the fuel. Is fuel contaminated?	-	Go to *Step 9*	Go to *Step 10*
9	Replace the contaminated fuel. Is the repair complete?	-	System OK	-

Hard Start (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check the fuel injector driver circuit. 2. Disconnect all of the fuel injector harness connectors at the fuel injectors. 3. Connect an injector test light between the harness terminals of each fuel injector connector. 4. Note the test light while cranking the engine. Does the test light blink at all connectors?	-	Go to *Step 13*	Go to *Step 11*
11	Check the fuel injector driver wiring harness, the connectors, and the connector terminals for the proper connections. Is the problem found?	-	Go to *Step 12*	Go to *Step 30*
12	Repair the wiring harness, the connector, or the connector terminal as needed. Is the repair complete?	-	System OK	-
13	Measure the resistance of each fuel injector. Is the fuel injector resistance within the value specified (20°C [68°F] - the resistance will increase slightly at higher temperatures)?	11.6-12.4 Ω	Go to *Step 15*	Go to *Step 14*
14	Replace any fuel injector with a resistance that is out of specifications. Is the repair complete?	-	System OK	-
15	Perform an injector balance test. Is the problem found?	-	Go to *Step 16*	Go to *Step 17*
16	Replace any restricted or leaking fuel injectors as needed. Is the repair complete?	-	System OK	-
17	1. Check for the proper ignition voltage output for each cylinder with a spark tester. 2. Inspect the spark plugs for cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Inspect the ignition wires for short conditions. 4. Inspect all of the ignition grounds for loose connections. 5. Inspect the electronic control module (ECM) for the proper operation. Is the problem found?	-	Go to *Step 18*	Go to *Step 19*
18	Correct or replace any faulty ignition components. Is the repair complete?	-	System OK	-
19	Does the engine misfire or cut out under load or at idle?	-	Go to „Ignition System Check”	Go to *Step 20*
20	Does the engine start, but then immediately stall?	-	Go to *Step 21*	Go to *Step 23*
21	1. Remove the crankshaft position sensor (CPS). 2. Inspect for faulty connections and repair as needed. Is the problem found?	-	Go to *Step 22*	Go to *Step 25*
22	Repair the faulty connections as needed. Is the repair complete?	-	System OK	-

Hard Start (Cont'd)

Step	Action	Value(s)	Yes	No
23	1. Check for the proper valve timing. 2. Check the cylinder compression. 3. Inspect the pushrods, the rocker arms, the valve springs, and the camshaft lobes for excessive wear. 4. Inspect the intake manifold and the exhaust manifold passages for casting flash. Is the problem found?	-	Go to *Step 24*	Go to *Step 25*
24	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
25	Check the idle air control valve operation. Repair or replace components as needed. Is the repair complete?	-	System OK	-
26	Check the base idle setting of the throttle body. Is the base idle setting properly adjusted?	-	Go to *Step 27*	Go to *Step 28*
27	Check the throttle position sensor circuit for proper operation. Repair or replace components as needed. Is the repair complete?	-	System OK	-
28	Adjust the base idle setting to specifications. Is the repair complete?	-	System OK	-
29	Repair the fuel system as needed. Is the repair complete?	-	System OK	-
30	Replace the electronic control module. Is the repair complete?	-	System OK	-

SURGES OR CHUGGLES

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.

Important: Make sure the driver understands torque converter clutch (TCC) and A/C compressor operation as described in the owner's manual.

The speedometer reading and the speed reading on the scan tool should be equal.

Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks”
2	Connect the scan tool to the assembly line diagnostic link (ALDL). Does the oxygen (O_2) sensor (or O2S1) respond quickly to different throttle positions?	-	Go to *Step 4*	Go to *Step 3*
3	1. Check the O_2 (or O2S1) sensor for silicone or other contaminants from fuel or use of improper room temperature vulcanizing (RTV) sealant. 2. Replace the contaminated O_2 sensor (or O2S1) . Is the repair complete?	-	System OK	-

Surges or Chuggles (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Drive the vehicle at the speed of the complaint. 2. Monitor the long term fuel trim reading using the scan tool. Is the long term fuel trim reading within the value specified?	115-150 counts	Go to *Step 7*	Go to *Step 5*
5	Is the long term fuel trim reading below the value specified?	115 counts	Go to „Diagnostic Aids for DTC 45"	Go to *Step 6*
6	Is the long term fuel trim reading above the value specified?	150 counts	Go to „Diagnostic Aids for DTC 44"	-
7	Check the fuel system pressure while the condition exists. Is the fuel system pressure within specifications?	284-325 kPa (41-47 psi)	Go to *Step 8*	Go to *Step 17*
8	Check the in line fuel filter. Is the filter dirty or plugged?	-	Go to *Step 18*	Go to *Step 9*
9	Perform an injector balance test. Did the injector balance test pinpoint the problem?	-	Go to *Step 19*	Go to *Step 10*
10	1. Check for proper ignition voltage output using a spark tester. 2. Inspect the spark plugs for cracks, wear, improper gap, burned electrodes, or heavy deposits. Is the problem found?	-	Go to *Step* 11	Go to *Step 12*
11	Repair or replace any ignition system components as needed. Is the repair complete?	-	System OK	-
12	1. Inspect the electronic control module grounds for being clean, tight, and in their proper locations. 2. Inspect the vacuum lines for kinks or leaks. Is the problem found?	-	Go to *Step* 13	Go to *Step 14*
13	Repair the electrical connections or the vacuum lines as needed. Is the repair complete?	-	System OK	-
14	Check the generator output voltage. Is the generator voltage within the value specified?	12-16 V	Go to *Step 16*	Go to *Step 15*
15	Repair the generator. Is the repair complete?	-	System OK	-
16	1. Check for intermittent exhaust gas recirculation (EGR) valve operation. 2. Check torque converter clutch (TCC) operation. 3. Repair or replace any components as needed. Is the repair complete?	-	System OK	-
17	Repair the fuel system as needed. Is the repair complete?	-	System OK	-
18	Replace the fuel filter. Is the repair complete?	-	System OK	-
19	Replace the leaking or restricted fuel injectors. Is the repair complete?	-	System OK	-

LACK OF POWER, SLUGGISHNESS, OR SPONGINESS

Definition: The engine delivers less than expected power. There is little or no increase in speed when the accelerator pedal is partially applied.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks”
2	1. Verify the customer's complaint. 2. Compare the performance of the customer's vehicle with a similar unit. Does the problem exist?	-	Go to *Step 3*	System OK
3	1. Inspect the air filter for excessive contamination. 2. Replace the air filter as needed. 3. Check the transaxle shift pattern and down shift operation. Does the transaxle operate properly?	-	Go to *Step 4*	Go to *Step 5*
4	Check the fuel system pressure. Is the fuel system pressure within specifications?	284-325 kPa (41-47 psi)	Go to *Step 7*	Go to *Step 6*
5	Repair the transaxle as needed. Is the repair complete?	-	System OK	-
6	Repair the fuel system as needed. Is the repair complete?	-	System OK	-
7	Check for a restricted fuel filter or contaminated fuel. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
8	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
9	1. Check the ignition system output for all of the cylinders using a spark tester. 2. Check for proper ignition control operation. Is the ignition system operating properly?	-	Go to *Step 10*	Go to *Step 11*
10	1. With the engine at normal operating temperature, connect a vacuum gauge to a vacuum port on the intake manifold. 2. Operate the engine at 1000 rpm. 3. Record the vacuum reading. 4. Increase the engine speed to 2500 rpm. 5. Note the vacuum reading at a steady 2500 rpm. Does the vacuum decrease more than the value specified?	10 kPa (3 in. Hg)	Go to *Step 12*	Go to *Step 15*
11	Repair or replace any ignition system components as needed. Is the repair complete?	-	System OK	-
12	Inspect the exhaust system for restrictions and damaged or collapsed pipes. Is the problem found?	-	Go to *Step 13*	Go to *Step 14*
13	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
14	1. Check the cylinder compression and valve timing. 2. Inspect the camshaft for excessive wear. Is the problem found?	-	Go to *Step 15*	Go to *Step 16*

Lack of Power, Sluggishness, or Sponginess (Cont'd)

Step	Action	Value(s)	Yes	No
15	Repair or replace any engine components as needed. Is the repair complete?	-	System OK	-
16	1. Check the electronic control module grounds for being clean, tight, and in their proper location. 2. Check the exhaust recirculation valve for being open or partially open all the time. 3. Check the torque converter clutch operation. 4. Check the A/C system operation. 5. Check the generator output. 6. Repair the generator if the output is not within the specified range. Are all checks and repairs complete?	12-16 V	System OK	-

DETONATION/SPARK KNOCK

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks”
2	1. Fill the fuel tank with a known good grade of gasoline that has the octane rating of the value specified. 2. Reevaluate the vehicle's performance. Does the detonation problem still exist?	87-89 octane	Go to *Step 3*	System OK
3	1. Inspect for low engine coolant. 2. Check for restricted air flow to the radiator or restricted coolant flow. 3. Check for a faulty thermostat. 4. Check for an incorrect coolant solution. Is the problem found?	-	Go to *Step 4*	Go to *Step* 5
4	Repair or replace any cooling system components as needed. Is the repair complete?	-	System OK	-
5	1. Check the voltage using the scan tool. 2. Replace the CTS if the resistance is not within specifications as listed in the Diagnostic Aids for diagnostic trouble code 14 (or P0118). Is the problem found?	-	Go to *Step 6*	Go to *Step* 7
6	Replace the CTS or repair the circuit as needed. Is the repair complete?	-	System OK	-
7	1. Check the ignition system output with a spark tester. 2. Inspect the spark plugs for the proper heat range and gap. 3. Check for the proper operation of the ignition controls. Is the ignition system operating properly?	-	Go to *Step 9*	Go to *Step 8*

Detonation/Spark Knock (Cont'd)

Step	Action	Value(s)	Yes	No
8	Repair or replace the ignition system components as needed. Is the repair complete?	-	System OK	-
9	1. Connect the scan tool to the assembly line diagnostic link (ALDL) or data link connector (DLC). 2. Road test the vehicle at the speed of the complaint. 3. Monitor the long term fuel trim reading from the scanner data stream. Is the long term fuel trim reading above the value specified?	150 counts	Go to „Diagnostic Aids for DTC 44„	Go to *Step 10*
10	Check the fuel system pressure. Is the problem found?	284-325 kPa (41-47 psi)	Go to *Step 11*	Go to *Step 12*
11	Repair or replace the fuel system components as needed. Is the repair complete?	-	System OK	-
12	1. Inspect for carbon buildup inside the engine. 2. Remove the carbon with a top engine cleaner. Follow the instructions supplied with the product. 3. Check the basic engine parts such as the camshaft, the cylinder head, the pistons, etc. for excessive wear. 4. Replace any excessively worn parts. Is the procedure complete?	-	Go to *Step 13*	-
13	1. Check the exhaust gas recirculation valve for proper operation. 2. Check the air intake system for proper operation. 3. Check the torque converter clutch operation and transaxle shift points. 4. Check the service bulletins for programmable read-only memory (PROM) updates. 5. Check the cylinder compression. 6. Repair or replace any faulty components. Are all checks and repairs complete?	-	System OK	-

HESITATION, SAG, STUMBLE

Definition: Momentary lack of response as the accelerator is pushed down. This can occur at any vehicle speed. It is usually the most severe when first trying to make the vehicle move, as from a stop. Hesitation, sag, or stumble may cause the engine to stall if severe enough.

Important: Before diagnosing this condition, check service bulletins for PROM updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks”
2	1. Check the fuel system pressure. If the pressure is not within the value specified, service the fuel system as needed. 2. Inspect the throttle position sensor (TPS) for binding or sticking. The TPS voltage should increase at a steady rate as the throttle is moved toward wide open throttle (WOT). Is the problem found?	284-325 kPa (41-47 psi)	Go to *Step 3*	Go to *Step 4*
3	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
4	1. Check the manifold absolute pressure (MAP) sensor response and accuracy. 2. Inspect the fuel for water contamination. 3. Check the canister purge system for proper operation. Is the problem found?	-	Go to *Step 5*	Go to *Step 6*
5	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
6	1. Disconnect all of the fuel injector harness connectors. 2. Connect an injector test light between the harness terminals of each fuel injector. 3. Note the test light while cranking the engine. Does the test light blink on all connectors?	-	Go to *Step 8*	Go to Step 7
7	1. Repair or replace the faulty fuel injector drive harness, the connector, or the connector terminal. 2. If the connections and the harnesses are good, replace the electronic control module (ECM) for an internal open in the fuel injector driver circuit. Is the repair complete?	-	System OK	-
8	Measure the resistance of each fuel injector. Is the fuel injector resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6-12.4 Ω	Go to *Step 10*	Go to *Step 9*
9	Replace any of the fuel injectors with a resistance that is out of specifications. Is the repair complete?	-	System OK	-
10	Perform an injector balance test. Is the problem found?	-	Go to *Step* 11	Go to *Step 12*
11	Replace any restricted or leaking fuel injectors. Is the repair complete?	-	System OK	-

Hesitation, Sag, Stumble (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check the fuel system pressure after a cold start or during moderate or full throttle acceleration. Is the fuel pressure within specifications?	284-325 kPa (41-47 psi)	Go to *Step 14*	Go to *Step 13*
13	Repair the restriction in the fuel system or replace the faulty fuel pump. Is the repair complete?	-	System OK	-
14	1. Check for faulty ignition wires. 2. Inspect for fouled spark plugs. 3. Check the ignition system output on each cylinder with a spark tester. Is the problem found?	-	Go to *Step 15*	Go to *Step 16*
15	Repair or replace any ignition components as needed. Is the repair complete?	-	System OK	-
16	1. Check the generator output voltage. 2. Repair or replace the generator if the generator output is less than the value specified. 3. Check the exhaust gas recirculation (EGR) valve operation. Are all checks and needed repairs complete?	12-16 V	System OK	-

CUTS OUT, MISSES

Definition: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. The exhaust has a steady spitting sound at idle or low speed.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks”
2	Check the ignition system output voltage for all of the cylinders using a spark tester. Is spark present on all of the cylinders?	-	Go to *Step 3*	Go to „Ignition System Check”
3	1. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 2. Check the resistance of the ignition wires. Replace any ignition wires that have a resistance greater than the value specified. Is the problem found?	30,000 Ω	Go to *Step 4*	Go to *Step 5*
4	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
5	With the engine running, spray the ignition wires with a fine water mist to check for arcing and shorting to ground. Is the problem found?	-	Go to *Step 6*	Go to *Step 7*
6	Replace the ignition wires. Is the repair complete?	-	System OK	-

Cuts Out, Misses (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Perform a cylinder compression test. 2. If the compression is low, repair the engine as needed. 3. Inspect for proper valve timing, bent pushrods, worn rocker arms, broken or weak valve springs, and worn camshaft lobes. 4. Inspect the intake manifold and the exhaust manifold passages for casting flash. Is the problem found?	-	Go to *Step 8*	Go to *Step 9*
8	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
9	1. Check the fuel system for a plugged inline fuel filter. 2. Check the fuel system for low fuel pressure. If the fuel pressure is below the value specified, service the fuel system as needed. 3. Inspect for contaminated fuel. Is the problem found?	284-325 kPa (41-47 psi)	Go to *Step 10*	Go to *Step 11*
10	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
11	1. Disconnect all of the fuel injector harness connectors at the fuel injectors. 2. Connect an injector test light to the harness terminals of each fuel injector connector. 3. Note the test light while cranking the engine for each fuel injector. Does the test light blink for all of the fuel injectors?	-	Go to *Step 13*	Go to *Step 12*
12	1. Repair or replace the faulty injector drive circuit harness, the connector, or the connector terminal. 2. If the harness, the connectors, and the terminals are OK, replace the electronic control module (ECM). Is the repair complete?	-	System OK	-
13	Measure the resistance of each fuel injector. Is the injector resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6-12.4 Ω	Go to *Step 15*	Go to *Step 14*
14	Replace any fuel injectors with a resistance that is out of specifications. Is the repair complete?	-	System OK	-
15	Perform an injector balance test. Is the problem found?	-	Go to *Step 16*	Go to *Step 17*
16	Replace any restricted or leaking fuel injectors. Is the repair complete?	-	System OK	-
17	1. Check for electromagnetic interference. 2. Monitor the engine rpm with a scan tool. Does the scan tool rpm change greatly with little change in actual engine rpm?	-	Go to *Step 18*	-
18	1. Inspect the routing of the ignition wires. 2. Inspect all of the ignition system grounds. 3. Correct the routing or repair the ground connections as needed. Are all checks and needed repairs complete?	-	System OK	-

POOR FUEL ECONOMY

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.

Important: Driving habits affect fuel economy. Check the owner's driving habits by asking the following questions:

1. Is the A/C system (i.e. defroster mode) turned on all the time?
2. Are the tires at the correct air pressure?
3. Have excessively heavy loads been carried?
4. Does the driver accelerate too much and too often? Suggest the driver read the section in the owner's manual about fuel economy.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks”
2	1. Inspect the air filter for excessive contamination. 2. Inspect for fuel system leaks. Are all needed checks complete?	-	Go to *Step 3*	-
3	1. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 2. Replace any faulty spark plugs. 3. Inspect the ignition wires for cracking, hardness, and proper connections. Are all needed checks and repairs complete?	-	Go to *Step 4*	-
4	1. Inspect the engine coolant level. 2. Check the thermostat for being always open or for an incorrect heat range. 3. Replace the thermostat as needed. Are all needed checks and repairs complete?	-	Go to *Step 5*	-
5	1. Check the transaxle shift pattern. Ensure all transaxle gears are functioning. 2. Check the torque converter clutch (TCC) operation with a scan tool. The scan tool should indicate rpm drop when the TCC is commanded on. 3. Check for proper calibration of the speedometer. 4. Check the brakes for dragging. 5. Check the cylinder compression. 6. Repair, replace, or adjust any components as needed. Are all checks and needed repairs complete?	-	System OK	-

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Definition: The engine runs unevenly at idle. If the condition is bad enough, the vehicle may shake. Also, the idle varies in rpm (called „hunting”). Either condition may be severe enough to cause stalling. The engine idles at incorrect idle speed.

Important: Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks”
2	1. Connect the scan tool to the assembly line diagnostic link (ALDL) or data link connector (DLC). 2. Monitor the oxygen (O_2) sensor or (O2S1) reading at different throttle positions. Does the O_2 sensor (O2S1) change quickly from rich to lean at the different throttle positions?	-	Go to *Step 5*	Go to *Step 3*
3	Check the O_2 (O2S1) sensor for contamination from fuel or improper use of RTV sealant. Is the O_2 (O2S1) sensor contaminated?	-	*Go to Step 4*	Go to *Step 5*
4	Replace the contaminated O_2 (O2S1) sensor as needed. Is the repair complete?	-	System OK	-
5	1. Check for a sticking throttle shaft or binding throttle linkage that may cause incorrect throttle position sensor (TPS) voltage. 2. Check the TPS voltage reading with the throttle closed. Is the TPS voltage within the value specified?	0.4-0.8 V	Go to *Step 6*	Go to „Diagnostic Aids for DTC 21„
6	1. Check the coolant temperature sensor (CTS) voltage reading using the scan tool. 2. Compare the CTS reading with the ambient temperature when the engine is cold. Does the CTS temperature reading differ from the ambient temperature by more than the value specified?	3°C (5°F)	Go to *Step 7*	Go to *Step 9*
7	Check for high resistance in the CTS circuit or the sensor itself. Is the problem found?	-	Go to *Step* 8	Go to *Step 9*
8	Replace the CTS or repair the circuit as needed. Is the repair complete?	-	System OK	-
9	Check the manifold absolute pressure (MAP) sensor for response and accuracy. Is the problem found?	-	Go to *Step 10*	Go to *Step 11*
10	Replace the MAP sensor or repair the MAP sensor circuit as needed. Is the repair complete?	-	System OK	-
11	1. Road test the vehicle at the speed of the complaint. 2. Monitor the fuel trim reading using the scan tool. Is the fuel trim reading within the value specified?	115-150 counts	Go to *Step 14*	Go to *Step 12*
12	Is the fuel trim reading below the value specified?	115 counts	Go to „Diagnostic Aids for DTC 45 or DTC P0172”	Go to *Step 13*

Rough, Unstable, or Incorrect Idle, Stalling (Cont'd)

Step	Action	Value(s)	Yes	No
13	Is the fuel trim reading above the value specified?	150 counts	Go to „Diagnostic Aids for DTC 44 or DTC P0172”	-
14	1. Disconnect all of the fuel injector harness connectors at the fuel injectors. 2. Connect an injector test light between the harness terminals of each fuel injector connector. 3. Note the test light while cranking the engine. Does the test light blink for all of the fuel injectors?	-	Go to *Step 16*	Go to *Step 15*
15	1. Repair or replace the faulty injector drive circuit harness, the connector, or the connector terminals as needed. 2. If the harness, the connectors, and the terminals are OK, replace the electronic control module (ECM). Is the repair complete?	-	System OK	-
16	Measure the resistance of each of the fuel injectors. Is the resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6-12.4 Ω	Go to *Step 18*	Go to *Step 17*
17	Replace any fuel injectors with a resistance that is out of specifications. Is the repair complete?	-	System OK	-
18	Perform an injector balance test. Is the problem found?	-	Go to *Step 19*	Go to *Step 20*
19	Replace any leaking or restricted fuel injectors. Is the repair complete?	-	System OK	-
20	1. With the engine OFF, disconnect the fuel pressure regulator vacuum hose. 2. Thoroughly inspect the fuel pressure regulator vacuum port and the fuel pressure regulator vacuum hose for the presence of fuel. Is the problem found?	-	Go to *Step 21*	Go to *Step 22*
21	Replace the fuel pressure regulator as needed. Is the repair complete?	-	System OK	-
22	1. Check the ignition system output voltage for all of the cylinders using a spark tester. 2. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 3. Inspect the ignition wires for cracking, hardness, or improper connections. 4. Replace any ignition wires with a resistance over the value specified. Is the problem found?	30,000 Ω	Go to *Step 23*	Go to *Step 24*
23	Repair or replace any ignition system components as needed. Is the repair complete?	-	System OK	-
24	1. Inspect for vacuum leaks. 2. Check for proper positive crankcase ventilation (PCV) operation. 3. Check the idle air control (IAC) valve operation. 4. Inspect the ECM ground connections. Is the problem found?	-	Go to *Step 25*	Go to *Step 26*

Rough, Unstable, or Incorrect Idle, Stalling (Cont'd)

Step	Action	Value(s)	Yes	No
25	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
26	1. Check the exhaust gas recirculation (EGR) valve for proper operation. 2. Inspect the battery cables and the ground straps for proper connections. 3. Check the generator voltage output. Repair or replace the generator if the voltage output is not within the value specified. Is the problem found?	12-16 V	Go to *Step 27*	Go to *Step 28*
27	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
28	1. Inspect for broken engine mounts. 2. Check for proper valve timing. 3. Perform a cylinder compression test. 4. Inspect for bent pushrods, worn rocker arms, broken or weak valve springs, and a worn camshaft. 5. Perform repairs as needed. Are all of the checks and needed repairs complete?	-	System OK	-

EXCESSIVE EXHAUST EMISSIONS OR ODORS

Definition: A vehicle fails an emission test. The vehicle has an excessive rotten egg smell. Excessive odors do not necessarily indicate excessive emissions.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks”
2	1. Run the engine until it reaches operating temperature. 2. Perform an emission test. Did the vehicle pass the emission test?	-	System OK	Go to *Step 3*
3	1. Connect the scan tool to the assembly line diagnostic link (ALDL) or data link connector (DLC). 2. Road test the vehicle. 3. Monitor the long term fuel trim memory. Is the long term fuel trim memory within the value specified?	115-150 counts	Go to *Step 6*	Go to *Step 4*
4	Is the long term fuel trim memory below the value specified?	115 counts	Go to „Diagnostic Aids for DTC 45 or DTC P0172”	Go to *Step 5*
5	Is the long term fuel trim memory above the value specified?	150 counts	Go to „Diagnostic Aids for DTC 44 or DTC P0171”	-
6	1. Check for a properly installed fuel cap. 2. Check the fuel system pressure. 3. Perform an injector balance test. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*

Excessive Exhaust Emissions or Odors (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Repair or replace any fuel system components as needed. 2. Perform an emission test. Did the vehicle pass the emission test?	-	System OK	-
8	1. Check the ignition system for proper operation. 2. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 3. Check the ignition wires for cracking, hardness, or improper connections. Is the problem found?	-	Go to *Step 9*	Go to *Step 10*
9	1. Repair or replace any ignition system components as needed. 2. Perform an emission test. Did the vehicle pass the emission test?	-	System OK	-
10	1. Inspect for vacuum leaks. 2. Inspect the catalytic converter for contamination. 3. Inspect for carbon buildup on the throttle body and the throttle plate and inside the engine. Remove with a top engine cleaner. 4. Check the exhaust gas recirculation (EGR) valve for not opening. 5. Check for proper positive crankcase ventilation (PCV) operation. Are all checks and needed repairs complete?	-	System OK	-

DIESELING, RUN-ON

Definition: An engine continues to run after the ignition switch is turned OFF.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks„
2	Does the engine run smoothly after the ignition switch is turned OFF?	-	Go to *Step 3*	Go to *Step 4*
3	1. Check the ignition switch and the ignition switch adjustment. 2. Replace the ignition switch if needed. Is the repair complete?	-	System OK	-
4	1. Check the evaporative emission system. 2. Check for leaking fuel injectors. 3. Check the idle air control (IAC) valve operation. 4. Inspect for vacuum leaks. 5. Check for the proper base idle setting. Are all checks and repairs complete?	-	System OK	-

BACKFIRE

Definition: Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.

Important: Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	-	Go to *Step 2*	Go to „Important Preliminary Checks”
2	1. Inspect for crossed or crossfiring ignition wires. 2. Check the ignition system output voltage for all cylinders using a spark tester. 3. Inspect the spark plugs for excessive wear, burned electrodes, improper gap, or heavy deposits. Is the problem found?	-	Go to *Step 3*	Go to *Step 4*
3	Repair or replace any ignition system components as needed. Is the repair complete?	-	System OK	-
4	1. Check the fuel system operation. 2. Check the fuel injectors by performing an injector balance test. Is the problem found?	-	Go to *Step 5*	Go to *Step 6*
5	Repair or replace any fuel system components as needed. Is the repair complete?	-	System OK	-
6	1. Inspect the exhaust gas recirculation (EGR) gasket for a leak or a loose fit. 2. Check the EGR valve for proper operation. 3. Inspect the intake manifold and the exhaust manifold for a casting flash. Is the problem found?	-	Go to *Step 7*	Go to *Step 8*
7	Repair or replace any components as needed. Is the repair complete?	-	System OK	-
8	1. Inspect the timing belt for proper installation and tension. 2. Check the engine compression. 3. Inspect the intake manifold gasket and the exhaust manifold gasket for leaks. 4. Check for sticking or leaking valves. 5. Repair or replace any components as needed. Are all checks and corrections complete?	-	System OK	-

MAINTENANCE AND REPAIR

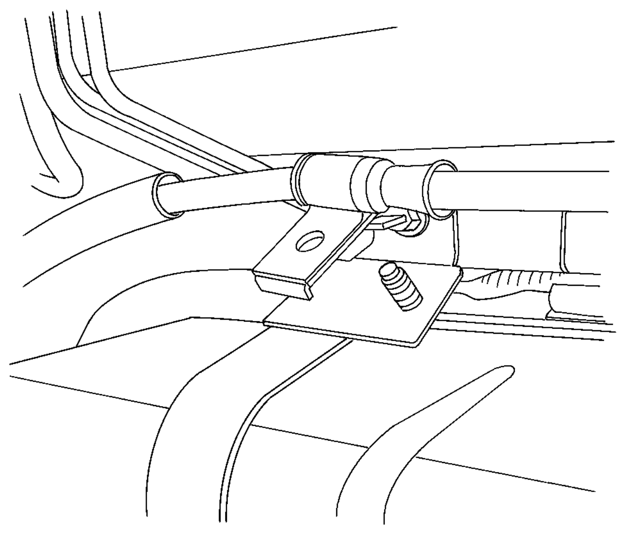
ON-VEHICLE SERVICE

FUEL TANK

Removal Procedure

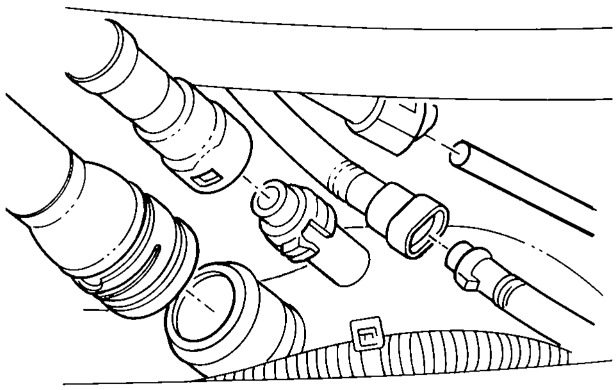
Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel pressure. Refer to „Fuel Pump” in this section.
2. Disconnect the negative battery cable.
3. Drain the fuel tank.
4. Disconnect the right rear parking brake cable from the retaining bracket attached to the right side fuel tank strap.



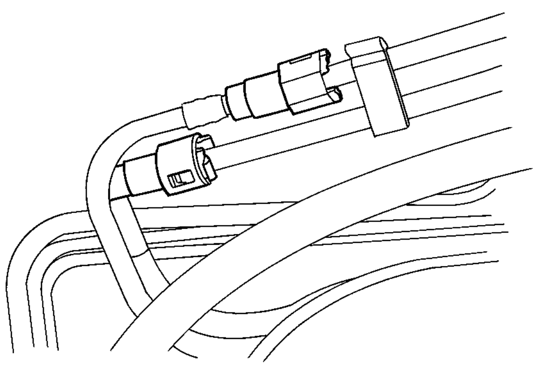
C102F057

5. Remove the fuel tank filler tube clamp at the fuel tank.
6. Disconnect the fuel tank filler tube.
7. Disconnect the fuel tank vent tube at the fuel tank.
8. Disconnect the fuel vapor line near the fuel tank filler tube.



C102F081

9. Disconnect the fuel pump harness connector near the left rear corner of the fuel tank.
10. Disconnect the fuel inlet line and the fuel return line near the right front of the fuel tank.
11. Disconnect the wiring harness clips and the fuel line clips as needed.



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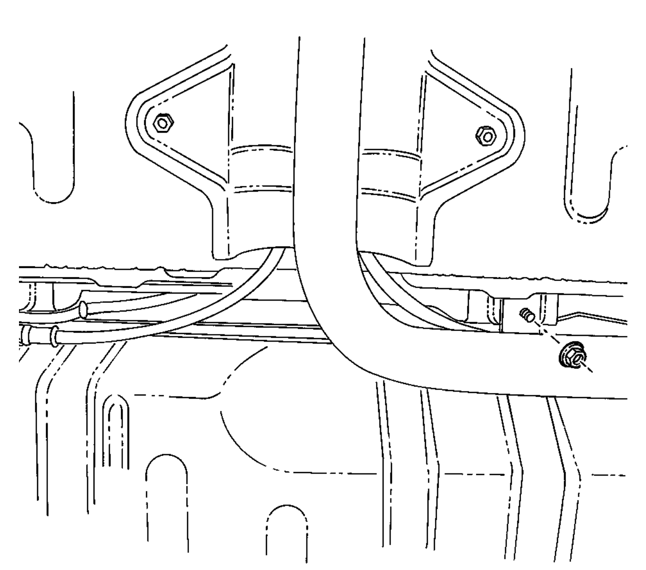
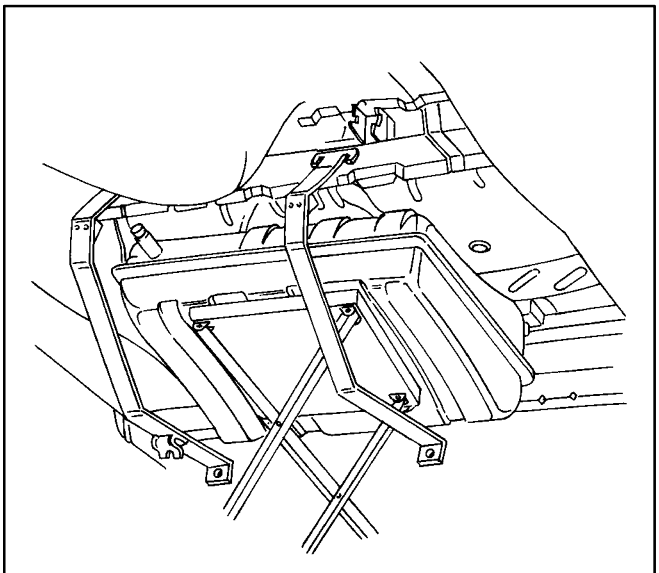


C102F082

12. Support the fuel tank.
13. Remove the fuel tank strap retaining nuts.
14. Remove the fuel tank straps.
15. Carefully lower the fuel tank.
16. Remove the fuel tank.
17. Transfer any parts as needed.



B102F005

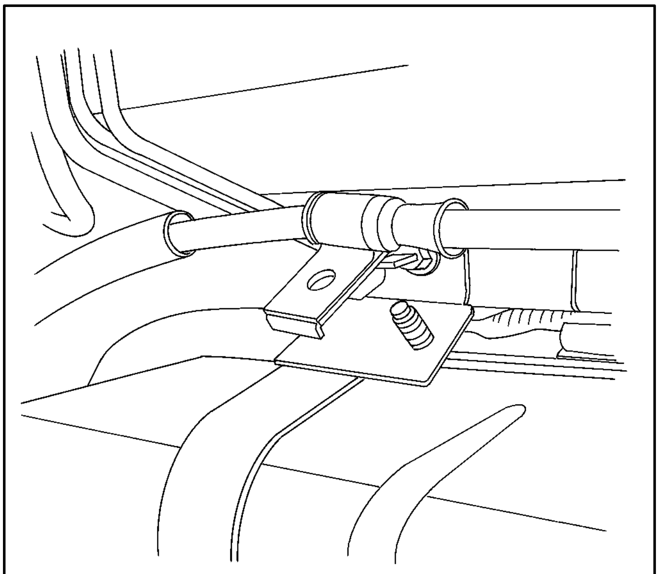
Installation Procedure

1. Raise the fuel tank into position.
2. Install the fuel tank straps.
3. Install the fuel tank strap retaining nuts.

Tighten

Tighten the fuel tank strap retaining nuts to 13 N•m (115 lb•in).

4. Connect the fuel outlet line and the fuel return line.
5. Connect the wiring harness clips and the fuel line clips as needed.
6. Connect the fuel pump harness connector.
7. Connect the fuel vapor line.
8. Connect the fuel tank filler tube.
9. Connect the fuel tank vent tube.
10. Install the fuel tank filler tube clamp at the fuel tank.



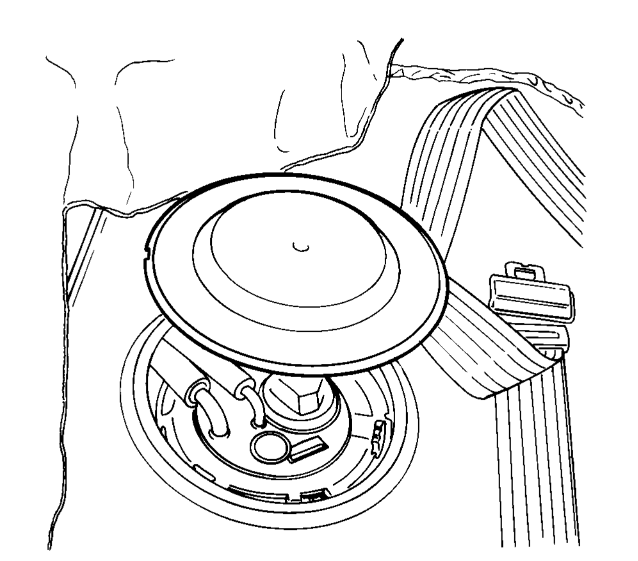
C102F057

11. Connect the right rear parking brake cable to the retaining bracket attached to the right side fuel tank strap.
12. Connect the negative battery cable.
13. Fill the fuel tank.
14. Perform a leak check of the fuel tank and the fuel line connections.

FUEL PUMP

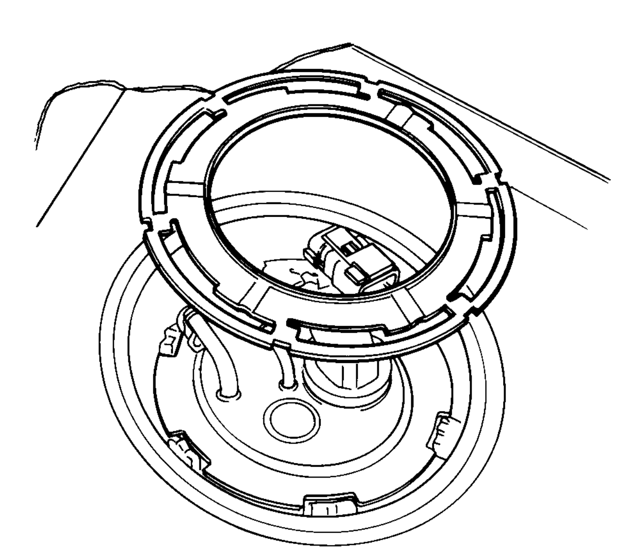
Removal Procedure

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.



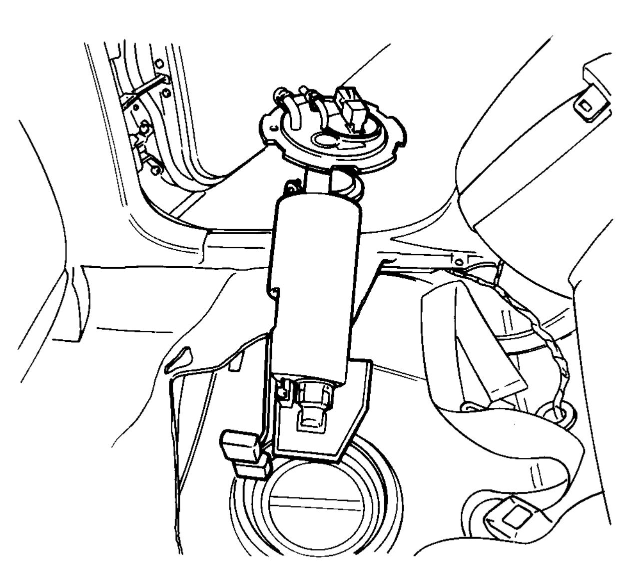
A102F024

1. Relieve the fuel system pressure.
   1.1. Remove the fuel cap.
   1.2. Remove fuel pump fuse EF18 from the engine fuse block.
   1.3. Start the engine and allow the engine to stall.
   1.4. Crank the engine for an additional 10 seconds.
2. Disconnect the negative battery cable.
3. Remove the rear seat. Refer to *Section 9H, Seats.*
4. Remove the fuel pump access cover.



A102F025

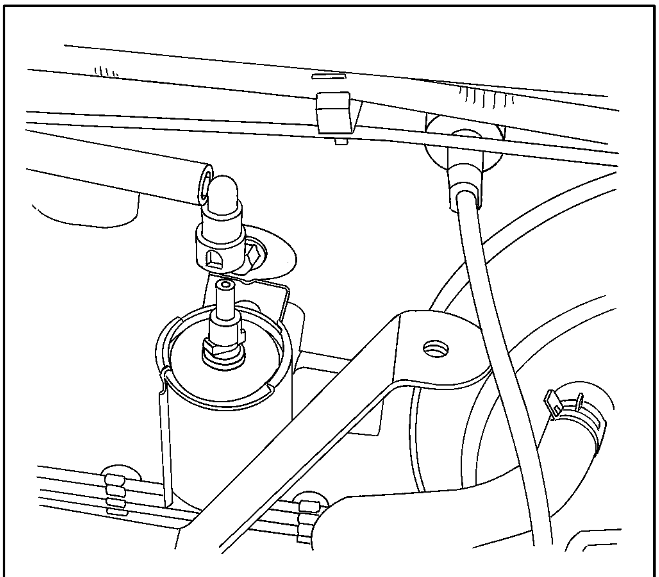
5. Disconnect the electrical connector at the fuel pump assembly.
6. Disconnect the fuel outlet line.
7. Disconnect the fuel tank return line.
8. Turn the lock ring counterclockwise to clear the tank tabs.
9. Remove the fuel pump assembly from the tank.
10. Remove and discard the gasket.



A102F026

Installation Procedure

1. Clean the gasket mating surface on the fuel tank.
2. Position the new gasket in place.
3. Install the fuel pump into the fuel tank in the same location as removed for ease of line and connector installation.
4. Position the lock ring in place and turn it clockwise until it contacts the tank stop.
5. Connect the fuel pump assembly connector.
6. Install the fuel pump outlet line.
7. Install the fuel tank return line.
8. Install the fuel pump access cover.
9. Connect the negative battery cable.
10. Perform an operational check of the fuel pump.
11. Install the rear seat. Refer to *Section 9H, Seats.*


C102F059

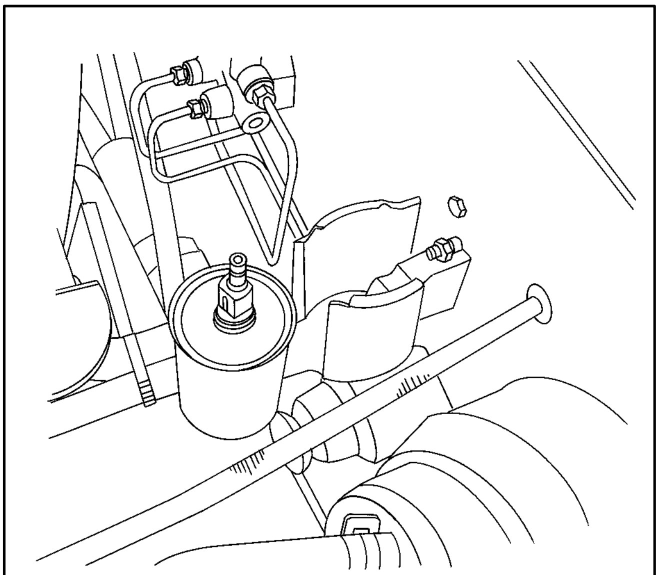
FUEL FILTER

Removal Procedure

1. Disconnect the negative battery cable.

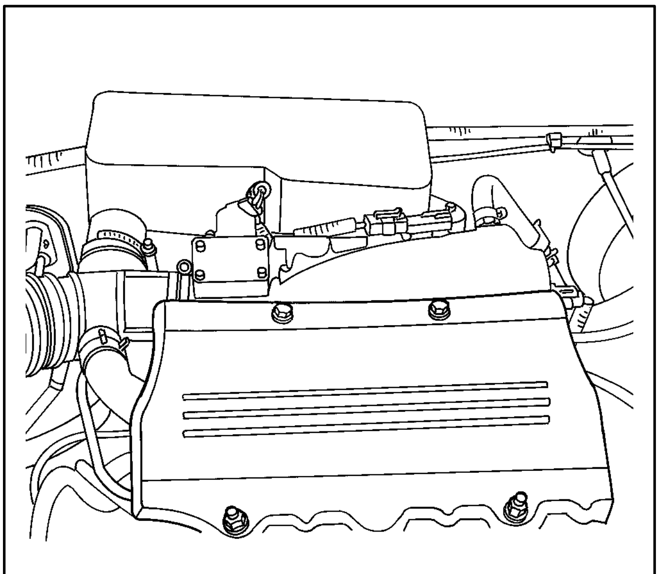
Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

2. Relieve the fuel system pressure. Refer to „Fuel Pump" in this section.
3. Disconnect the inlet/outlet fuel lines by moving the line connector lock forward and pulling the hose off of the fuel filter tube.
4. Remove the fuel filter.


C102F060

Installation Procedure

1. Install the new fuel filter into the retaining clamp. Note the flow direction.
2. Install the fuel filter.
3. Connect the inlet/outlet lines. Secure the lines with the connector lock.
4. Connect the negative battery cable.
5. Perform a leak test of the fuel filter.

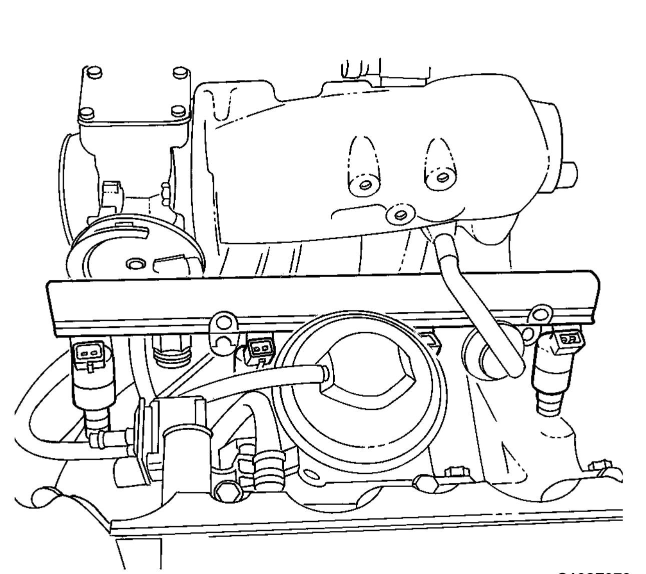

C102F063

FUEL RAIL AND INJECTORS (SOHC)

Removal Procedure

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel pressure. Refer to „Fuel Pump" in this section.
2. Disconnect the negative battery cable.
3. Remove the bolts and the fuel injector cover.
4. Remove the air intake tube and resonator.
5. Disconnect the fuel injector harness connectors.
6. Remove the fuel pressure regulator vacuum hose.



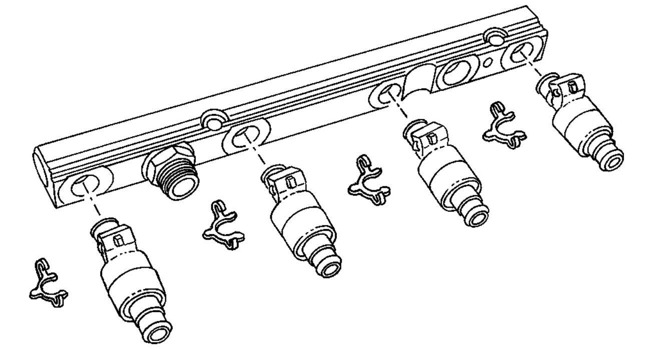
C102F079

7. Remove the throttle cable bracket and bolt.
8. Remove the fuel inlet line.
9. Remove the fuel rail mounting bolts.

Notice: Before removal, the fuel rail assembly may be cleaned with a spray type cleaner, following package instructions. Do not immerse the fuel rails in liquid cleaning solvent. Use care in removing the fuel rail assembly to prevent damage to the electrical connectors and the injector spray tips. Prevent dirt and other contaminants from entering open lines and passages. Fittings should be capped and holes plugged during service.

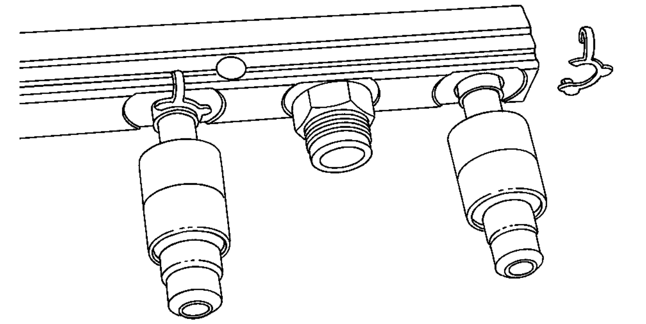
Important: If a fuel injector becomes separated from the fuel rail and remains in the cylinder head, replace the fuel injector O-ring seals and the retaining clip.

10. Remove the fuel rail with the fuel injectors attached.



C102F095

11. Remove the fuel injector retainer clips.
12. Remove the fuel injectors by pulling them down and out.
13. Discard the fuel injector O-rings.

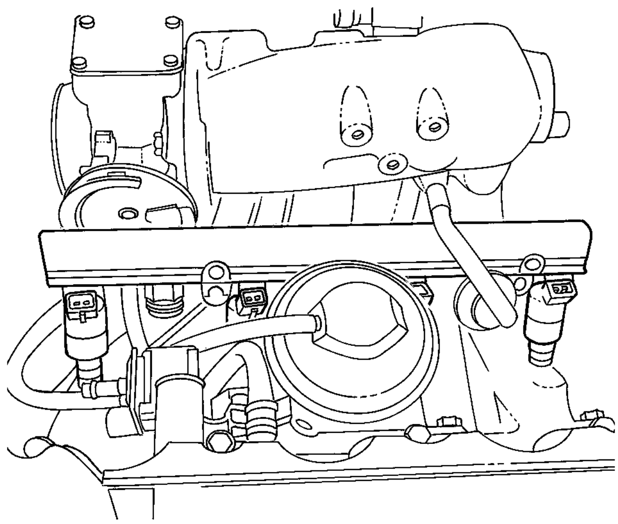


C102F096

Installation Procedure

Important: Different fuel injectors are calibrated for different flow rates. When ordering new fuel injectors, be certain to order the identical part number that is inscribed on the old fuel injector.

1. Lubricate the new fuel injector O-rings with engine oil. Install the new O-rings on the fuel injectors.
2. Install the fuel injectors into the fuel rail sockets with the fuel injector terminals facing outward.
3. Install the fuel injector retainer clips onto the fuel injectors and the fuel rail ledge.
4. Make sure that the clips are parallel to the fuel injector harness connector.



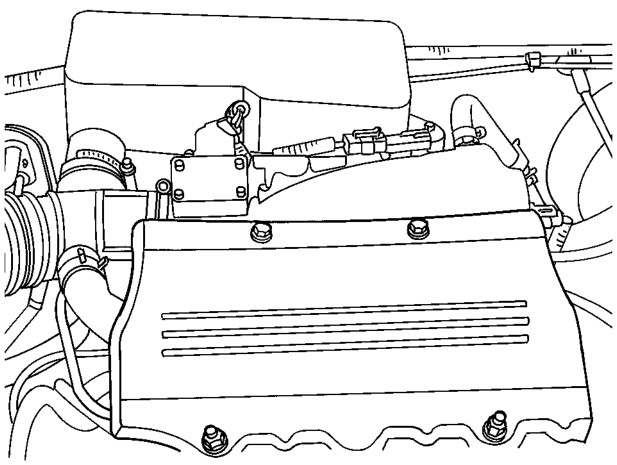
C102F079

5. Install the fuel rail assembly into the cylinder head.
6. Install the fuel rail retaining bolts.

Tighten

Tighten the fuel rail retaining bolts to 25 N•m (18 lb•ft).

7. Install the fuel inlet hose line.
8. Connect the fuel injector harness connectors. Rotate the fuel injector as required to avoid stretching the wire harness.
9. Install the fuel pressure regulator vacuum hose.
10. Connect the negative battery cable.
11. Perform a leak check of the fuel rail and the fuel injectors.



C102F063

12. Install the air tube and resonator.
13. Install the throttle cable bracket with the bolts.

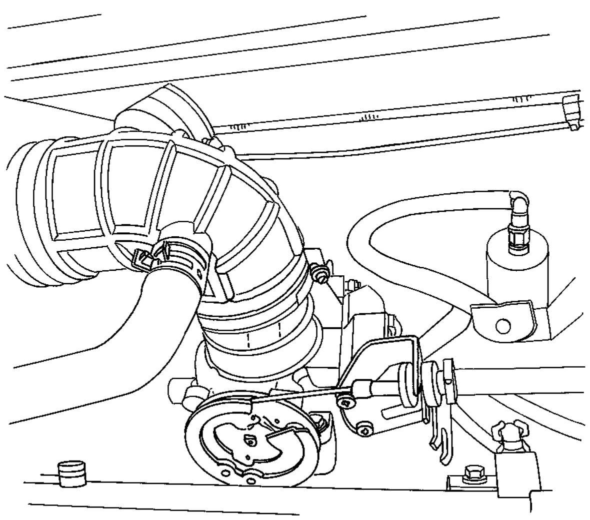
Tighten

Tighten the throttle cable bracket bolts to 10 N•m (89 lb•in).

14. Install the fuel injector cover with the bolts.

Tighten

Tighten the fuel injector cover bolts to 10 N•m (89 lb•in).



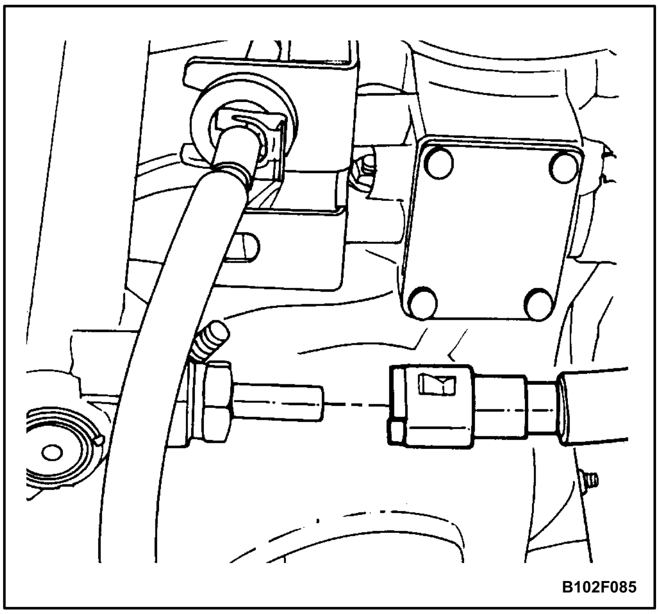
C102F065

FUEL RAIL AND INJECTORS (DOHC)

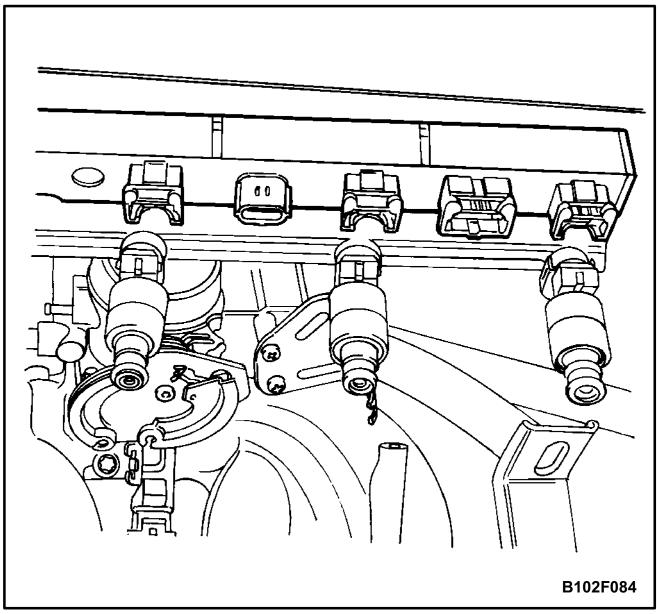
Removal Procedure

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure. Refer to „Fuel Pump” in this section.
2. Disconnect the negative battery cable.
3. Disconnect the manifold air temperature (MAT) sensor connector.
4. Disconnect the breather hose from the valve cover.



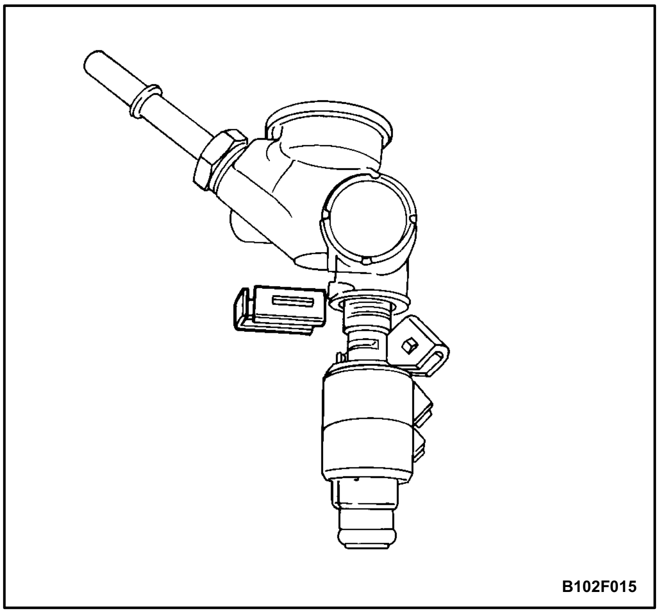
5. Remove the air intake tube and resonator.
6. Disconnect the positive crankcase ventilation (PCV) hose from the valve cover.
7. Disconnect the throttle cables from the throttle body and the bracket.
8. Remove the fuel pressure regulator. Refer to „Fuel Pressure Regulator (DOHC)" in this section.
9. Disconnect the fuel return line at the fuel rail.
10. Disconnect the fuel inlet line at the fuel rail.
11. Remove the fuel rail retaining bolts.
12. Remove the throttle cable bracket bolts and the brackets.



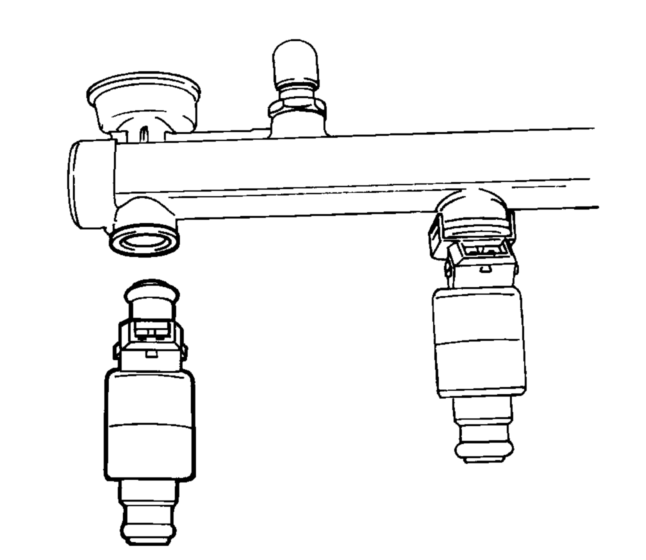
Notice: Before removal, the fuel rail assembly may be cleaned with a spray-type cleaner, following package instructions. Do not immerse the fuel rails in liquid cleaning solvent. Use care in removing the fuel rail assembly to prevent damage to the electrical connectors and the injector spray tips. Prevent dirt and other contaminants from entering open lines and passages. Fittings should be capped and holes plugged during service.

Important: If an injector becomes separated from the rail and remains in the cylinder head, replace the injector O-ring seals and the retaining clip.

13. Remove the fuel rail with the fuel injector channel cover and the injectors attached.
14. Disconnect the fuel injector channel cover connectors.



15. Remove the fuel injector retainer clips.
16. Remove the fuel injectors by pulling them down and out.
17. Discard the fuel injector O-rings.

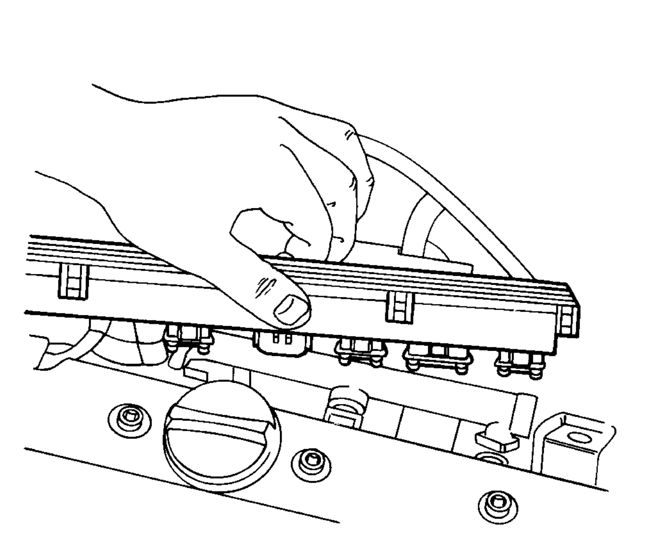


B102F016

Installation Procedure

Important: Different injectors are calibrated for different flow rates. When ordering new fuel injectors, be certain to order the identical part number that is inscribed on the old injector.

1. Lubricate the new fuel injector O-rings with engine oil. Install the new O-rings on the fuel injectors.
2. Install the fuel injectors into the fuel rail sockets with the fuel injector terminals facing outward.
3. Install the fuel injector retaining clips onto the fuel injector and the fuel rail ledge.
4. Make sure that the clips are parallel to the fuel injector harness connector.



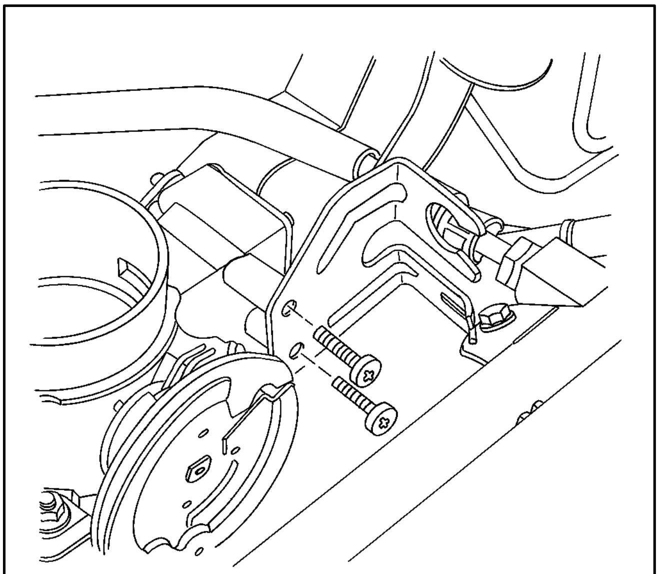
B102F018

5. Install the fuel rail assembly into the cylinder head.
6. Install the fuel rail retaining bolts.

Tighten

Tighten the fuel rail retaining bolts to 25 N•m (18 lb•ft).

7. Connect the fuel inlet line to the fuel rail.
8. Connect the fuel return line to the fuel rail
9. Install the fuel pressure regulator. Refer to „Fuel Pressure Regulator (2.0L DOHC)" in this section.
10. Connect the fuel injector channel cover and connectors. Rotate each fuel injector as required.



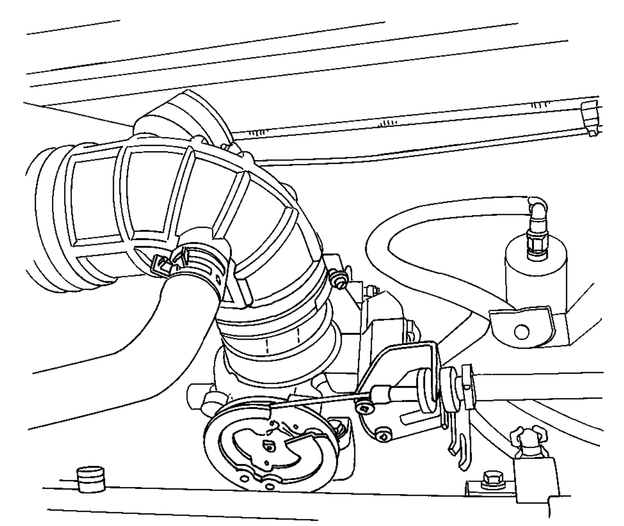
C102F067

11. Install the throttle cable bracket and the bolts.

Tighten

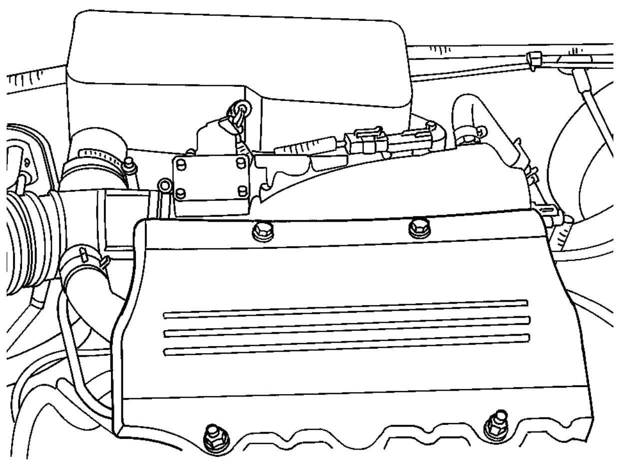
Tighten the throttle cable bracket bolts to 10 N•m (89 lb•in).

12. Connect the PCV hose to the valve cover.
13. Connect the throttle cables to the throttle body and bracket.



C102F065

14. Install the air intake tube and resonator.
15. Connect the breather hose to the valve cover.
16. Connect the MAT sensor connector.
17. Connect the negative battery cable.
18. Perform a leak check of the fuel rail and fuel injectors.



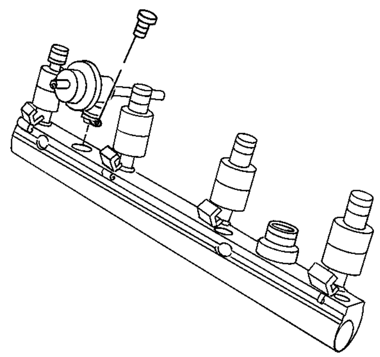
C102F063

FUEL PRESSURE REGULATOR (SOHC)

Removal Procedure

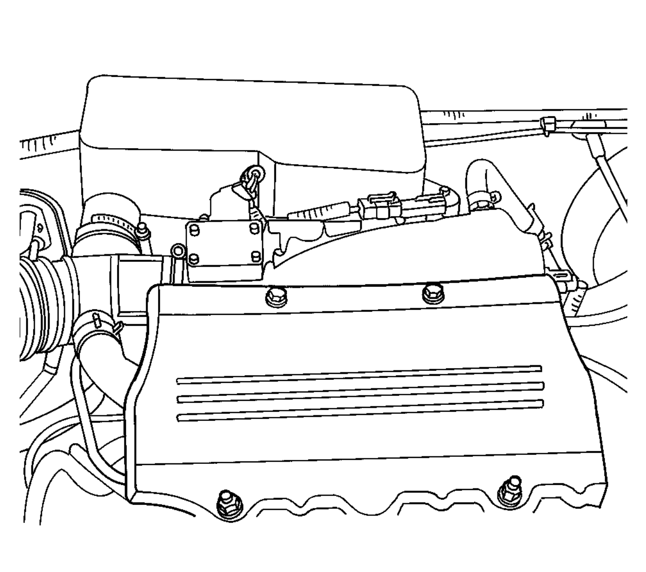
Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel pressure. Refer to „Fuel Pump" in this section.
2. Disconnect the negative battery cable.
3. Remove the bolts and the fuel injector cover.
4. Remove the fuel rail. Refer to „Fuel Rail and Injectors (SOHC)" in this section.



C102F064

5. Remove the fuel pressure regulator retaining bolt.
6. Remove the fuel pressure regulator by turning it back and forth and then pulling it out.
7. Discard the O-ring.



C102F063

Installation Procedure

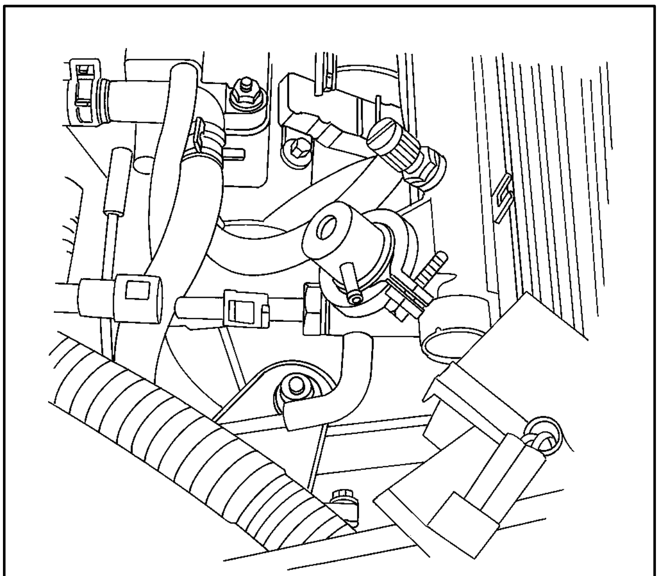
1. Lubricate a new O-ring with engine oil. Install the new O-ring onto the fuel pressure regulator body.
2. Insert the fuel pressure regulator into the fuel rail body.
3. Install the retaining bolt.

   Tighten

   Tighten the fuel pressure regulator retaining bolt to 10 N•m (89 lb•in).
4. Install the fuel rail. Refer to „Fuel Rail and Injectors (SOHC)" in this section.
5. Connect the negative battery cable.
6. Perform a leak test of the fuel pressure regulator with the engine off and the ignition ON.
7. Install the fuel injector cover with the bolts.

   Tighten

   Tighten the fuel injector cover bolts to 10 N•m (89 lb•in).



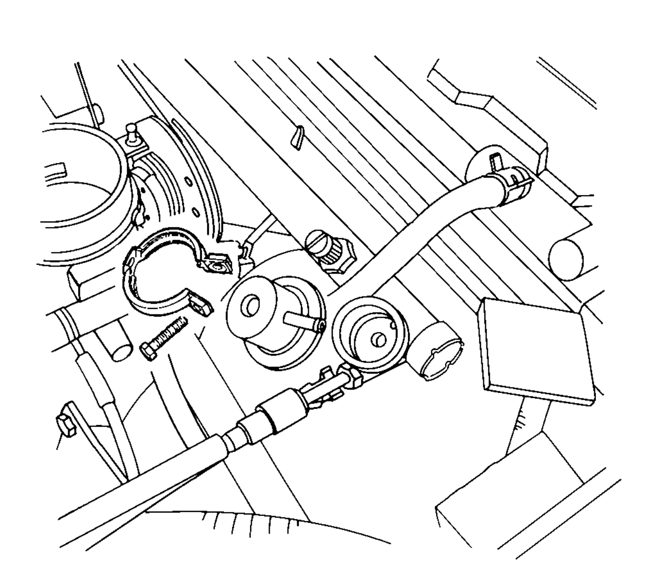
C102F069

FUEL PRESSURE REGULATOR (DOHC)

Removal Procedure

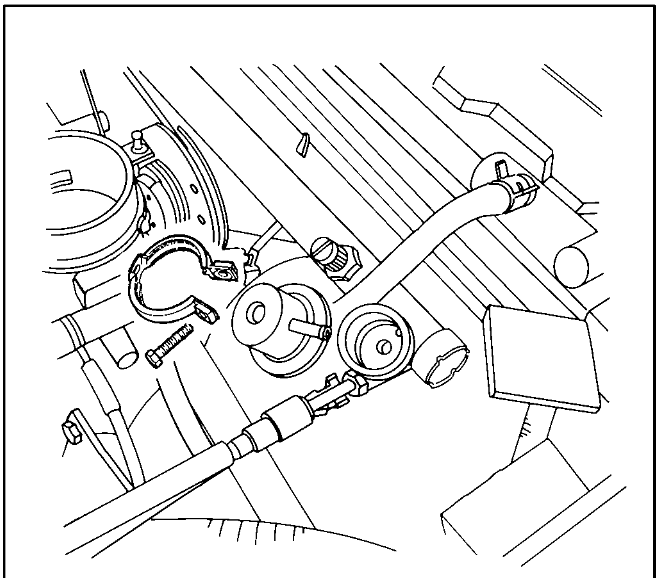
Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel pressure. Refer to „Fuel Pump" in this section.
2. Disconnect the negative battery cable.
3. Disconnect the manifold air temperature (MAT) sensor connector.
4. Disconnect the breather hose from the valve cover.
5. Remove the air intake tube.
6. Disconnect the vacuum hose from the fuel pressure regulator.



C102F068

7. Remove the fuel pressure regulator retaining clamp.
8. Remove the fuel pressure regulator by turning it back and forth and then pulling it out.
9. Discard the O-ring.



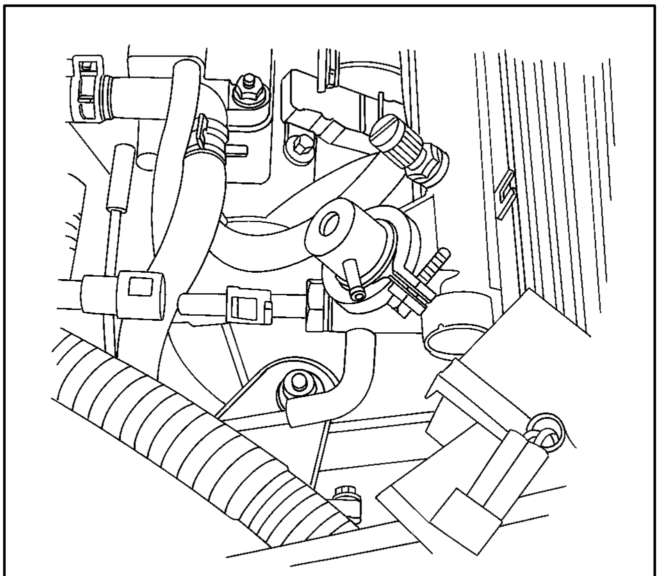
C102F068

Installation Procedure

1. Lubricate a new O-ring. Install the new O-ring onto the fuel pressure regulator body.
2. Insert the fuel pressure regulator into the fuel rail body.
3. Install the fuel pressure regulator retaining clamp.

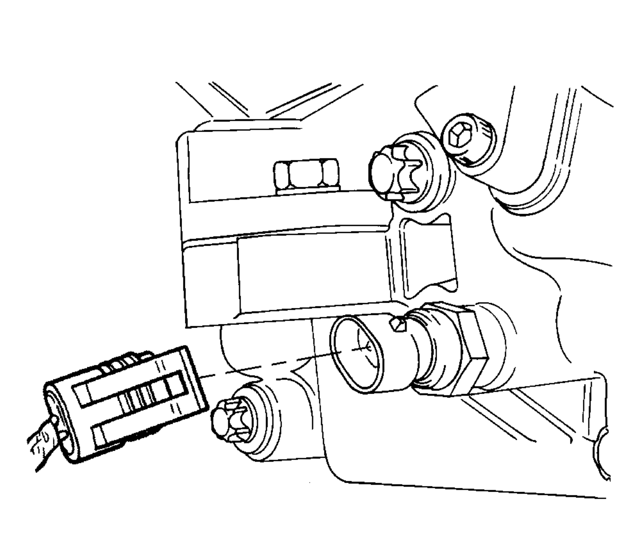
Tighten

Tighten the fuel pressure regulator retaining clamp to 12 N•m (106 lb•in).



C102F069

4. Connect the vacuum hose to the fuel pressure regulator.
5. Install the air intake tube.
6. Connect the breather hose to the valve cover.
7. Connect the MAT sensor connector.
8. Connect the negative battery cable.
9. Perform a leak test of the fuel pressure regulator with the engine off and the ignition ON.



B102F029

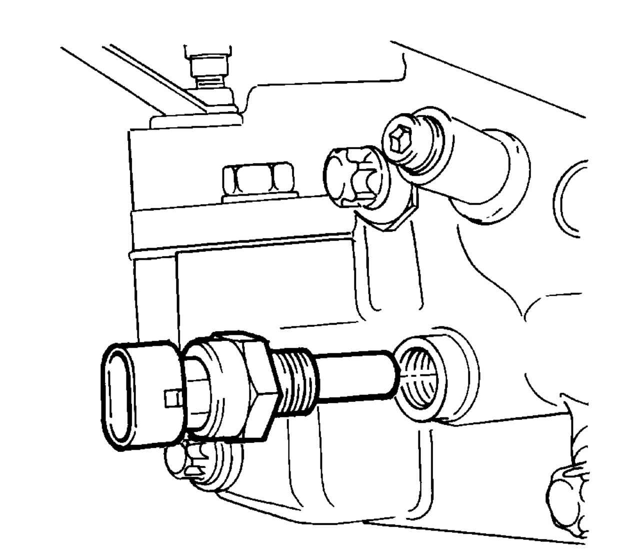
COOLANT TEMPERATURE SENSOR (TYPICAL)

Removal Procedure

1. Relieve the coolant system pressure.
2. Disconnect the negative battery cable.
3. Disconnect the coolant temperature sensor (CTS) connector.

Notice: Take care when handling the coolant temperature sensor. Damage to the sensor will affect the proper operation of the fuel injection system.

4. Remove the CTS from the direct ignition system (DIS) ignition coil adapter.



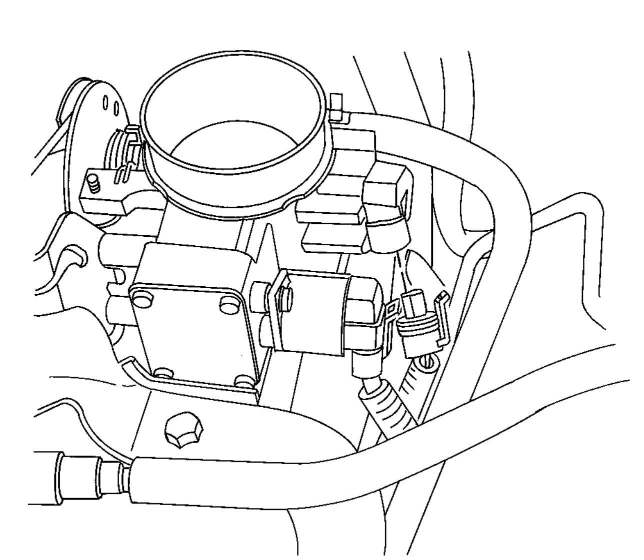
B102F030

Installation Procedure

1. Coat the threads of the CTS with sealer.
2. Install the CTS into the DIS ignition coil adapter.

   Tighten

   Tighten the coolant temperature sensor to 25 N•m (18 lb•ft).
3. Connect the CTS connector.
4. Fill the coolant system.
5. Connect the negative battery cable.

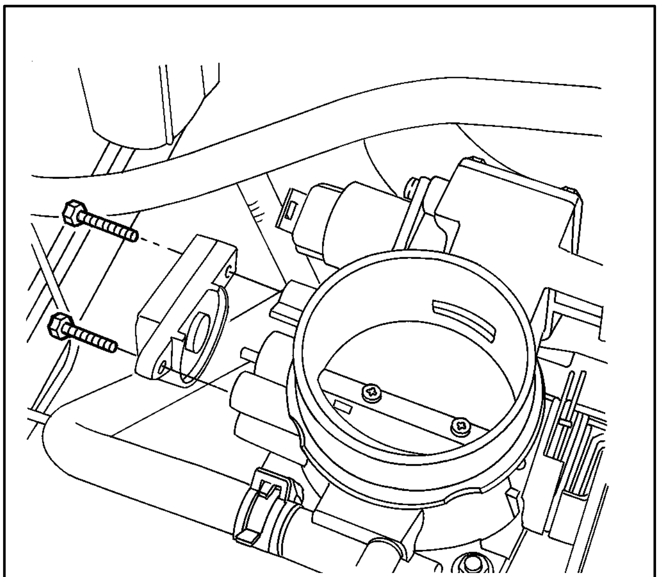


C102F073

THROTTLE POSITION SENSOR (TYPICAL)

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the air intake tube and resonator.
3. Disconnect the throttle position sensor (TPS) connector.
4. Remove the TPS retaining bolts and the TPS.


C102F074

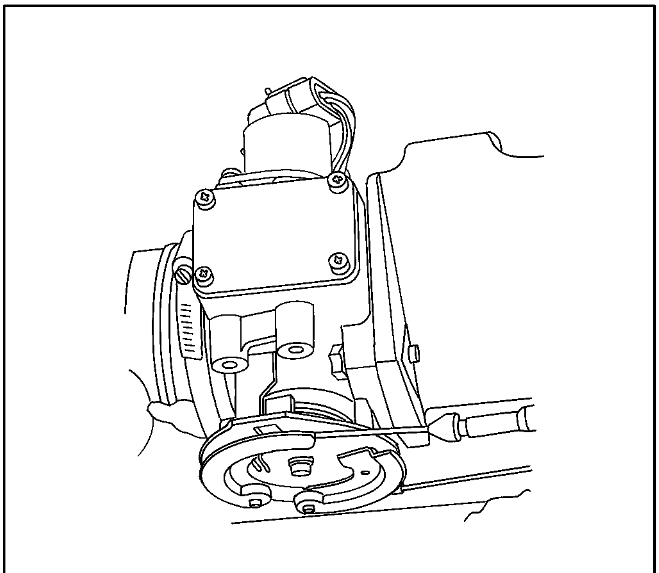
Installation Procedure

1. With the throttle valve closed, position the TPS on the throttle shaft. Align the TPS with the bolt holes.
2. Install the TPS retaining bolts.

Tighten

Tighten the throttle position sensor retaining bolts to 2 N•m (18 lb•in).

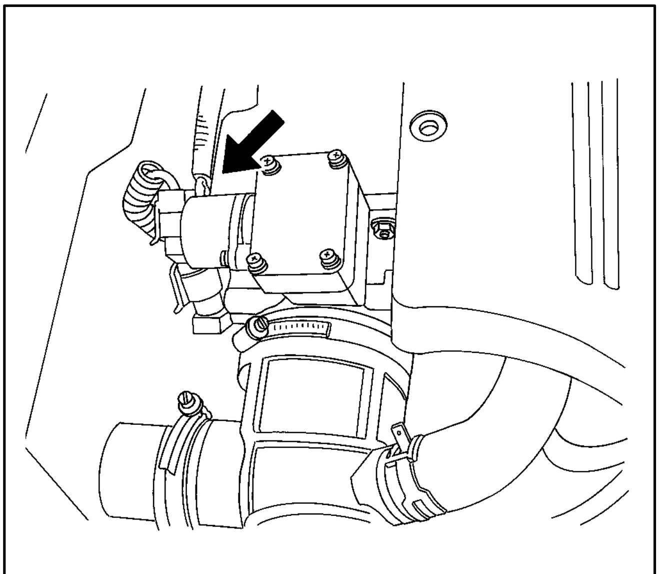
3. Connect the TPS connector.
4. Install the air intake tube and resonator.
5. Connect the negative battery cable.


C102F070

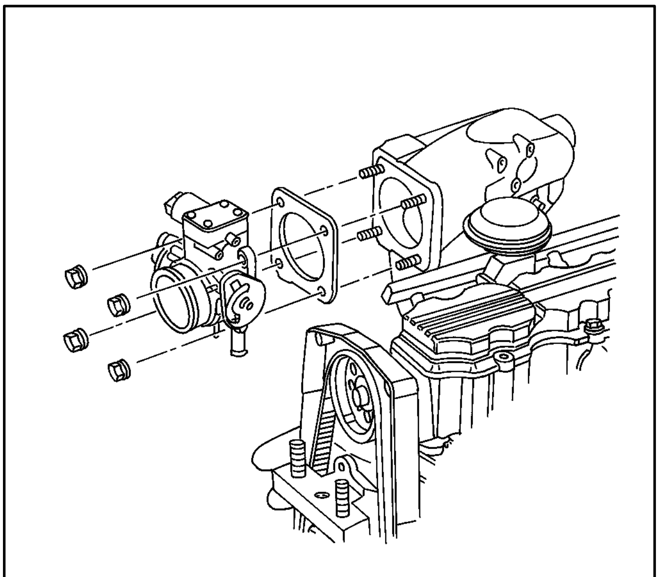
THROTTLE BODY (SOHC)

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the air intake tube from the throttle body.
3. Disconnect the throttle cables by opening the throttle and moving the cable through the release slot.
4. Remove the resonator.

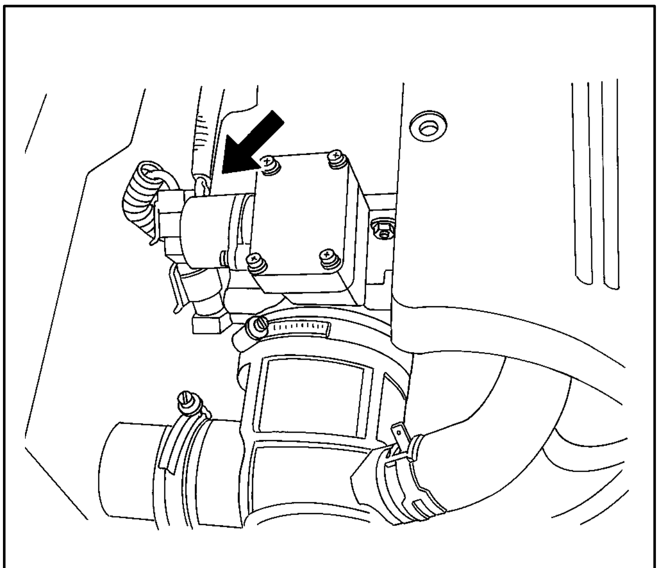

C102F078

5. Disconnect the vacuum hoses from the throttle body.
6. Disconnect the throttle position sensor (TPS) and the idle air control valve connectors.



C102F075

7. Remove the coolant hoses from the throttle body.
8. Remove the throttle body retaining nuts.
9. Remove the throttle body and discard the gasket.
10. Remove the TPS. Refer to „Throttle Position Sensor” in this section.
11. Remove the idle air control (IAC) valve. Refer to „Idle Air Control Valve” in this section.



C102F078

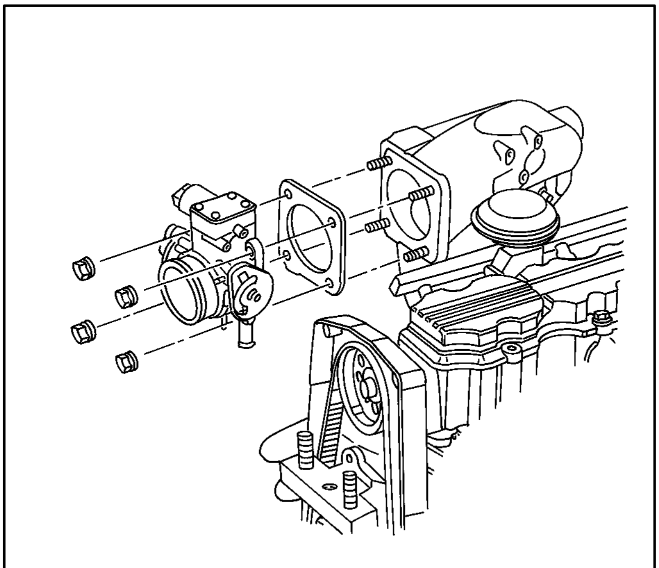
Installation Procedure

Notice: Use care in cleaning old gasket material from machined aluminum surfaces. Sharp tools may damage sealing surfaces.

1. Clean the gasket mating surface on the intake manifold.

Notice: The throttle body may be cleaned in a cold immersion-type cleaner following disassembly. The TPS and the idle air control valve should not come in contact with any solvent or cleaner as they may be damaged.

2. Clean the throttle body.
3. Install the TPS. Refer to „Throttle Position Sensor” in this section.
4. Install the IAC valve. Refer to „Idle Air Control Valve” in this section.



C102F075

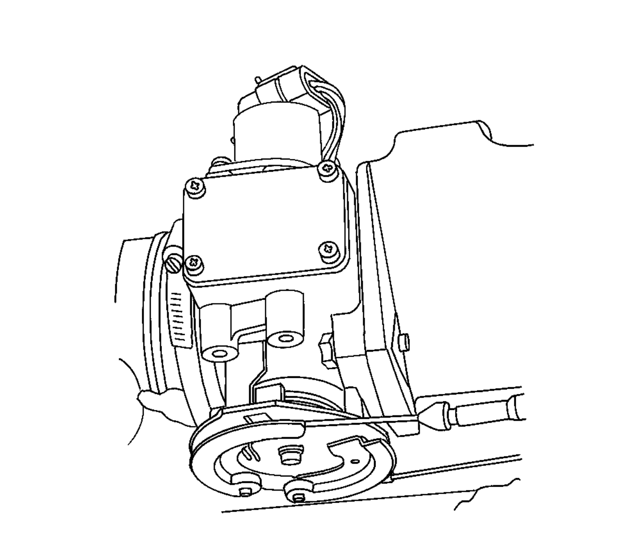
5. Install the throttle body assembly with a new gasket to the intake manifold.
6. Install the throttle body retaining nuts.

Tighten

Tighten the throttle body retaining nuts to 15 N•m (11 lb•ft).

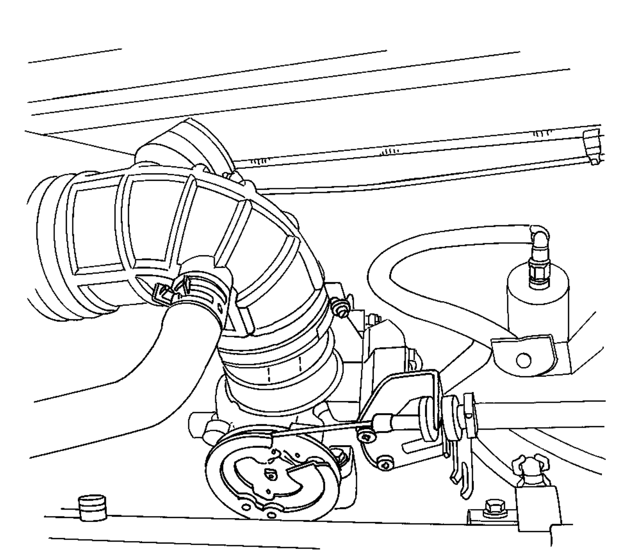
7. Install the coolant hoses.
8. Connect the vacuum hoses to the throttle body.

Important: Make sure the throttle control cables do not hold the throttle open. With the engine off, check to see that the accelerator pedal is free.



C102F070

9. Connect the throttle cables.
10. Install the air intake tube.
11. Connect the TPS connector and the idle air control valve connector.
12. Install the resonator.
13. Connect the negative battery cable.
14. Fill the cooling system.

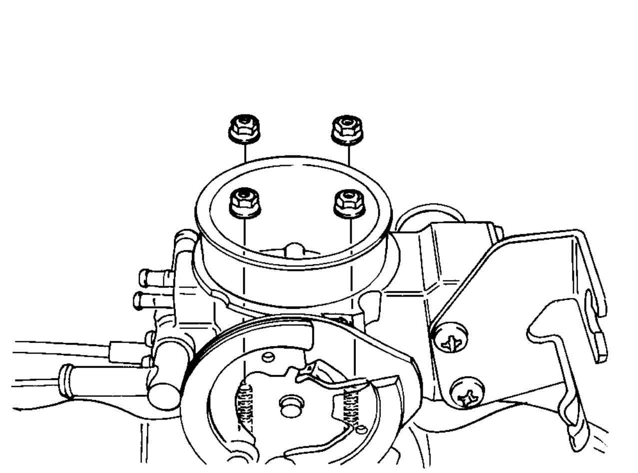


C102F065

THROTTLE BODY (DOHC)

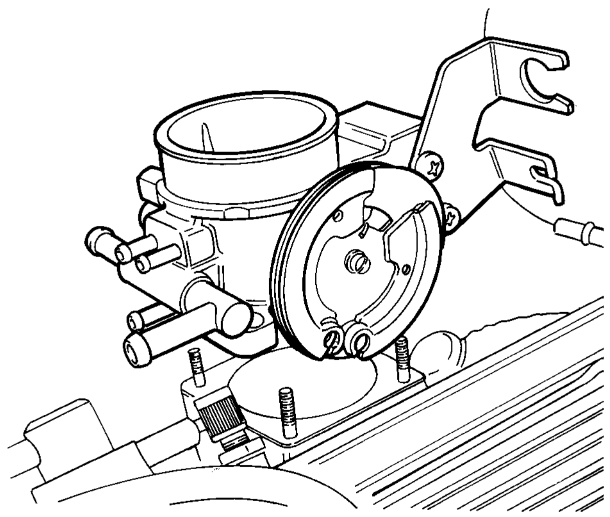
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the manifold air temperature (MAT) sensor connector.
3. Disconnect the breather hose from the valve cover.
4. Remove the air intake tube.



B102F028

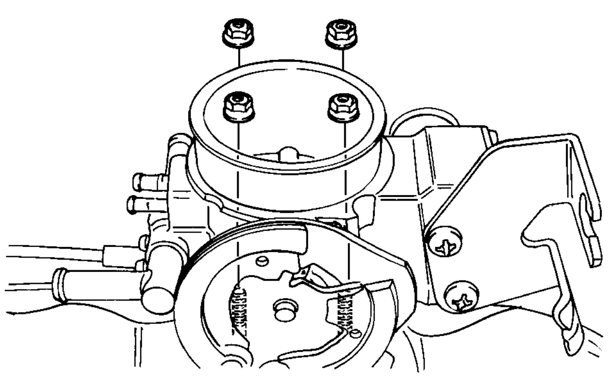
5. Disconnect the throttle cables by opening the throttle and moving the cable through the release slot.
6. Disconnect the vacuum hoses from the throttle body.
7. Disconnect the throttle position sensor (TPS) and the idle air control valve connectors.
8. Disconnect the coolant hoses from the throttle body.
9. Remove the throttle body retaining nuts.



B102F027

Notice: Cover the opening of the intake manifold after removing the throttle body assembly. This will prevent any objects or debris from entering the engine which may cause damage.

10. Remove the throttle body and discard the gasket.
11. Remove the TPS. Refer to „Throttle Position Sensor" in this section.
12. Remove the idle air control (IAC) valve. Refer to „Idle Air Control Valve" in this section.



B102F028

Installation Procedure

Notice: Use care in cleaning old gasket material from machined aluminum surfaces. Sharp tools may damage sealing surfaces.

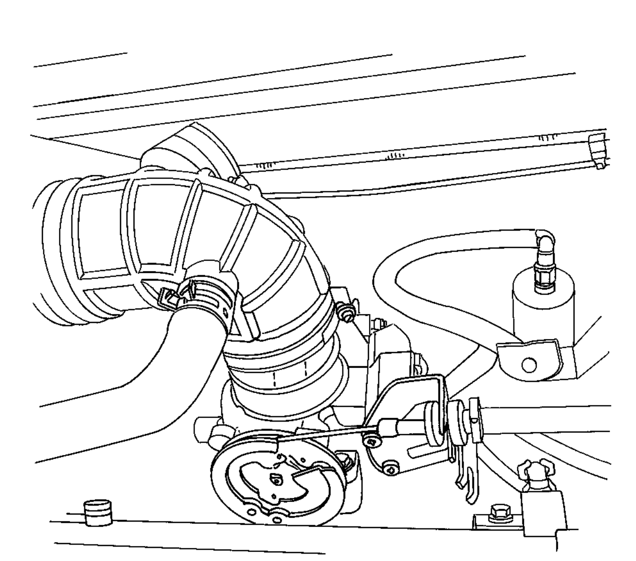
1. Clean the gasket mating surface on the intake manifold.

Notice: The throttle body may be cleaned in a cold immersiontype cleaner following disassembly. The TPS and the idle air control valve should not come in contact with any solvent or cleaner, as they may be damaged.

2. Clean the throttle body.
3. Install the TPS. Refer to „Throttle Position Sensor" in this section.
4. Install the IAC valve. Refer to „Idle Air Control Valve" in this section.
5. Install the throttle body assembly with a new gasket to the intake manifold.
6. Install the throttle body retaining nuts.

Tighten

Tighten the throttle body retaining nuts to 9 N•m (80 lb•in).

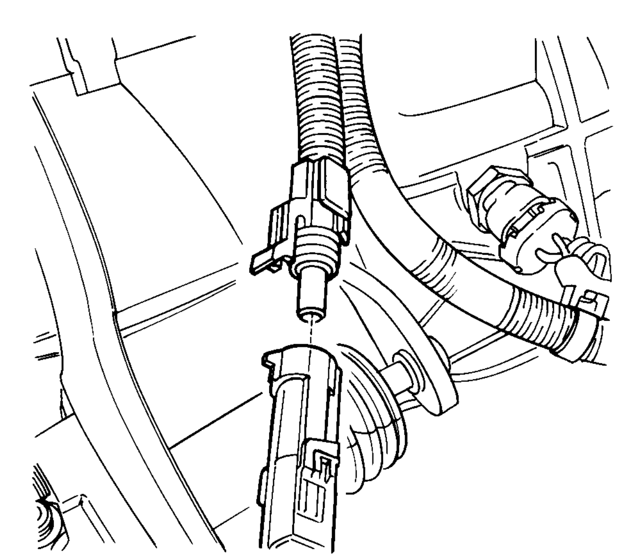


C102F065

7. Connect the TPS connector and the IAC valve connector.
8. Connect the coolant hoses to the throttle body.
9. Connect the vacuum hoses to the throttle body.

Important: Make sure the throttle/cruise control cables do not hold the throttle open. With the engine off, check to see that the accelerator pedal is free.

10. Connect the throttle/cruise cables.
11. Install the air intake tube.
12. Connect the breather hose to the valve cover.
13. Connect the MAT sensor connector.
14. Connect the negative battery cable.
15. Fill the cooling system.



A102F029

OXYGEN SENSOR (TYPICAL)

Removal Procedure

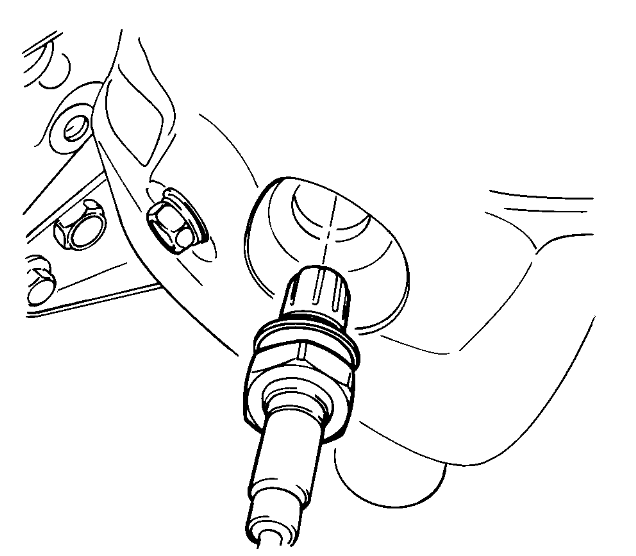
1. Disconnect the negative battery cable.

Notice: The oxygen sensor uses a permanently attached pigtail and connector. This pigtail should not be removed from the oxygen sensor. Damage or removal of the pigtail or the connector could affect proper operation of the oxygen sensor. Take care when handling the oxygen sensor. Do not drop the oxygen sensor.

2. Disconnect the oxygen sensor connector.

Notice: The oxygen sensor may be difficult to remove when engine temperature is below 48°C (120°F). Excessive force may damage threads in the exhaust manifold.

3. Carefully remove the oxygen sensor from the exhaust manifold.



A102F030

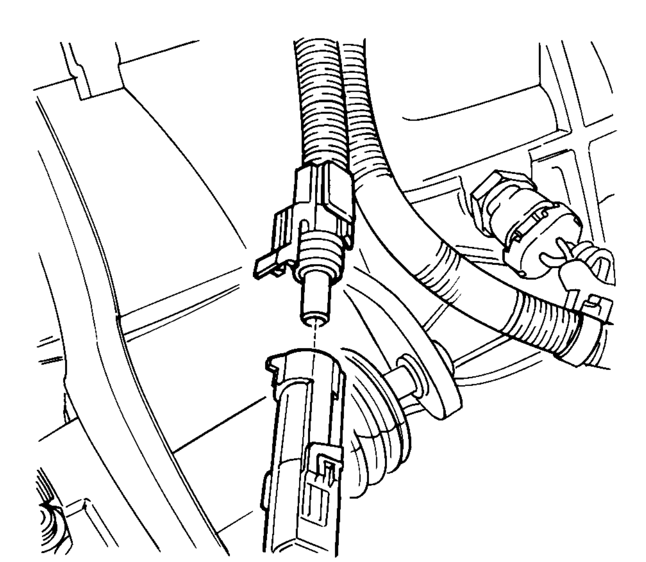
Installation Procedure

Important: A special anti-seize compound is used on the oxygen sensor threads. This compound consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or serviced sensors will already have the compound applied to the threads. If a sensor is removed from any engine and is to be reinstalled, the threads must have an anti-seize compound applied before reinstallation.

1. Coat the threads of the oxygen sensor with an anti-seize compound, if needed.
2. Install the oxygen sensor into the exhaust manifold.

   Tighten

   Tighten the oxygen sensor to 41 N•m (30 lb•ft).
3. Connect the oxygen sensor connector.
4. Connect the negative battery cable.



A102F029

OXYGEN SENSOR (O2S 1) - 2.2L DOHC

Removal Procedure

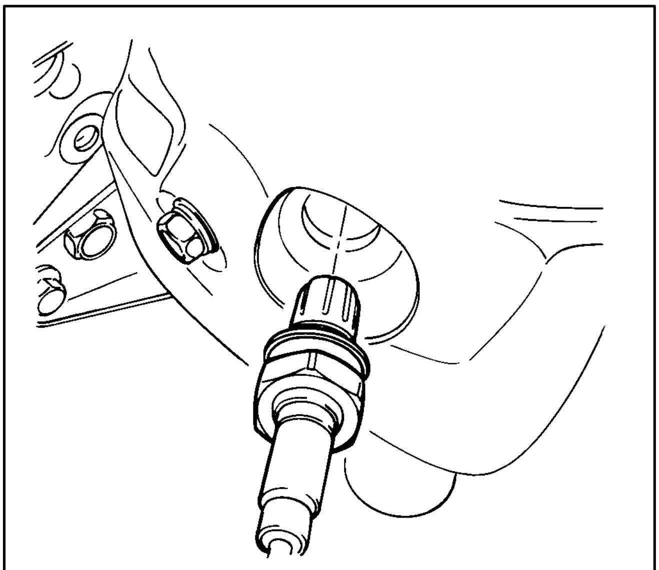
1. Disconnect the negative battery cable.

Notice: The oxygen sensor (O2S 1) uses a permanently attached pigtail and connector. This pigtail should not be removed from the O2S 1. Damage or removal of the pigtail or the connector could affect proper operation of the O2S 1. Take care when handling the O2S 1. Do not drop the O2S 1.

2. Disconnect the O2S 1 connector.

Notice: The oxygen sensor may be difficult to remove when engine temperature is below 48°C (118°F). Excessive force may damage threads in the exhaust manifold.

3. Carefully remove the O2S 1 from the exhaust manifold.



A102F030

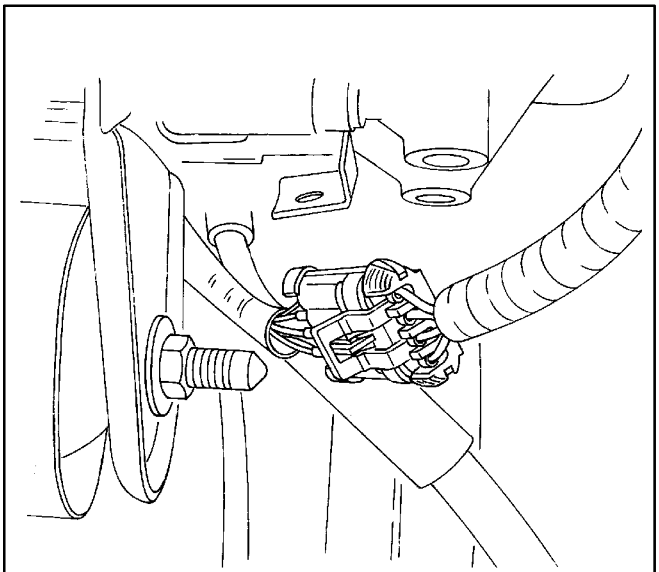
Installation Procedure

Important: A special anti seize compound is used on the oxygen sensor threads. This compound consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or serviced sensors will already have the compound applied to the threads. If a sensor is removed from any engine and is to be reinstalled, the threads must have an antiseize compound applied before reinstallation.

1. Coat the threads of the O2S 1 with an antiseize compound, if needed.
2. Install the O2S 1 into the exhaust manifold.

   Tighten

   Tighten the oxygen sensor to 41 N•m (30 lb•ft).
3. Connect the O2S 1 connector.
4. Connect the negative battery cable.

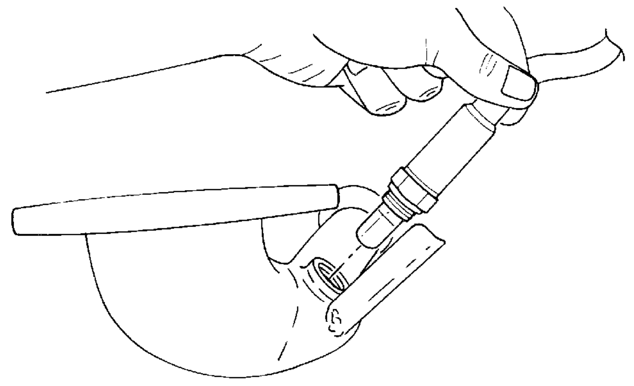


C402G003

HEATED OXYGEN SENSOR (HO2S 2) - 2.2L DOHC

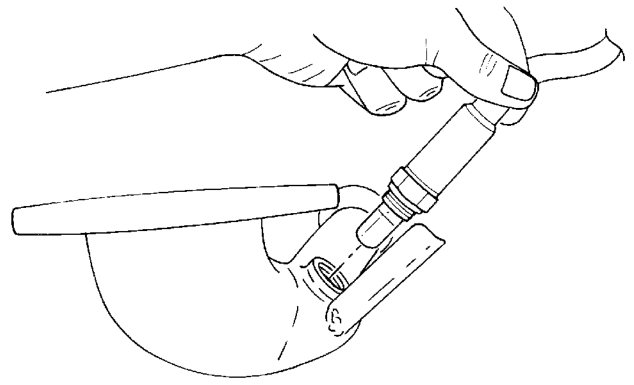
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector.



C402G006

3. Remove the heated oxygen sensor.



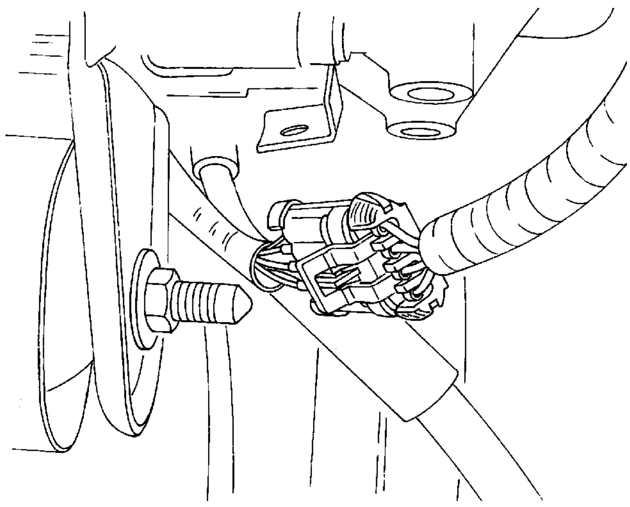
C402G006

Installation Procedure

1. Install the heated oxygen sensor.

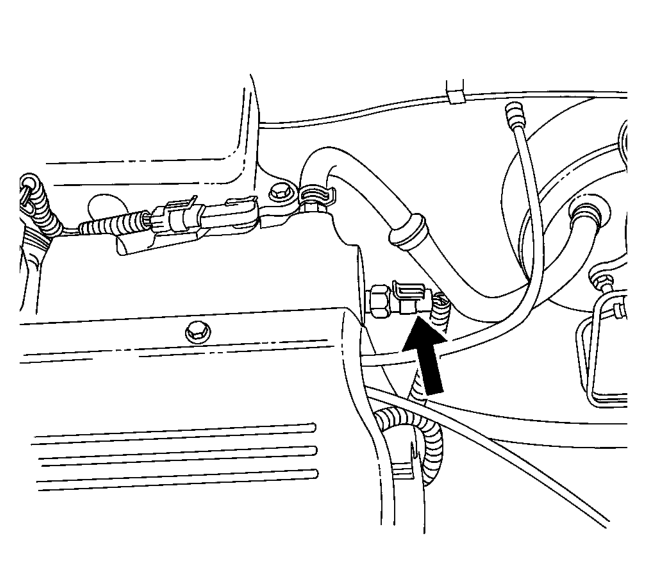
Tighten

Tighten the heated oxygen sensor to 41 N•m (30 lb•ft).



C402G003

2. Connect the electrical connector.
3. Connect the negative battery cable.



C102F099

MANIFOLD AIR TEMPERATURE SENSOR (TYPICAL)

Removal Procedure

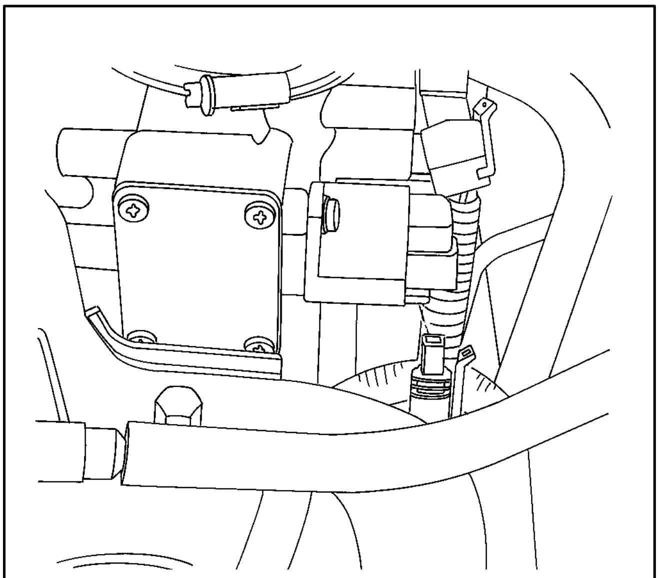
1. Disconnect the negative battery cable.
2. Disconnect the manifold air temperature (MAT) sensor connector.
3. Remove the MAT sensor.

Installation Procedure

1. Install the MAT sensor.

   Tighten

   Tighten the manifold air temperature sensor to 20 N•m (15 lb•ft).
2. Connect the MAT connector.
3. Connect the negative battery cable.



C102F071

IDLE AIR CONTROL VALVE (TYPICAL)

Removal Procedure

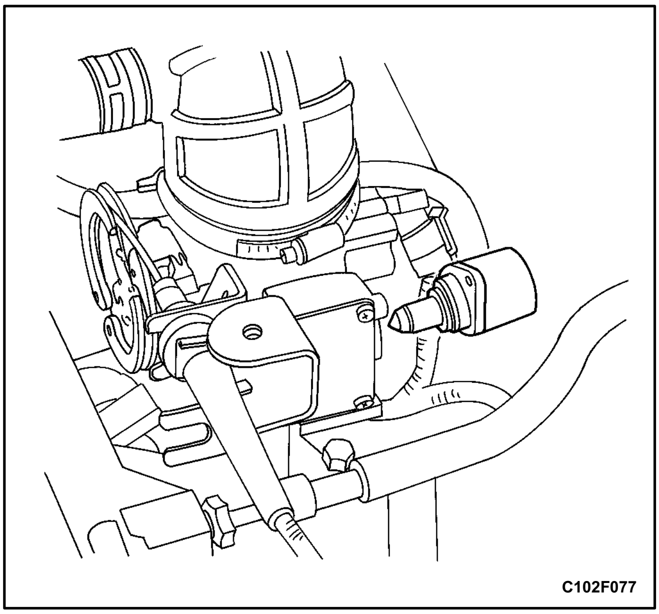
1. Disconnect the negative battery cable.
2. Remove the air intake resonator.
3. Disconnect the idle air control (IAC) valve connector.
4. Remove the IAC valve retaining bolts.

Notice: On IAC valves that have been in service, do not push on the valve pintle. The force required to move the pintle may damage the threads on the worm drive.

5. Remove the IAC valve.

Notice: Do not use methyl ethyl ketone because it can damage the parts.

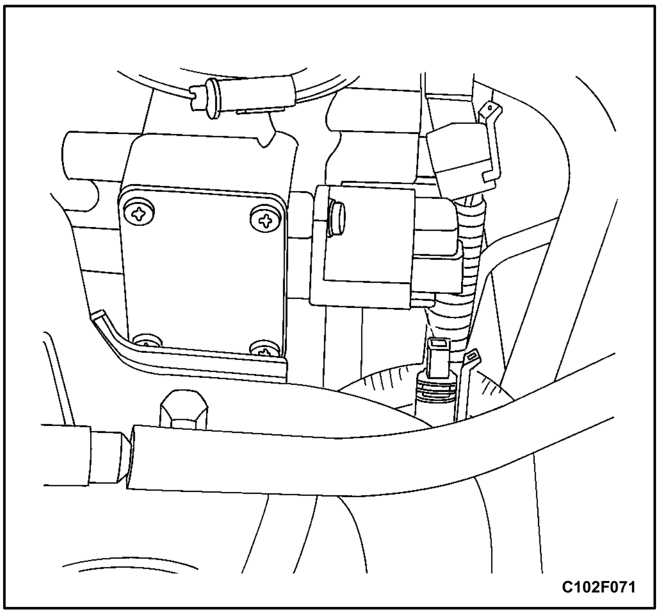
6. Clean the IAC valve O-ring seal area, the pintle valve seat, and the air passage with a suitable fuel system cleaner.



Installation Procedure

Important: If installing a new IAC valve, be sure to replace it with an identical part. The IAC valve pintle shape and diameter are designed for the specific application. Measure the distance between the tip of the IAC valve pintle and the mounting flange. If the distance is greater than 28 mm (1.1 inches), use finger pressure to slowly retract the pintle. The force required to retract the pintle will not damage the IAC valve. The purpose of the 28 mm (1.1 inch) setting is to prevent the IAC pintle from bottoming out on the pintle seat. This 28 mm (1.1 inch) setting is also an adequate setting for controlled idle on a restart.

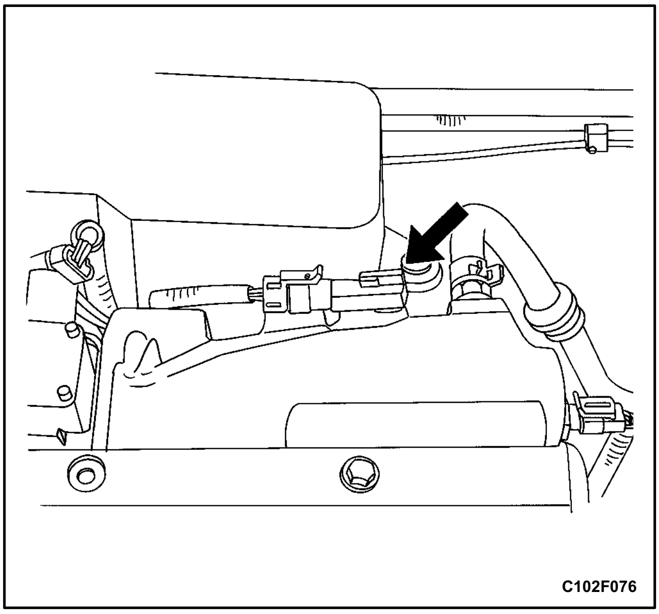
1. Lubricate a new O-ring with engine oil. Install the new O-ring onto the valve.
2. Install the IAC valve into the throttle body.



3. Install the IAC valve retaining bolts.

   Tighten

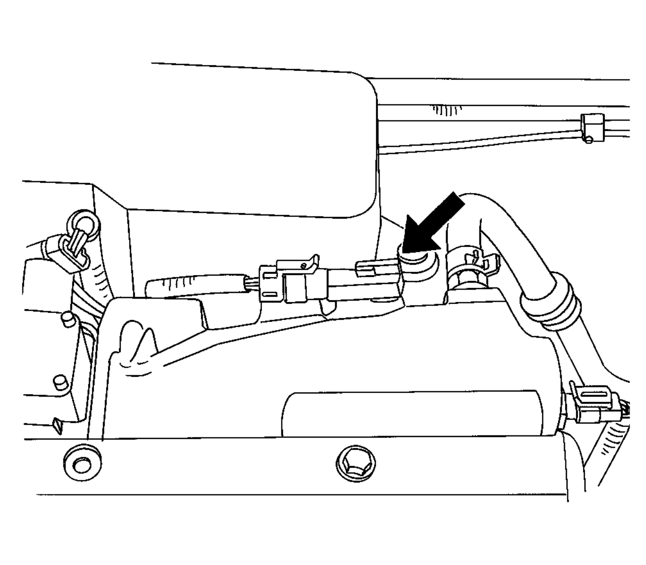
   Tighten the idle air control valve retaining bolts to 3 N•m (27 lb•in).
4. Connect the IAC valve connector.
5. Install the air intake resonator.
6. Connect the negative battery cable.
7. Start the engine and check for the proper idle speed.



MANIFOLD ABSOLUTE PRESSURE SENSOR (SOHC)

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the vacuum hose from the manifold absolute pressure (MAP) sensor.
3. Disconnect the MAP connector.
4. Remove the MAP sensor mounting bolt and the MAP sensor.



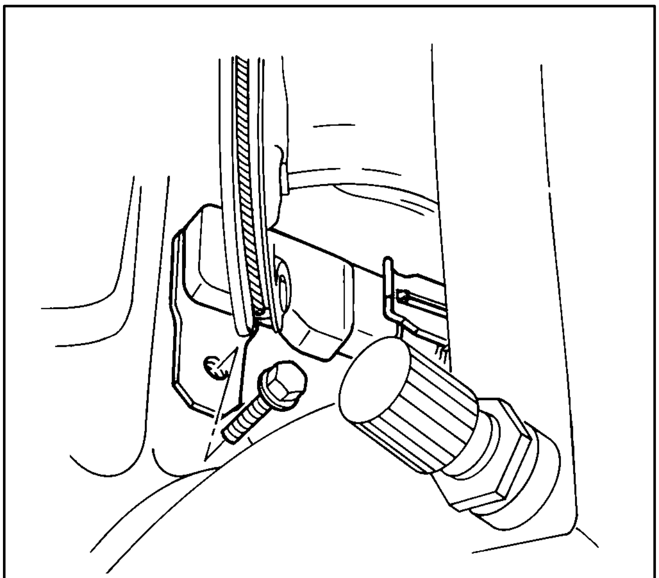
C102F076

Installation Procedure

1. Insert the MAP sensor into its mounting.
2. Install the bolt through the MAP sensor mounting.

   Tighten

   Tighten the manifold absolute pressure sensor retaining bolt to 10 N•m (89 lb•in).
3. Connect the MAP sensor connector.
4. Connect the vacuum hose to the MAP sensor.
5. Connect the negative battery cable.

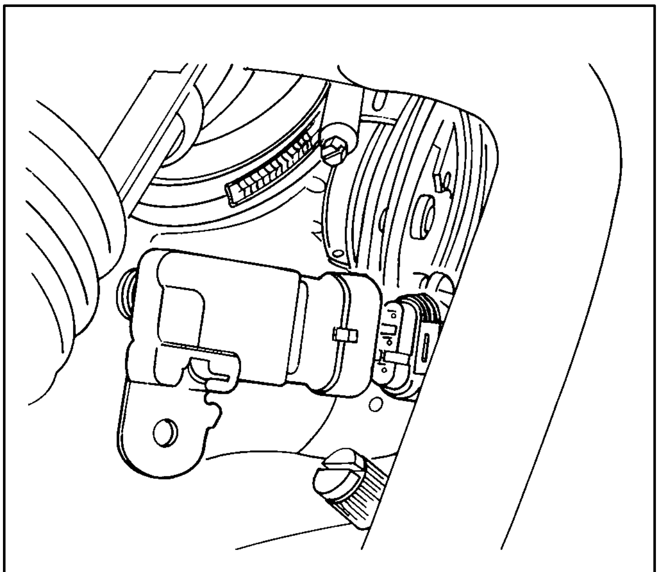


C302F103

MANIFOLD ABSOLUTE PRESSURE SENSOR (DOHC)

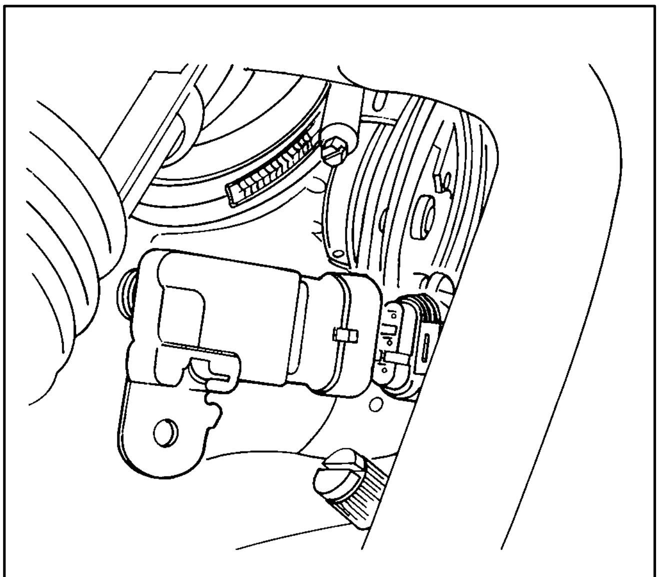
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the manifold absolute pressure (MAP) sensor bolt.



C302F104

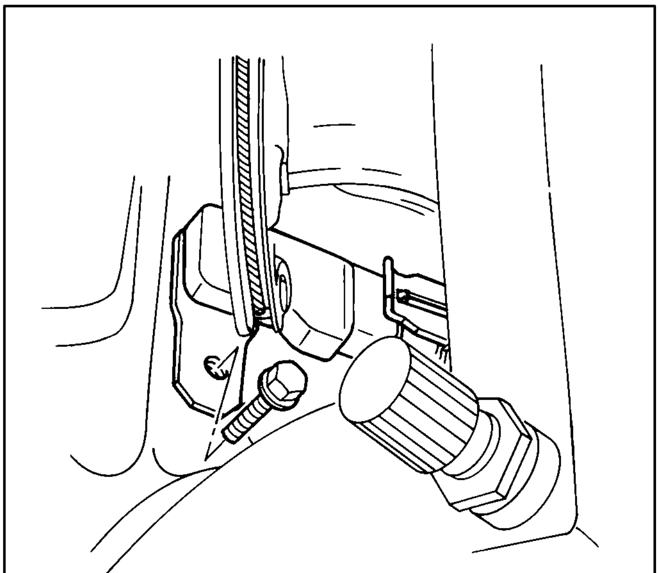
3. Remove the MAP sensor up and clear of the intake manifold recess.
4. Disconnect the MAP sensor connector.



C302F104

Installation Procedure

1. Connect the MAP sensor connector to the MAP sensor.
2. Install the MAP sensor into the intake manifold.

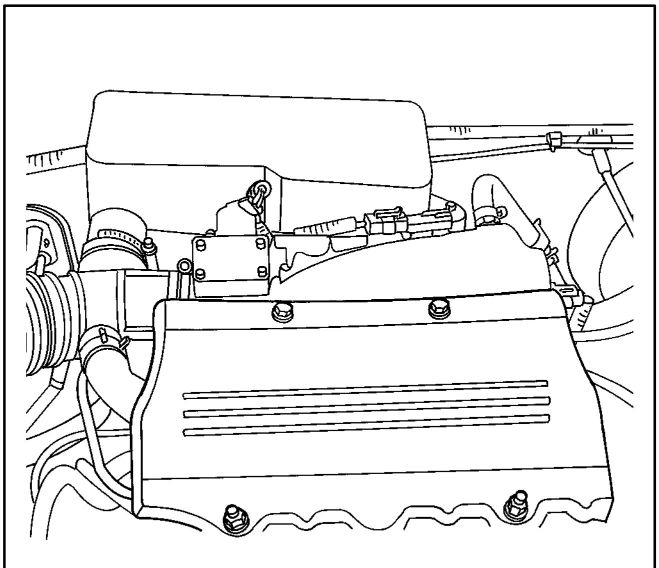


C302F103

3. Install the MAP sensor retaining bolt.

   Tighten

   Tighten the MAP sensor retaining bolt to 10 N•m (89 lb•in).
4. Connect the negative battery cable.

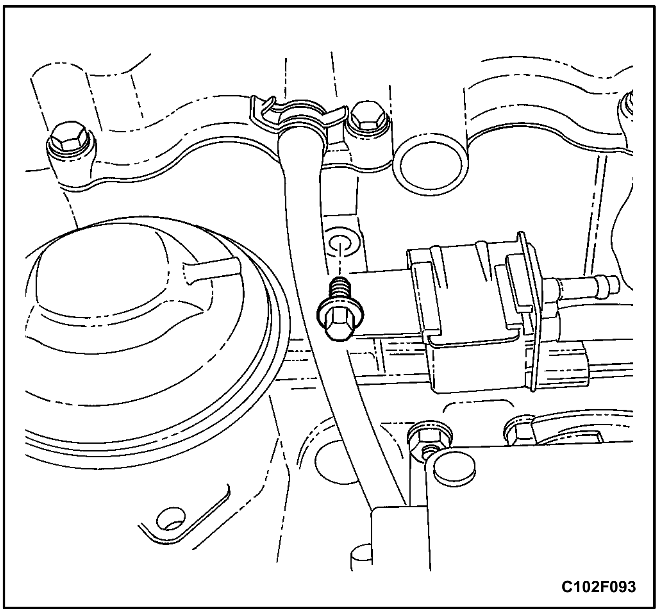


C102F063

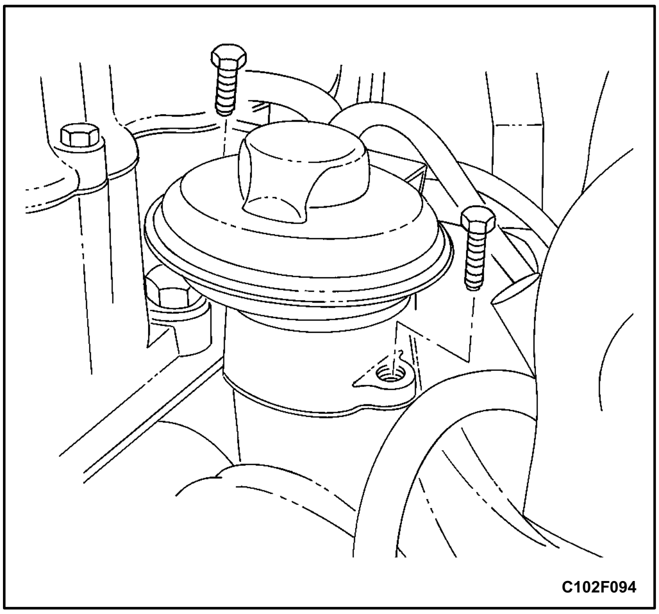
EXHAUST GAS RECIRCULATION VALVE (SOHC)

Removal Procedure

1. Remove the bolts and the fuel injector cover.
2. Remove the air intake tube and resonator.
3. Disconnect the vacuum hose from the exhaust gas recirculation (EGR) valve.
4. Remove the fuel rail. Refer to „Fuel Rail and Injectors (SOHC)” in this section.



5. Remove the canister purge solenoid bracket bolts and reposition the bracket.
6. Remove the bolts and the EGR valve.

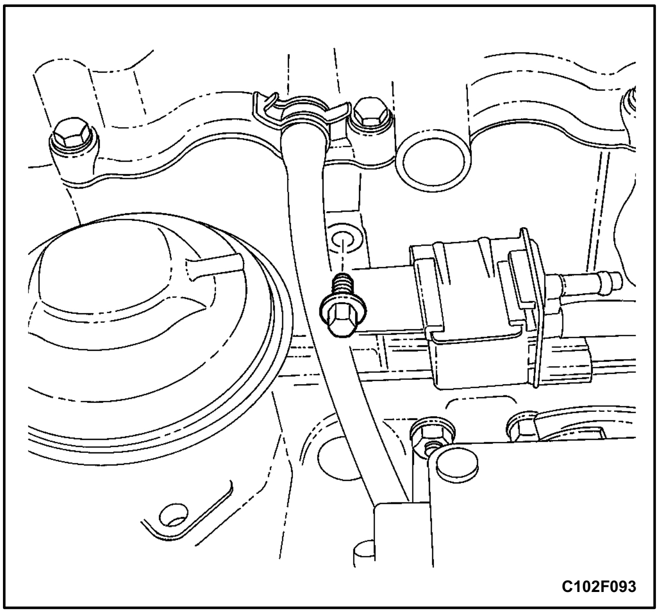


Installation Procedure

1. Install the EGR valve and the bolts.

Tighten

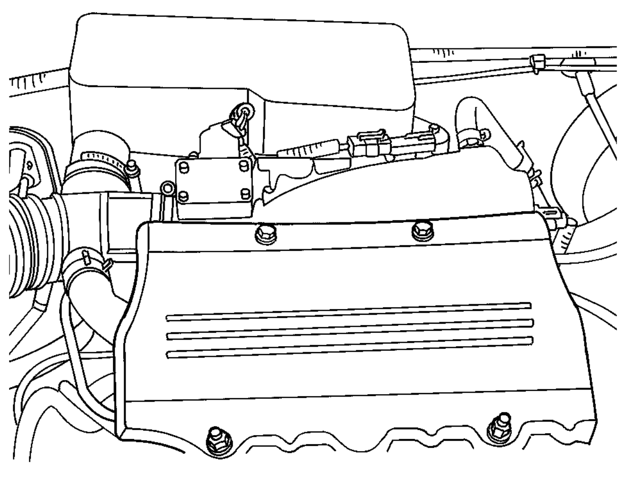
Tighten the EGR valve bolts to 20 N•m (15 lb•ft).



2. Install the canister purge solenoid bracket bolts.

Tighten

Tighten the canister purge solenoid bracket bolts to 5 N•m (44 lb•in).

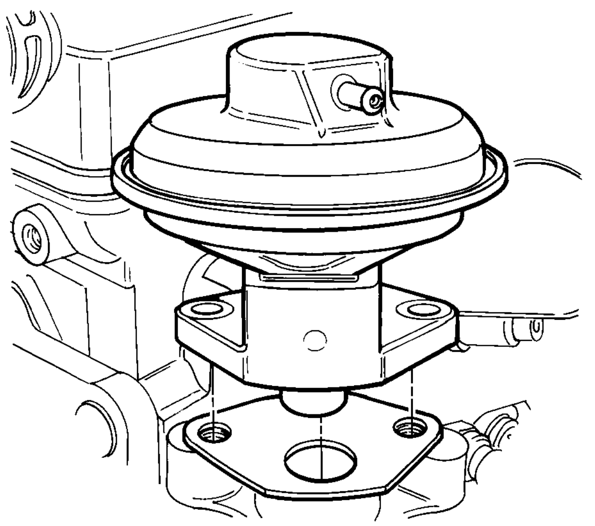


C102F063

3. Remove the fuel rail. Refer to „Fuel Rail and Injectors (SOHC)" in this section.
4. Connect the vacuum hose to the exhaust gas recirculation (EGR) valve.
5. Install the air intake tube and resonator.
6. Remove the fuel injector cover and the bolts.

Tighten

Tighten the fuel injector cover bolts to 10 N•m (89 lb•in).

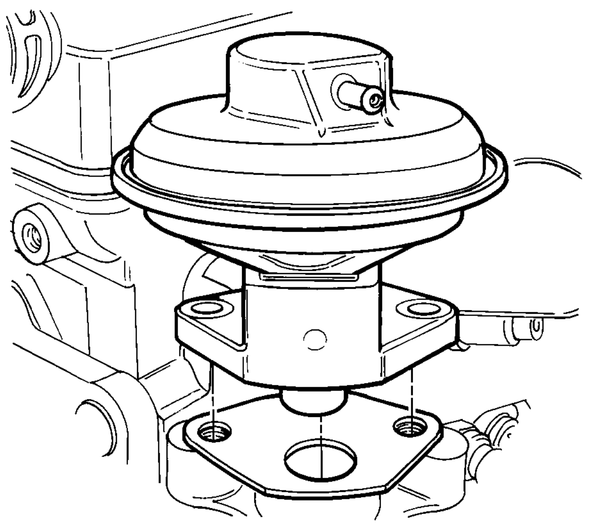


B102F017

EXHAUST GAS RECIRCULATION VALVE (DOHC)

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the vacuum hose from the exhaust gas recirculation (EGR) valve.
3. Remove the EGR valve retaining bolts.
4. Remove the EGR valve from the DIS ignition coil adapter.



B102F017

Installation Procedure

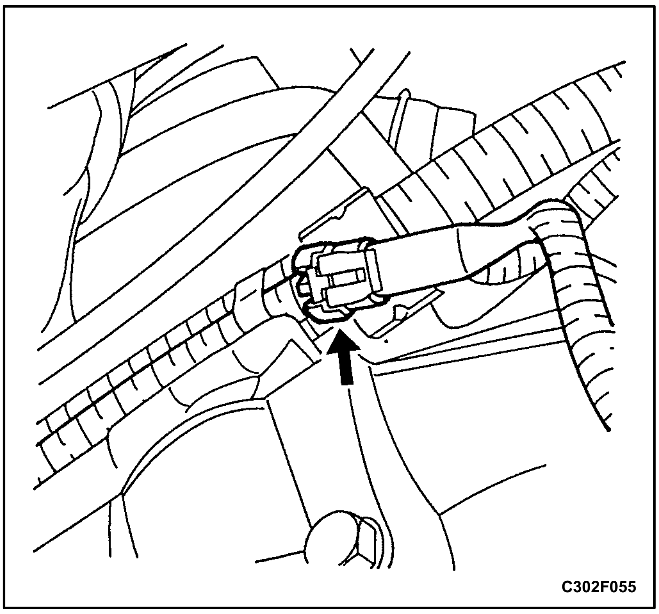
1. Clean the DIS ignition coil adapter mating surface.
2. Install a new EGR valve gasket.
3. Install the EGR valve with the bolts.

Tighten

Tighten the exhaust gas recirculation valve retaining bolts to 20 N•m (15 lb•ft).

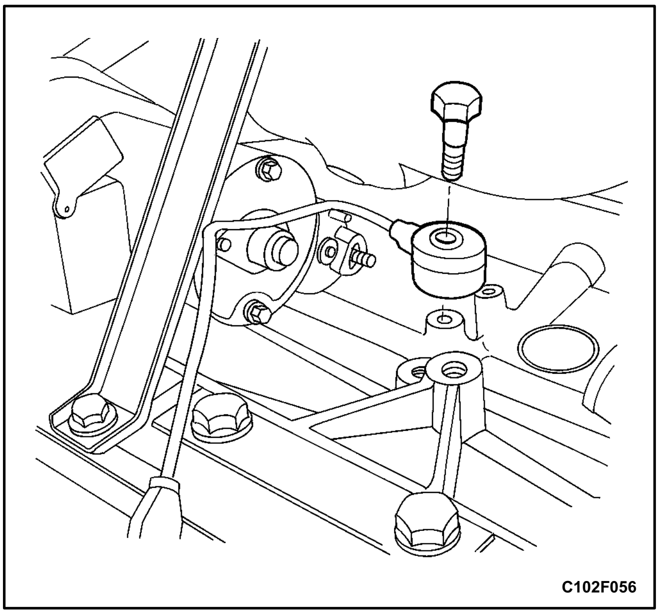
4. Connect the vacuum hose to the EGR valve.
5. Connect the negative battery cable.

KNOCK SENSOR (DOHC)

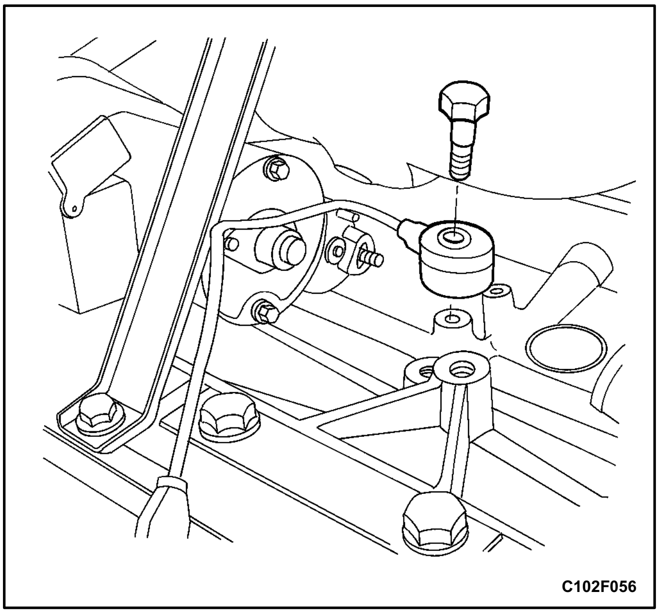


Removal Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Disconnect electrical connector at the knock sensor.



4. Remove the bolt and the knock sensor.

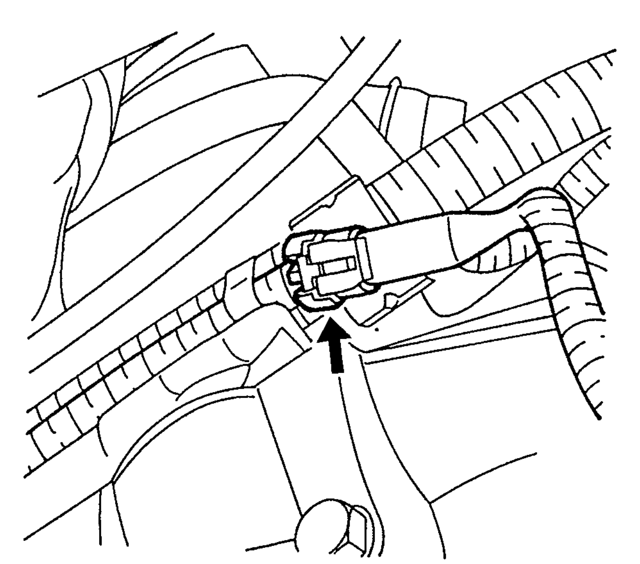


Installation Procedure

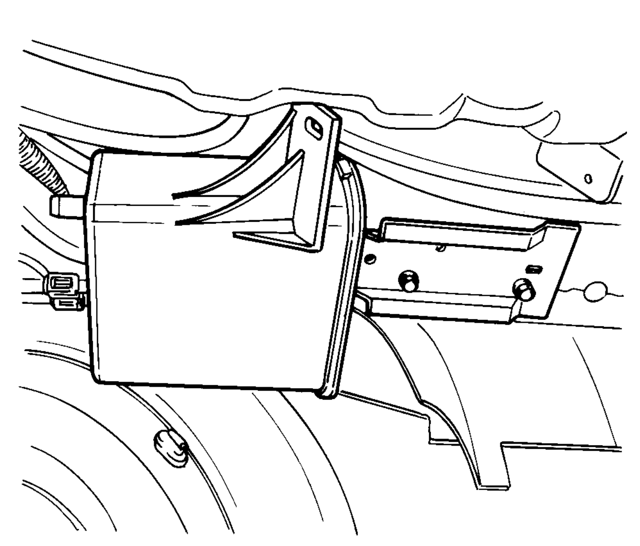
1. Install the knock sensor with the bolt.

Tighten

Tighten the knock sensor bolt to 20 N•m (15 lb•ft).


C302F055

2. Connect the electrical connector at the knock sensor.
3. Lower the vehicle.
4. Connect the negative battery cable.

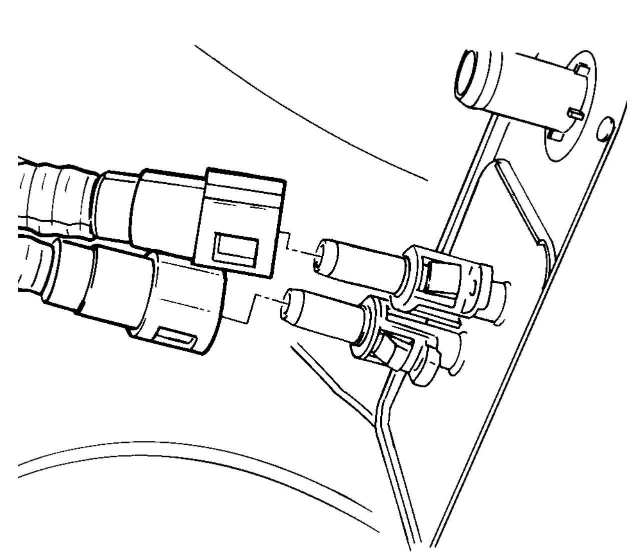

A102F020

EVAPORATIVE EMISSION CANISTER

Removal Procedure

Caution: Canister and vacuum hoses contain fuel vapors. Do not smoke in the area or permit an open flame.

1. Remove the canister protective cover.
2. Disconnect the canister fuel vapor hoses.
3. Remove the bolt that secures the canister flange to the vehicle.
4. Slide the canister out of the track holder.
5. Remove the canister.


A102F021

Installation Procedure

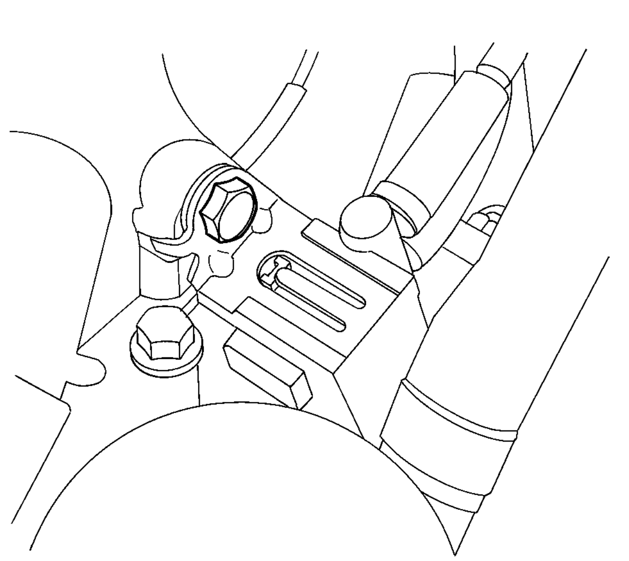
1. Insert the canister into the track and slide it into position.
2. Install the canister flange bolt.

   Tighten

   Tighten the evaporative emission canister flange bolt to 20 N•m (15 lb•ft).
3. Connect the canister fuel vapor hoses.
4. Install the canister protective cover.

   Tighten

   Tighten the evaporative emission canister protective cover to 8 N•m (71 lb•in).

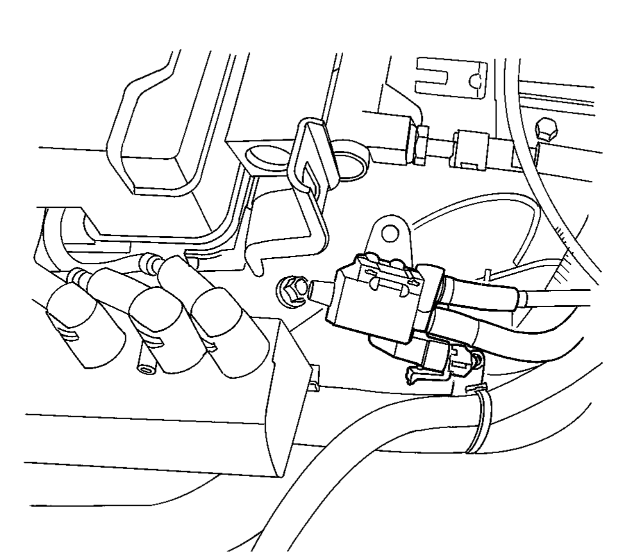


C102F061

CONTROLLED CANISTER PURGE SOLENOID

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the controlled canister purge (CCP) solenoid connector.
3. Disconnect the vacuum hoses from the CCP solenoid.
4. Remove the CCP solenoid bracket bolt from the intake manifold.
5. Unclip the CCP solenoid from the mounting bracket.



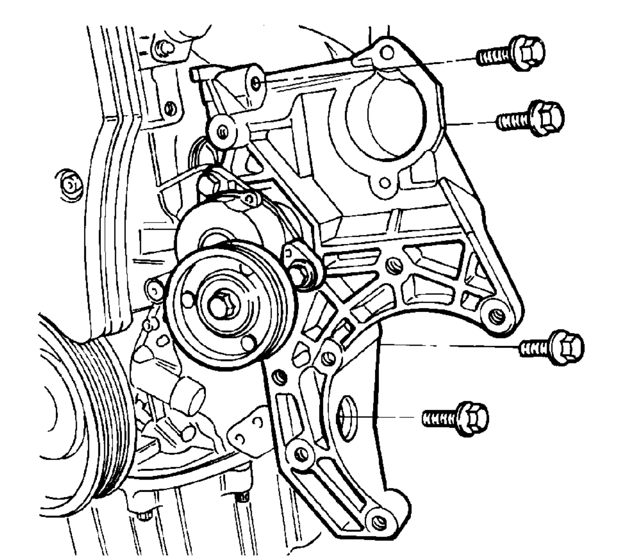
C102F062

Installation Procedure

1. Attach the CCP solenoid to the mounting bracket.
2. Install the CCP solenoid and the mounting bracket to the intake manifold with the bracket bolt.

   Tighten

   Tighten the controlled canister purge solenoid bracket bolt to 5 N•m (44 lb•in).
3. Connect the vacuum hoses to the CCP solenoid.
4. Connect the CCP solenoid connector.
5. Connect the negative battery cable.

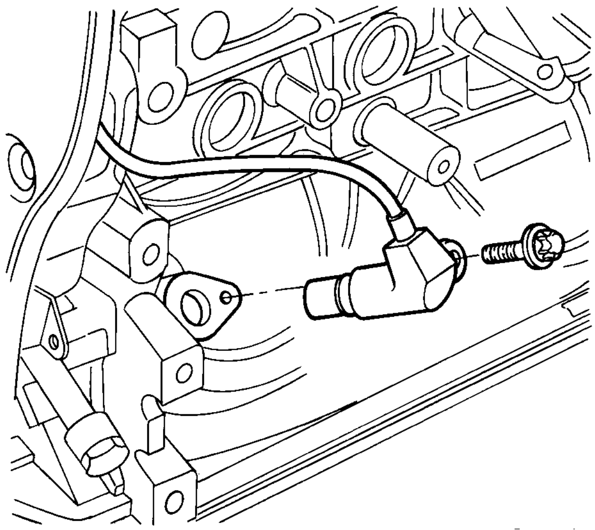


B102F025

CRANKSHAFT POSITION SENSOR (TYPICAL)

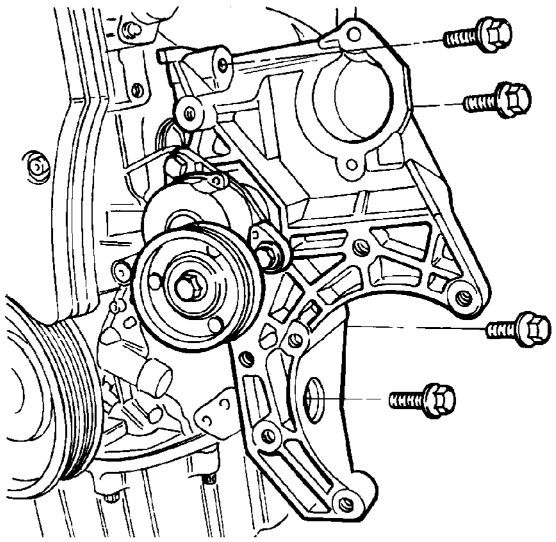
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the power steering pump, if equipped. Refer to *Section 6B, Power Steering Pump*.
3. Remove the A/C compressor. Refer to *Section 7D, Automatic Temperature Control Heating, Ventilation, and Air Conditioning System*.
4. Remove the rear A/C compressor mounting bracket bolts and the rear A/C compressor mounting bracket.
5. Remove the accessory mounting bracket by removing the bolts.
6. Remove the front timing belt cover on vehicles with an SOHC engine. Refer to *Section 1B, SOHC Engine Mechanical*.



B102F020

7. Disconnect the crankshaft position sensor (CPS) connector.
8. Remove the CPS retaining bolt.
9. Gently rotate and remove the CPS from the engine block.



B102F025

Installation Procedure

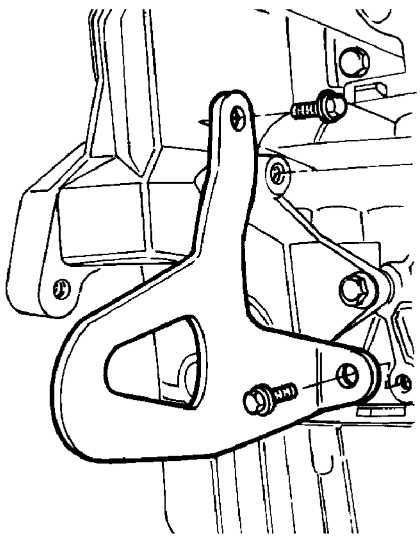
1. Insert the CPS into the engine block.
2. Install the CPS retaining bolt.

   Tighten

   Tighten the crankshaft position sensor retaining bolt to 10 N•m (89 lb•in).
3. Connect the CPS connector.
4. Install the front timing belt cover on vehicles with an SOHC engine. Refer to *Section 1B, SOHC Engine Mechanical.*
5. Install the accessory mounting bracket with the bolts.

   Tighten

   Tighten the accessory mounting bracket bolts to 35N•m (26 lbft).

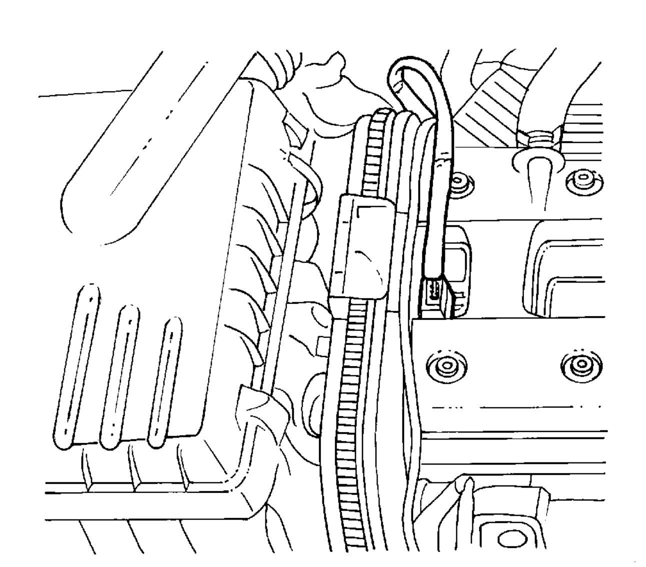


B102F026

6. Install the rear A/C mounting bracket.

   Tighten

   Tighten the rear A/C mounting bracket bolts to 35 N•m (26 lb•ft).
7. Install the A/C compressor. Refer to *Section 7D, Automatic Temperature Control Heating, Ventilation, and Air Conditioning System*.
8. Install the power steering pump. Refer to *Section 6B, Power Steering Pump*.
9. Connect the negative battery cable.

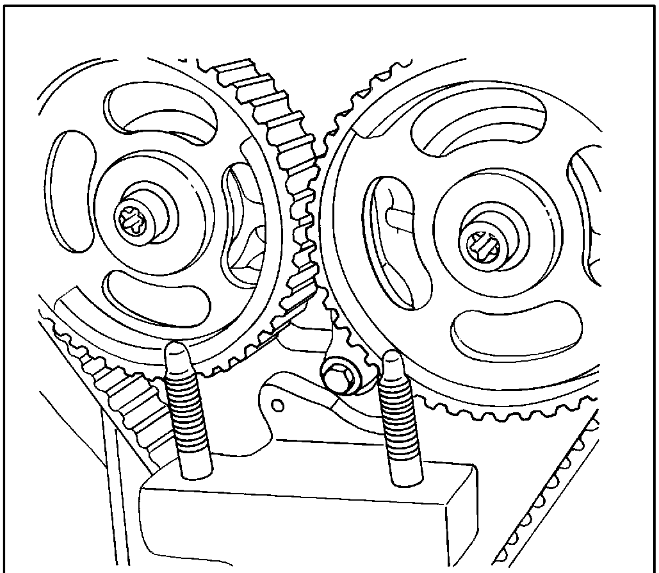


B402F049

CAMSHAFT POSITION SENSOR

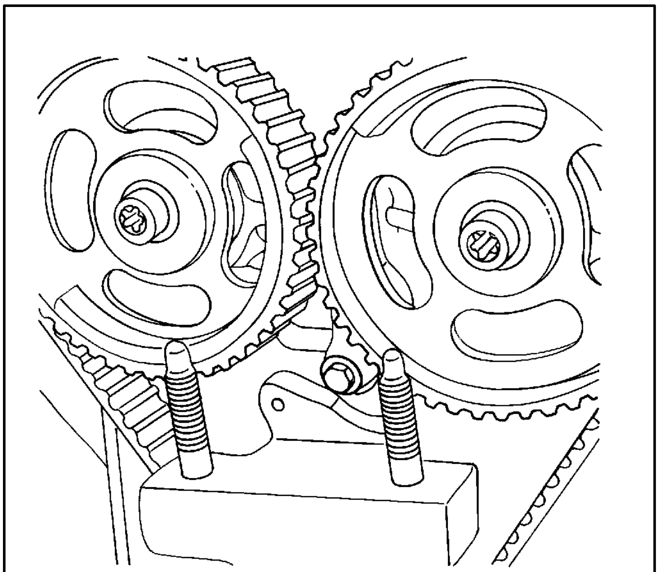
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Disconnect the sensor electrical connector.



B402F050

4. Remove the timing belt front cover. Refer to *Section 1C, DOHC Engine Mechanical.*
5. Remove the camshaft position sensor bolts.
6. Remove the camshaft position sensor from the top.



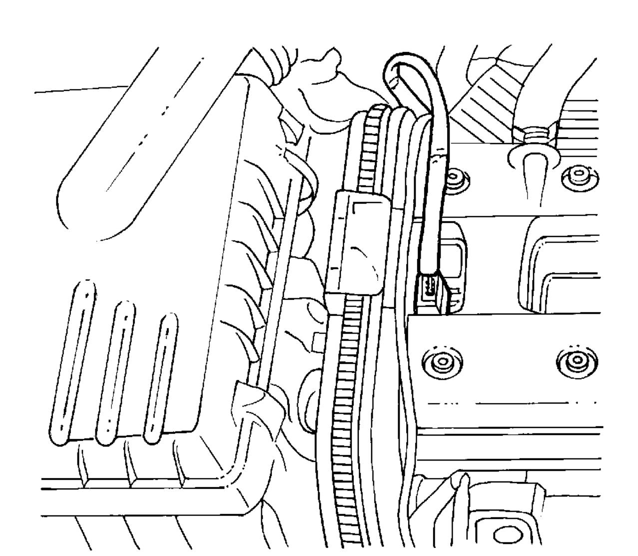
B402F050

Installation Procedure

1. Install the camshaft position sensor and bolts.

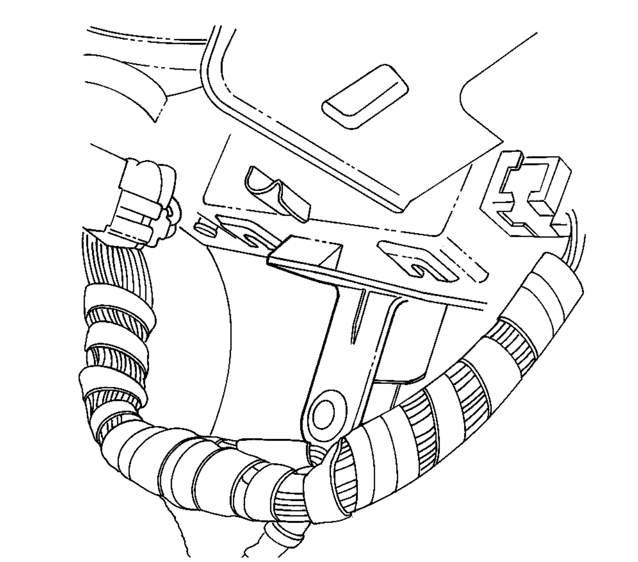
Tighten

Tighten the camshaft position bolts to 12 N•m (106 lb•in).



B402F049

2. Install the timing belt front cover, the crankshaft pulley, the accessory drive belt, and the air filter. Refer to *Section 1C, DOHC Engine Mechanical*.
3. Connect the sensor electrical connector.
4. Install the engine cover.
5. Connect the negative battery cable.

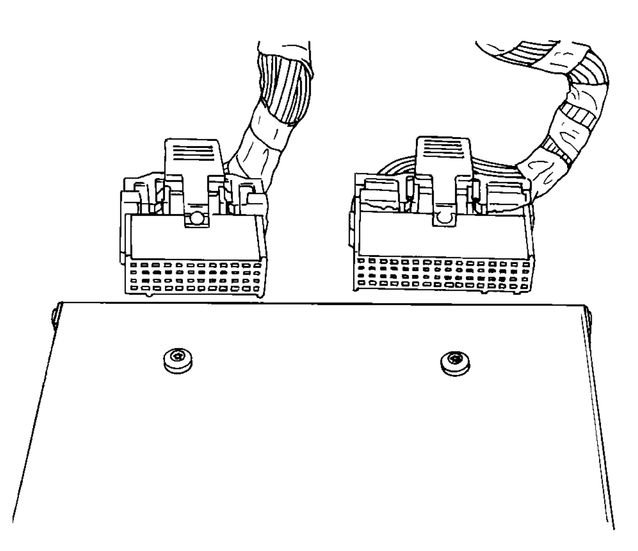


C102F080

ELECTRONIC CONTROL MODULE (TYPICAL)

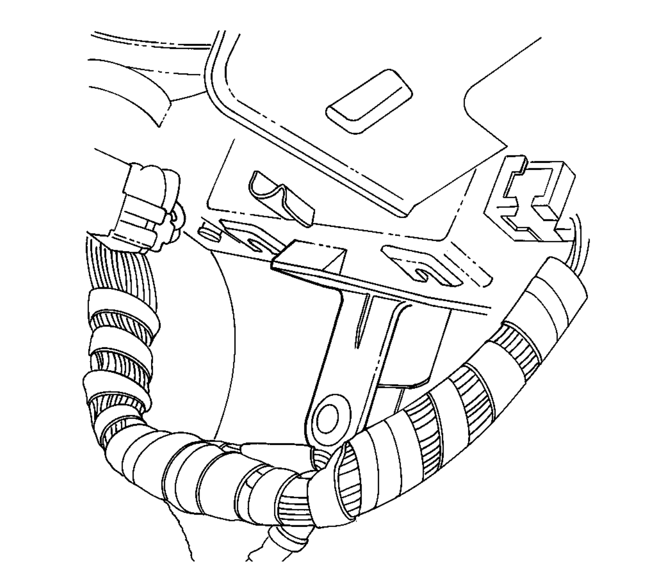
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the passenger side kick panel. Refer to *Section 9G, Interior Trim*.
3. Remove the electronic control module (ECM) bracket trim locks.
4. Pull the ECM down from the ECM mounting base.



B102F010

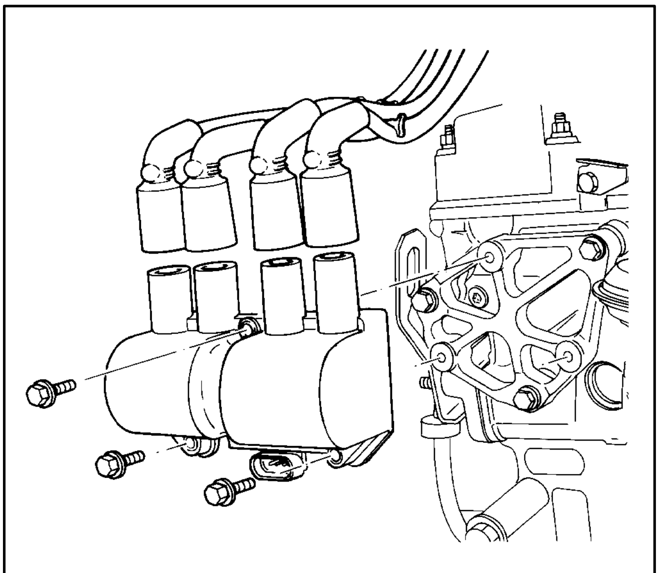
5. Disconnect the ECM connectors from the ECM.



C102F080

Installation Procedure

1. Connect the ECM connectors to the ECM.
2. Align the ECM into the mounting base.
3. Snap the ECM into its mounting base.
4. Install the ECM trim locks.
5. Install the passenger side kick panel. Refer to *Section 9G, Interior Trim*.
6. Connect the negative battery cable.

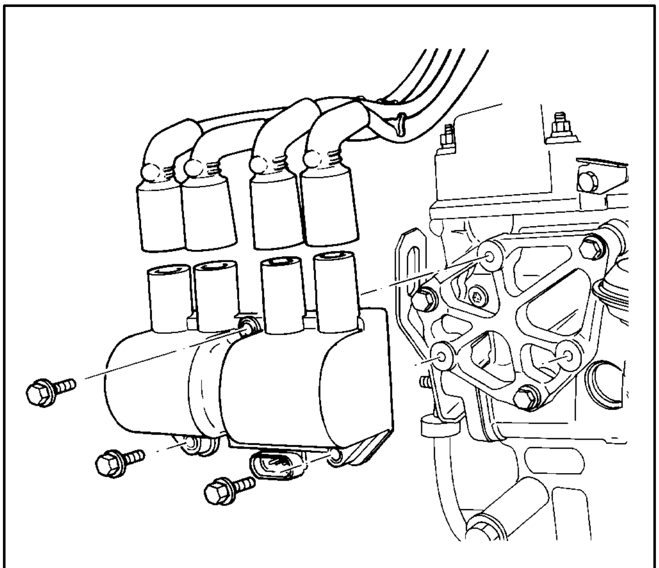


A102F011

DIRECT IGNITION SYSTEM IGNITION COIL (TYPICAL)

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the direct ignition system (DIS) ignition coil connector.
3. Note the ignition wire location and remove the ignition wires.
4. Remove the DIS ignition coil retaining bolts.
5. Remove the DIS ignition coil.



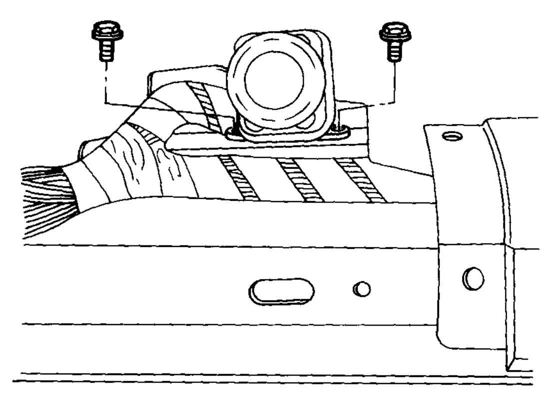
A102F011

Installation Procedure

1. Install the DIS ignition coil into the mounting location and install the retaining bolts.

   Tighten

   Tighten the DIS ignition coil retaining bolts to 10 N•m (89 lb•in).
2. Connect the DIS ignition coil connector.
3. Install the ignition wires.
4. Connect the negative battery cable.

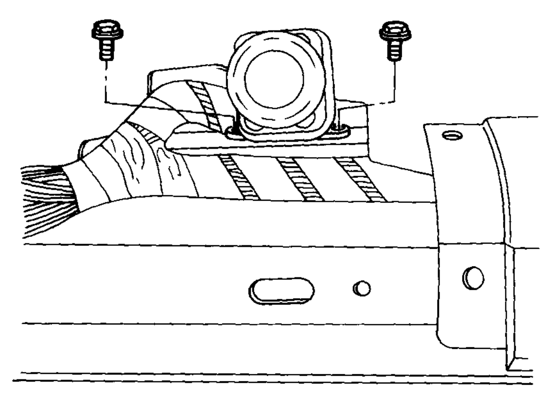


C202F102

FUEL CUTOFF SWITCH

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the passenger front rocker trim panel. Refer to *Section 9G, Interior Trim*.
3. Remove the lower Bpillar trim panel. Refer to *Section 9G, Interior Trim.*
4. Reposition the carpet.
5. Remove the fuel cutoff switch mounting bolts.
6. Disconnect the electrical connector at the fuel cutoff switch.



C202F102

Installation Procedure

1. Connect the electrical connector at the fuel cutoff switch.
2. Install the fuel cutoff switch mounting bolts.

Tighten

Tighten the fuel cutoff switch mounting bolts to 3 N•m (27 lb•in).

Important: The fuel cutoff switch may have to be reset in order to start the vehicle.

3. Reposition the carpet.
4. Install the lower Bpillar trim panel. Refer to *Section 9G, Interior Trim.*
5. Install the passenger front rocker trim panel. Refer to *Section 9G, Interior Trim.*
6. Connect the negative battery cable.

GENERAL DESCRIPTION AND SYSTEM OPERATION

IGNITION SYSTEM OPERATION

This ignition system does not use a conventional distributor and coil. It uses a crankshaft position sensor input to the electronic control module (ECM). The ECM then determines electronic spark timing (EST) and triggers the direct ignition system ignition coil.

This type of distributorless ignition system uses a ``waste spark'' method of spark distribution. Each cylinder is paired with the cylinder that is opposite it (1-4 or 2-3). The spark occurs simultaneously in the cylinder coming up on the compression stroke and in the cylinder coming up on the exhaust stroke. The cylinder on the exhaust stroke requires very little of the available energy to fire the spark plug. The remaining energy is available to the spark plug in the cylinder on the compression stroke.

These systems use the EST signal from the ECM to control the EST. The ECM uses the following information:

- Engine load (manifold pressure or vacuum).
- Atmospheric (barometric) pressure.
- Engine temperature.
- Intake air temperature.
- Crankshaft position.
- Engine speed (rpm).

DIRECT IGNITION SYSTEM IGNITION COIL

The direct ignition system (DIS) ignition coil is mounted near the rear of the camshaft carrier on the single overhead camshaft engine. On the dual overhead camshaft engine, the DIS ignition coil is mounted near the rear of the cylinder head. Each pair of terminals of the DIS ignition coil provides the spark for two spark plugs simultaneously. The DIS ignition coil is not serviceable and must be replaced as an assembly.

CRANKSHAFT POSITION SENSOR

This direct ignition system uses a magnetic crankshaft position sensor. This sensor protrudes through its mount to within approximately 1.3 mm (0.05 inch) of the crankshaft reluctor. The reluctor is a special wheel attached to the crankshaft with 58 slots machined into it, 57 of which are equally spaced in 6-degree intervals. The last slot is wider and serves to generate a „sync pulse." As the crankshaft rotates, the slots in the reluctor change the magnetic field of the sensor, creating an induced voltage pulse. The longer pulse of the 58th slot identifies a specific orientation of the crankshaft and allows the electronic control module (ECM) to determine the crankshaft orientation at all times. The ECM uses this information to generate timed ignition and injection pulses that it sends to the ignition coils and to the fuel injectors.

CAMSHAFT POSITION SENSOR

The camshaft position sensor (CMP) sends a CMP signal to the engine control module (ECM). The ECM uses this signal as a „sync pulse" to trigger the injectors in the proper sequence. The ECM uses the CMP signal to indicate the position of the #1 piston during its power stroke. This allows the ECM to calculate true sequential fuel injection mode of operation. If the ECM detects an incorrect CMP signal while the engine is running, Diagnostic Trouble Code (DTC) P0341 will set. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. As long as the fault is present, the engine can be restarted. It will run in the calculated sequential mode with a 1 in 6 chance of the injector sequence being correct.

IDLE AIR SYSTEM OPERATION

The idle air system operation is controlled by the base idle setting of the throttle body and the idle air control (IAC) valve.

The electronic control module (ECM) uses the IAC valve to set the idle speed dependent on conditions. The ECM uses information from various inputs, such as coolant temperature, manifold vacuum, etc., for the effective control of the idle speed.

FUEL CONTROL SYSTEM OPERATION (2.0L SOHC/DOHC)

The function of the fuel metering system is to deliver the correct amount of fuel to the engine under all operating conditions. The fuel is delivered to the engine by the individual fuel injectors mounted into the intake manifold near each cylinder.

The two main fuel control sensors are the manifold absolute pressure (MAP) sensor and the oxygen (O_2) sensor.

The MAP sensor measures or senses the intake manifold vacuum. Under high fuel demands, the MAP sensor reads a low vacuum condition, such as wide open throttle. The electronic control module (ECM) uses this information to enrich the mixture, thus increasing the fuel injector on-time, to provide the correct amount of fuel. When decelerating, the vacuum increases. This vacuum change is sensed by the MAP sensor and read by the ECM, which then decreases the fuel injector on-time due to the low fuel demand conditions.

The O_2 sensor is located in the exhaust manifold. The O_2 sensor indicates to the ECM the amount of oxygen in the exhaust gas and the ECM changes the air/fuel ratio to the engine by controlling the fuel injectors. The best air/fuel ratio to minimize exhaust emissions is 14.7 to 1, which allows the catalytic converter to operate most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a „closed loop" system.

The ECM uses voltage inputs from several sensors to determine how much fuel to provide to the engine. The fuel is delivered under one of several conditions, called ``modes.''

Starting Mode

When the ignition is turned ON, the ECM turns the fuel pump relay on for 2 seconds. The fuel pump then builds fuel pressure. The ECM also checks the coolant temperature sensor (CTS) and the throttle position sensor (TPS) and determines the proper air/fuel ratio for starting the engine. This ranges from 1.5 to 1 at –36°C (–33°F) coolant temperature to 14.7 to 1 at 94°C (201°F) coolant temperature. The ECM controls the amount of fuel delivered in the starting mode by changing how long the fuel injector is turned on and off. This is done by ``pulsing'' the fuel injectors for very short times.

Clear Flood Mode

If the engine floods with excessive fuel, it may be cleared by pushing the accelerator pedal down all the way. The ECM will then completely turn off the fuel by eliminating any fuel injector signal. The ECM holds this injector rate as long as the throttle stays wide open and the engine is below approximately 400 rpm. If the throttle position becomes less than approximately 80 percent, the ECM returns to the starting mode.

Run Mode

The run mode has two conditions called ``open loop'' and ``closed loop.''

Open Loop

When the engine is first started and it is above 400 rpm, the system goes into ``open loop'' operation. In ``open loop,'' the ECM ignores the signal from the oxygen sensor and calculates the air/fuel ratio based on inputs from the CTS and the MAP sensor. The ECM stays in „open loop" until the following conditions are met:

- The O_2 sensor has a varying voltage output, showing that it is hot enough to operate properly.
- The CTS is above a specified temperature.
- A specific amount of time has elapsed after starting the engine.

Closed Loop

The specific values for the above conditions vary with different engines and are stored in the electronically erasable programmable read only memory (EEPROM). When these conditions are met, the system goes into „closed loop" operation. In „closed loop," the ECM calculates the air/fuel ratio (fuel injector ontime) based on the signal from the oxygen sensor. This allows the air/fuel ratio to stay very close to 14.7 to 1.

Acceleration Mode

The ECM responds to rapid changes in throttle position and airflow and provides extra fuel.

Deceleration Mode

The ECM responds to changes in throttle position and airflow and reduces the amount of fuel. When deceleration is very fast, the ECM can cut off fuel completely for short periods of time.

Battery Voltage Correction Mode

When battery voltage is low, the ECM can compensate for a weak spark delivered by the ignition module by using the following methods:

- Increasing the fuel injector pulse width.
- Increasing the idle speed rpm.
- Increasing the ignition dwell time.

Fuel Cut-Off Mode

No fuel is delivered by the fuel injectors when the ignition is off. This prevents dieseling or engine runon. Also, the fuel is not delivered if there are no reference pulses received from the CPS. This prevents flooding.

FUEL CONTROL SYSTEM OPERATION (2.2L DOHC)

The function of the fuel metering system is to deliver the correct amount of fuel to the engine under all operating conditions. The fuel is delivered to the engine by the individual fuel injectors mounted into the intake manifold near each cylinder.

The main fuel control sensors are the manifold absolute pressure (MAP) sensor, the oxygen (O2S 1) sensor, and the heated oxygen sensor (HO2S 2).

The MAP sensor measures or senses the intake manifold vacuum. Under high fuel demands, the MAP sensor reads a low vacuum condition, such as wide open throttle. The engine control module (ECM) uses this information to enrich the mixture, thus increasing the fuel injector ontime, to provide the correct amount of fuel. When decelerating, the vacuum increases. This vacuum change is sensed by the MAP sensor and read by the ECM, which then decreases the fuel injector ontime due to the low fuel demand conditions.

The O2S 1 sensor is located in the exhaust manifold. The HO2S 2 is located in the exhaust pipe. The oxygen sensors indicate to the ECM the amount of oxygen in the exhaust gas, and the ECM changes the air/fuel ratio to the engine by controlling the fuel injectors. The best air/fuel ratio to minimize exhaust emissions is 14.7 to 1, which allows the catalytic converter to operate most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system iscalled a „closed loop" system.

The ECM uses voltage inputs from several sensors to determine how much fuel to provide to the engine. The fuel is delivered under one of several conditions, called ``modes.''

Starting Mode

When the ignition is turned ON, the ECM turns the fuel pump relay on for 2 seconds. The fuel pump then builds fuel pressure. The ECM also checks the engine coolant temperature sensor (CTS) and the throttle position sensor and determines the proper air/fuel ratio for starting the engine. This ranges from 1.5 to 1 at –36°C (–33°F) coolant temperature to 14.7 to 1 at 94°C (201°F) coolant temperature. The ECM controls the amount of fuel delivered in the starting mode by changing how long the fuel injector is turned on and off. This is done by ``pulsing'' the fuel injectors for very short times.

Clear Flood Mode

If the engine floods with excessive fuel, it may be cleared by pushing the accelerator pedal down all the way. The ECM will then completely turn off the fuel by eliminating any fuel injector signal. The ECM holds this injector rate as long as the throttle stays wide open and the engine is below approximately 400 rpm. If the throttle position becomes less than approximately 80 percent, the ECM returns to the starting mode.

Run Mode

The run mode has two conditions called ``open loop'' and ``closed loop.''

Open Loop

When the engine is first started and it is above 400 rpm, the system goes into ``open loop'' operation. In ``open loop,'' the ECM ignores the signal from the O2S 1 and calculates the air/fuel ratio based on inputs from the CTS sensor and the MAP sensor. The ECM stays in „open loop" until the following conditions are met:

- The O2S 1 has a varying voltage output, showing that it is hot enough to operate properly.
- The CTS sensor is above a specified temperature.
- A specific amount of time has elapsed after starting the engine.

Closed Loop

The specific values for the above conditions vary with different engines and are stored in the electronically erasable programmable read only memory (EEPROM). When these conditions are met, the system goes into „closed loop" operation. In „closed loop," the ECM calculates the air/fuel ratio (fuel injector ontime) based on the signals from the oxygen sensors. This allows the air/fuel ratio to stay very close to 14.7 to 1.

Acceleration Mode

The ECM responds to rapid changes in throttle position and airflow and provides extra fuel.

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Battery Voltage Correction Mode

When battery voltage is low, the ECM can compensate for a weak spark delivered by the ignition module by using the following methods:

- Increasing the fuel injector pulse width.
- Increasing the idle speed rpm.
- Increasing the ignition dwell time.

Fuel CutOff Mode

No fuel is delivered by the fuel injectors when the ignition is off. This prevents dieseling or engine run-on. Also, the fuel is not delivered if there are no reference pulses received from the CPS sensor. This prevents flooding.

EVAPORATIVE EMISSION CONTROL SYSTEM OPERATION

The basic evaporative emission (EVAP) control system used is the charcoal canister storage method. This method transfers fuel vapor from the fuel tank to an activated carbon (charcoal) storage canister which holds the vapors when the vehicle is not operating. When the engine is running, the fuel vapor is purged from the carbon element by intake airflow and consumed in the normal combustion process.

Gasoline vapors from the fuel tank flow into the tube labeled TANK. These vapors are absorbed into the carbon. The canister is purged by electronic control module (ECM) when the engine has been running for a specified amount of time. Air is drawn into the canister and mixed with the vapor. This mixture is then drawn into the intake manifold.

The ECM supplies a ground to energize the controlled canister purge solenoid valve. This valve is pulse width modulated (PWM) or turned on and off several times a second. The controlled canister purge PWM duty cycle varies according to operating conditions determined by mass airflow, fuel trim, and intake air temperature.

Poor idle, stalling, and poor driveability can be caused by the following conditions:

- An inoperative controlled canister purge valve.
- A damaged canister.
- Hoses that are split, cracked, or not connected to the proper tubes.

EVAPORATIVE EMISSION CANISTER

The evaporative emission canister is an emission control device containing activated charcoal granules. The evaporative emission canister is used to store fuel vapors from the fuel tank. Once certain conditions are met, the electronic control module (ECM) activates the controlled canister purge solenoid, allowing the fuel vapors to be drawn into the engine cylinders and burned.

POSITIVE CRANKCASE VENTILATION CONTROL SYSTEM OPERATION

A positive crankcase ventilation (PCV) control system is used to provide complete use of the crankcase vapors. Fresh air from the air cleaner is supplied to the crankcase. The fresh air is mixed with blowby gases which is then passed through a vacuum hose into the intake manifold.

Periodically inspect the hoses and the clamps. Replace any crankcase ventilation components as required.

A restricted or plugged PCV hose may cause the following conditions:

- Rough idle.
- Stalling or low idle speed.
- Oil leaks.
- Oil in the air cleaner.
- Sludge in the engine.

A leaking PCV hose may cause the following conditions:

- Rough idle.
- Stalling.
- High idle speed.

COOLANT TEMPERATURE SENSOR

The coolant temperature sensor (CTS) is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance (100,000 ohms at −40°C [−40°F]) while high temperature causes low resistance (70 ohms at 130°C [266°F]).

The electronic control module (ECM) supplies 5 volts to the coolant sensor through a resistor in the ECM and measures the change in voltage. The voltage will be high when the engine is cold, and low when the engine is hot. By measuring the change in voltage, the ECM can determine the coolant temperature. The engine coolant temperature affects most of the systems that the ECM controls. A failure in the coolant sensor circuit should set a diagnostic trouble code 14 or 15. Remember, these diagnostic trouble codes indicate a failure in the coolant temperature circuit, so proper use of the chart will lead either to repairing a wiring problem or to replacing the sensor to repair a problem properly.

THROTTLE POSITION SENSOR

The throttle position sensor (TPS) is a potentiometer connected to the throttle shaft of the throttle body. The TPS electrical circuit consists of a 5volt supply line and a ground line, both provided by the electronic control module (ECM). The ECM calculates the throttle position by monitoring the voltage on this signal line. The TPS output changes as the accelerator pedal is moved, changing the throttle valve angle. At a closed throttle position, the output of the TPS is low, about 0.5 volt. As the throttle valve opens, the output increases so that, at wide open throttle (WOT), the output voltage will be about 5 volts.

The ECM can determine fuel delivery based on throttle valve angle (driver demand). A broken or loose TPS can cause intermittent bursts of fuel from the injector and an unstable idle, because the ECM thinks the throttle is moving. A problem in any of the TPS circuits should set a diagnostic trouble code 21 or 22. Once the diagnostic trouble code is set, the ECM will substitute a default value for the TPS and some vehicle performance will return. A diagnostic trouble code 21 will cause a high idle speed.

OXYGEN SENSOR (2.0L SOHC/DOHC)

The oxygen (O_2) sensor is mounted in the exhaust system where it can monitor the O_2 content of the exhaust gas stream. The oxygen content in the exhaust reacts with the sensor to produce a voltage output. This voltage ranges from approximately 0.1 volt (high O_2 - lean mixture) to 0.9 volt (low O_2 - rich mixture). This voltage can be measured with a digital voltmeter having at least 10 megohms input impedance. Use of standard shop type voltmeters will result in very inaccurate readings.

The electronic control module (ECM) monitors the O_2 sensor output and determines what changes are necessary in the fuel mixture command.

The O_2 sensor circuit sets a diagnostic trouble code 13 when it is open. A constant low voltage in the sensor circuit, indicating a lean mixture, sets a diagnostic trouble code 44. A constant high voltage, indicating a rich mixture, sets a diagnostic trouble code 45. Refer tothe diagnostic trouble code charts for conditions that could cause a lean or a rich system.

CATALYST MONITOR OXYGEN SENSORS (2.2L DOHC)

Threeway catalytic converters are used to control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx). The catalyst within the converters promotes a chemical reaction. This reaction oxidizes the HC and CO present in the exhaust gas and converts them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx by converting it to nitrogen. The ECM can monitor this process using the Bank 1 Sensor 1 and Bank 1 Sensor 2 sensors. These sensors produce an output signal which indicates the amount of oxygen present in the exhaust gas entering and leaving the threeway converter. This indicates the catalyst's ability to efficiently convert exhaust gasses. If the catalyst is operating efficiently, the Bank 1 Sensor 1 sensor signals will be more active than the signals produced by the Bank 1 Sensor 2 sensor. The catalyst monitor sensors operate the same way as the fuel control sensors. The sensors' main function is catalyst monitoring, but they also have a limited role in fuel control. If a sensor output indicates a voltage either above or below the 450 mv bias voltage for an extended period of time, the engine control module (ECM) will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the Bank 1 Sensor 1 sensor circuit will set DTC P0131, P0132, P0133 or P0134 depending on the special condition. A problem with the Bank 1 Sensor 2 sensor signal will set DTC P0137, P0138, P0140 or P0141 depending on the special condition.

A fault in the heated oxygen sensor heater element or its ignition feed or ground will result in lower oxygen sensor response. This may cause incorrect catalyst monitor diagnostic results.

EXHAUST GAS RECIRCULATION VALVE

The exhaust gas recirculation (EGR) system is used on engines equipped with an automatic transaxle to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperature. The main element of the system is the EGR valve operated by vacuum. The EGR valve feeds small amounts of exhaust gas into the intake manifold to decrease combustion temperature. The amount of exhaust gas recirculated is controlled by variations in vacuum and exhaust back pressure. If too much exhaust gas enters, combustion will not take place. For this reason, very little exhaust gas is allowed to pass through the valve, especially at idle.

The EGR valve is usually open under the following conditions:

- Warm engine operation.
- Above idle speed.

Results of Incorrect Operation

Too much EGR flow tends to weaken combustion, causing the engine to run roughly or to stop. With too much EGR flow at idle, cruise, or cold operation, any of the following conditions may occur:

- The engine stops after a cold start.
- The engine stops at idle after deceleration.
- The vehicle surges during cruise.
- Rough idle.

If the EGR valve stays open all the time, the engine may not idle. Too little or no EGR flow allows combustion temperatures to get too high during acceleration and load conditions. This could cause the following conditions:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.

MANIFOLD AIR TEMPERATURE SENSOR

The manifold air temperature (MAT) sensor is a thermistor, a resistor which changes value based on the temperature of the air entering the engine. Low temperature produces a high resistance (100,000 ohms at −40°C [−40°F]), while high temperature causes a low resistance (70 ohms at 130°C [266°F]).

The electronic control module (ECM) provides 5 volts to the MAT sensor through a resistor in the ECM and measures the change in voltage to determine the MAT. The voltage will be high when the manifold air is cold and low when the air is hot. The ECM knows the intake MAT by measuring the voltage.

The MAT sensor is also used to control spark timing when the manifold air is cold.

A failure in the MAT sensor circuit sets a diagnostic trouble code 23 or 25.

IDLE AIR CONTROL VALVE

Notice: Do not attempt to remove the protective cap and readjust the stop screw. Misadjustment may result in damage to the idle air control (IAC) valve or to the throttle body.

The IAC valve is mounted on the throttle body where it controls the engine idle speed under the command of the electronic control module (ECM). The ECM sends voltage pulses to the IAC valve motor windings, causing the IAC valve pintle to move in or out a given distance (a step or count) for each pulse. The pintle movement controls the airflow around the throttle valves which, in turn, control the engine idle speed.

The desired idle speeds for all engine operating conditions are programmed into the calibration of the ECM. These programmed engine speeds are based on the coolant temperature, the park/neutral switch status, the vehicle speed, the battery voltage, and the A/C system pressure, if equipped.

The ECM „learns" the proper IAC valve positions to achieve warm, stabilized idle speeds (rpm) desired for the various conditions (park/neutral or drive, A/C on or off, if equipped). This information is stored in ECM „keep alive" memories (information is retained after the ignition is turned off). All other IAC valve positioning is calculated based on these memory values. As a result, engine variations due to wear and variations in the minimum throttle valve position (within limits) do not affect engine idle speeds. This system provides correct idle control under all conditions. This also means that disconnecting power to the ECM can result in incorrect idle control or the necessity to partially press the accelerator when starting until the ECM relearns idle control.

Engine idle speed is a function of total airflow into the engine based on the IAC valve pintle position, the throttle valve opening, and the calibrated vacuum loss through accessories. The minimum throttle valve position is set at the factory with a stop screw. This setting allows enough airflow by the throttle valve to cause the IAC valve pintle to be positioned a calibrated number of steps (counts) from the seat during „controlled" idle operation. The minimum throttle valve position setting on this engine should not be considered the „minimum idle speed," as on other fuel injected engines. The throttle stop screw is covered with a plug at the factory following adjustment.

If the IAC valve is suspected as being the cause of improper idle speed, refer to „Idle Air Control System Check" in this section.

MANIFOLD ABSOLUTE PRESSURE SENSOR

The manifold absolute pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load and speed changes and converts these to a voltage output.

A closed throttle on engine coast down produces a relatively low MAP output. MAP is the opposite of vacuum. When manifold pressure is high, vacuum is low. The MAP sensor is also used to measure barometric pressure. This is performed as part of MAP sensor calculations. With the ignition ON and the engine not running, the electronic control module (ECM) will read the manifold pressure as barometric pressure and adjust the air/fuel ratio accordingly. This compensation for altitude allows the system to maintain driving performance while holding emissions low. The barometric function will update periodically during steady driving or under a wide open throttle condition. In the case of a fault in the barometric portion of the MAP sensor, the ECM will set to the default value.

A failure in the MAP sensor circuit sets a diagnostic trouble code 33 or 34.

The following tables show the difference between absolute pressure and vacuum related to MAP sensor output, which appears as the top row of both tables.

MAP

Volts	4.9	4.4	3.8	3.3	2.7	2.2	1.7	1.1	0.6	0.3	0.3
kPa	100	90	80	70	60	50	40	30	20	10	0
in. Hg	29.6	26.6	23.7	20.7	17.7	14.8	11.8	8.9	5.9	2.9	0

VACUUM

Volts	4.9	4.4	3.8	3.3	2.7	2.2	1.7	1.1	0.6	0.3	0.3
kPa	0	10	20	30	40	50	60	70	80	90	100
in. Hg	0	2.9	5.9	8.9	11.8	14.8	17.7	20.7	23.7	26.7	29.6

ELECTRONIC CONTROL MODULE

The electronic control module (ECM), located inside the passenger kick panel, is the control center of the fuel injection system. It constantly looks at the information from various sensors and controls the systems that affect the vehicle's performance. The ECM also performs the diagnostic functions of the system. It can recognize operational problems, alert the driver through the service engine soon (SES), and store diagnostic trouble code(s) which identify the problem areas to aid the technician in making repairs.

There are no serviceable parts in the ECM. The calibrations are stored in the ECM in the programmable read only memory (PROM).

The ECM supplies either 5 or 12 volts to power the sensors or switches. This is done through resistances in the ECM which are so high in value that a test light will not come on 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. You must use a digital voltmeter with a 10 megohm input impedance to get accurate voltage readings. The ECM controls output circuits such as the fuel injectors, the idle air control (IAC) valve, the A/C clutch relay, etc., by controlling the ground circuit through transistors or a device called a „quaddriver."

FUEL INJECTOR

The multiport fuel injection (MPFI) assembly is a solenoid-operated device controlled by the electronic control module (ECM) that meters pressurized fuel to a single engine cylinder. The ECM energizes the fuel injector or solenoid to a normally closed ball or pintle valve. This allows fuel to flow into the top of the injector, past the ball or pintle valve, and through a recessed flow director plate at the injector outlet.

The director plate has six machined holes that control the fuel flow, generating a conical spray pattern of finely atomized fuel at the injector tip. Fuel from the tip is directed at the intake valve, causing it to become further atomized and vaporized before entering the combustion chamber. A fuel injector which is stuck partially open would cause a loss of fuel pressure after the engine is shut down. Also, an extended crank time would be noticed on some engines. Dieseling could also occur because some fuel could be delivered to the engine after the ignition is turned off.

FUEL CUTOFF SWITCH

The fuel cutoff switch is a safety device. In the event of a collision or a sudden impact, it automatically cuts off the fuel supply and activates the door lock relay. After the switch has been activated, it must be reset in order to restart the engine. Reset the fuel cutoff switch by pressing the rubber top of the switch. The switch is located near the right side of the passenger's seat.

KNOCK SENSOR (DOHC)

The knock sensor detects abnormal knocking in the engine. The sensor is mounted in the engine block near the cylinders. The sensor produces an AC output voltage which increases with the severity of the knock.

This signal is sent to the electronic control module (ECM). The ECM then adjusts the ignition timing to reduce the spark knock.

STRATEGY BASED DIAGNOSTICS

Strategy Based Diagnostics

The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician on how to proceed with a diagnosis:

- Verify the customer complaint. To verify the customer complaint, the technician should know the normal operation of the system.
- Perform preliminary checks as follows:
  - Conduct a thorough visual inspection.
  - Review the service history.
  - Detect unusual sounds or odors.
  - Gather diagnostic trouble code (DTC) information to achieve an effective repair.
- Check bulletins and other service information. This includes videos, newsletters, etc.
- Refer to service information (manual) system check(s).
- Refer to service diagnostics.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

Re-examine the complaint.

When the complaint cannot be successfully found or isolated, a re-evaluation is necessary. The complaint should be re-verified and could be intermittent as defined in „Intermittents," or could be normal.

After isolating the cause, the repairs should be made. Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:

- Conditions noted by the customer.
- If a DTC was diagnosed, verify a repair by duplicating conditions present when the DTC was set as noted in the Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with On-Board Diagnostic (OBD) system diagnostics. Following a repair, the technician should perform the following steps:

Important: Follow the steps below when you verify repairs on OBD systems. Failure to follow these steps could result in unnecessary repairs.

- Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Fame data will only be stored for an A or B type diagnostic and only if the Malfunction Indicator Lamp has been requested).
- Clear the DTC(s).
- Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
- Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

OBD SERVICEABILITY ISSUES

Based on the knowledge gained from On-Board Diagnostic (OBD) experience in the 1994 and 1995 model years, this list of non-vehicle faults that could affect the performance of the OBD system has been compiled. These non-vehicle faults vary from environmental conditions to the quality of fuel used. With the introduction of OBD across the entire passenger car and light-duty truck market in 1996, illumination of the Malfunction Indicator Lamp (MIL) due to a non-vehicle fault could lead to misdiagnosis of the vehicle, increased warranty expense and customer dissatisfaction. The following list of non-vehicle faults does not include every possible fault and may not apply equally to all product lines.

Fuel Quality

Fuel quality is not a new issue for the automotive industry, but its potential for turning on the MIL with OBD systems is new.

Fuel additives such as ``dry gas" and ``octane enhancers" may affect the performance of the fuel. If this results in an incomplete combustion or a partial burn, it will set Diagnostic Trouble Code (DTC) P0300. The Reed Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall months when severe ambient temperature swings occur. A high Reed Vapor Pressure could show up as a Fuel Trim DTC due to excessive canister loading. High vapor pressures generated in the fuel tank can also affect the Evaporative Emission diagnostic.

Using fuel with the wrong octane rating for your vehicle may cause driveability problems. Many of the major fuel companies advertise that using "premium" gasoline will improve the performance of your vehicle. Most premium fuels use alcohol to increase the octane rating of the fuel. Although alcohol-enhanced fuels may raise the octane rating, the fuel's ability to turn into vapor in cold temperatures deteriorates. This may affect the starting ability and cold driveability of the engine.

Low fuel levels can lead to fuel starvation, lean engine operation, and eventually engine misfire.

NonOEM Parts

The OBD system has been calibrated to run with Original Equipment Manufacturer (OEM) parts. Something as simple as a high performance-exhaust system that affects exhaust system back pressure could potentially interfere with the operation of the exhaust gas recirculation (EGR) valve and thereby turn on the MIL. Small leaks in the exhaust system near the post catalyst oxygen sensor can also cause the MIL to turn on.

Aftermarket electronics, such as cellular phones, stereos, and antitheft devices, may radiate electromagnetic interference (EMI) into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL.

Environment

Temporary environmental conditions, such as localized flooding, will have an effect on the vehicle ignition system. If the ignition system is rainsoaked, it can temporarily cause engine misfire and turn on the MIL.

Refueling

A new OBD checks the integrity of the entire evaporative emission system. If the vehicle is restarted after refueling and the fuel cap is not secured correctly, the OBD system will sense this as a system fault and turn on the MIL and set DTC P0440.

Vehicle Marshaling

The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL with a set DTC P0300.

Poor Vehicle Maintenance

The sensitivity of the OBD will cause the MIL to turn on if the vehicle is not maintained properly. Restricted air filters, fuel filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to OBD. Poor vehicle maintenance can not be classified as a ``nonvehicle fault,” but with the sensitivity of the OBD, vehicle maintenance schedules must be more closely followed.

Severe Vibration

The Misfire diagnostic measures small changes in the rotational speed of the crankshaft. Severe driveline vibrations in the vehicle, such as caused by an excessive amount of mud on the wheels, can have the same effect on crankshaft speed as misfire and, therefore, may set DTC P0300.

Related System Faults

Many of the OBD system diagnostics will not run if the engine control module (ECM) detects a fault on a related system or component. One example would be that if the ECM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until the Misfire fault was repaired. If the Misfire fault is severe enough, the catalytic converter can be damaged due to overheating and will never set a Catalyst DTC until the Misfire fault is repaired and the Catalyst diagnostic is allowed to run to completion. If this happens, the customer may have to make two trips to the dealership in order to repair the vehicle.

SERIAL DATA COMMUNICATIONS

Class II Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the ``Class II” communication system. Each bit of information can have one of two lengths: long or short. This allows vehicle wiring to be reduced by transmitting and receiving multiple signals over a single wire. The messages carried on Class II data streams are also prioritized. If two messages attempt to establish communications on the data line at the same time, only the message with higher priority will continue. The device with the lower priority message must wait. The most significant result of this regulation is that it provides scan tool manufacturers with the capability to access data from any make or model vehicle that is sold.

The data displayed on the other scan tool will appear the same, with some exceptions. Some scan tools will only be able to display certain vehicle parameters as values that are a coded representation of the true or actual value. On this vehicle, the scan tool displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

ON-BOARD DIAGNOSTIC (OBD)

On-Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Remember, a fuel trim Diagnostic Trouble Code (DTC) may be triggered by a list of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

COMPREHENSIVE COMPONENT MONITOR DIAGNOSTIC OPERATION

Comprehensive component monitoring diagnostics are required to monitor emissions-related input and output powertrain components.

Input Components

Input components are monitored for circuit continuity and out-of-range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable, i.e. Throttle Position sensor (TPS) that indicates high throttle position at low engine loads or Manifold Absolute Pressure (MAP) voltage. Input components may include, but are not limited to, the following sensors:

- Vehicle Speed Sensor (VSS).
- Crankshaft Position sensor (CPS).
- Throttle Position Sensor (TPS).
- Engine Coolant Temperature Sensor (CTS).
- Camshaft Position (CMP) sensor.
- MAP sensor.

In addition to the circuit continuity and rationality check, the CTS sensor is monitored for its ability to achieve a steady state temperature to enable closed loop fuel control.

Output Components

Output components are diagnosed for proper response to control module 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 circuit:

- Idle Air Control (IAC) Motor.
- Control module controlled Evaporative Emission (EVAP) Canister Purge Valve.
- A/C relays.
- Cooling fan relay.
- VSS output.
- Malfunction Indicator Lamp (MIL) control.
- Cruise control inhibit.

Refer to „Engine Control Module" and the sections on Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the Exhaust Gas Recirculation (EGR) diagnostic active test will force the EGR valve open during closed throttle deceleration and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any on-board test run by the Diagnostic Management System which may have an effect on vehicle performance or emission levels.

Warm-Up Cycle

A warm-up cycle means that engine at temperature must reach a minimum of 70°C (160°F) and rise at least 22°C (40°F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions-related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault.

Failure Records

Failure Records data is an enhancement of the OBD Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in on-board memory, while Freeze Frame stores information only for emission-related faults that command the MIL on.

COMMON OBD TERMS

Diagnostic

When used as a noun, the word diagnostic refers to any on-board test run by the vehicle's Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. There are many diagnostics, shown in the following list:

- Misfire.
- Oxygen sensors (O2S 1).
- Heated oxygen sensor (HO2S 2).
- Exhaust Gas Recirculation (EGR).
- Catalyst monitoring.

Enable Criteria

The term "enable criteria" is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run.

``Enable criteria" is another way of saying ``conditions required."

The enable criteria for each diagnostic is listed on the first page of the Diagnostic Trouble Code (DTC) description under the heading ``Conditions for Setting the DTC." Enable criteria varies with each diagnostic and typically includes, but is not limited to the following items:

- Engine speed.
- Vehicle speed.
- Engine Coolant Temperature.

- Manifold Absolute Pressure (MAP).
- Barometric Pressure (BARO).
- Intake Manifold Air Temperature (MAP).
- Throttle Position.
- High canister purge.
- Fuel trim.
- A/C on.

Trip

Technically, a trip is a keyon run keyoff cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostics are run when the vehicle is at operating temperature, some when the vehicle first starts up; some require that the vehicle cruise at a steady highway speed, some run only when the vehicle is at idle. Some run only immediately following a cold engine startup.

A trip then, is defined as a key-on-run-key-off cycle in which the vehicle is operated in such a way as to satisfy the enable criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are not multiple faults present.

There is a continuous selfdiagnosis on certain control functions. This diagnostic capability is complimented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a DTC is set, and the Malfunction Indicator Lamp (MIL) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) is required by OnBoard Diagnostics (OBD) to illuminate under a strict set of guidelines.

Basically, the MIL is turned on when the engine control module (ECM) detects a DTC that will impact the vehicle emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if an emissionsrelated diagnostic test indicates a malfunction has occurred. It will stay on until the system or component passes the same test for three consecutive trips with no emissions related faults.

Extinguishing the MIL

When the MIL is on, the Diagnostic Executive will turn off the MIL after three consecutive trips that a ``test passed" has been reported for the diagnostic test that originally caused the MIL to illuminate. Although the MIL has been turned off, the DTC will remain in the ECM memory (both Freeze Frame and Failure Records) until forty (40) warmup cycles after no faults have been completed.

If the MIL was set by either a fuel trim or misfirerelated DTC, additional requirements must be met. In addition to the requirements stated in the previous paragraph, these requirements are as follows:

- The diagnostic tests that are passed must occur with 375 rpm of the rpm data stored at the time the last test failed.
- Plus or minus ten percent of the engine load that was stored at the time the last test failed. Similar engine temperature conditions (warmed up or warming up) as those stored at the time the last test failed.

Meeting these requirements ensures that the fault which turned on the MIL has been corrected.

The MIL is on the instrument panel and has the following functions:

- It informs the driver that a fault affecting the vehicle's emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a system check, the MIL will come on with the key ON and the engine not running. When the engine is started, the MIL will turn OFF.
- When the MIL remains ON while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, an OBD System Check must be performed. The procedures for these checks are given in OBD System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

Data Link Connector (DLC)

The provision for communicating with the control module is the Data Link Connector (DLC). The DLC is used to connect to a scan tool. Some common uses of the scan tool are listed below:

- Identifying stored DTCs.
- Clearing DTCs.
- Performing output control tests.
- Reading serial data.

DTC TYPES

Each Diagnostic Trouble Code (DTC) is directly related to a diagnostic test. The Diagnostic Management System sets DTCs based on the failure of the tests during a trip or trips. Certain tests must fail two consecutive trips before the DTC is set. The following are the three types of DTCs and the characteristics of those codes:

Type A

- Emissions related.
- Requests illumination of the Malfunction Indicator. Lamp (MIL) of the first trip with a fail.
- Stores a History DTC on the first trip with a fail.
- Stores a Freeze Frame (if empty).
- Stores a Fail Record.
- Updates the Fail Record each time the diagnostic test fails.

Type B

- Emissions related.
- ``Armed” after one trip with a fail.
- ``Disarmed” after one trip with a pass.
- Requests illumination of the MIL on the second consecutive trip with a fail.
- Stores a History DTC on the second consecutive trip. with a fail (The DTC will be armed after the first fail).
- Stores a Freeze Frame on the second consecutive trip with a fail (if empty).

Type D (Type D non-emissions related are not utilized on certain vehicle applications).

- Non-Emissions related.
- Does not request illumination of any lamp.
- Stores a History DTC on the first trip with a fail .
- Does not store a Freeze Frame.
- Stores Fail Record when test fails.
- Updates the Fail Record each time the diagnostic test fails.

Important: Only four Fail Records can be stored. Each Fail Record is for a different DTC. It is possible that there will not be Fail Records for every DTC if multiple DTCs are set.

Special Cases of Type B Diagnostic Tests

Unique to the misfire diagnostic, the Diagnostic Executive has the capability of alerting the vehicle operator to potentially damaging levels of misfire. If a misfire condition exists that could potentially damage the catalytic converter as a result of high misfire levels, the Diagnostic Executive will command the MIL to ``flash” as a rate of once per seconds during those the time that the catalyst damaging misfire condition is present.

Fuel trim and misfire are special cases of Type B diagnostics. Each time a fuel trim or misfire malfunction is detected, engine load, engine speed, and engine coolant temperature are recorded.

When the ignition is turned OFF, the last reported set of conditions remain stored. During subsequent ignition cycles, the stored conditions are used as a reference for similar conditions. If a malfunction occurs during two consecutive trips, the Diagnostic Executive treats the failure as a normal Type B diagnostic, and does not use the stored conditions. However, if a malfunction occurs on two non-consecutive trips, the stored conditions are compared with the current conditions. The MIL will then illuminate under the following conditions:

- When the engine load conditions are within 10% of the previous test that failed.
- Engine speed is within 375 rpm, of the previous test that failed.
- CTS is in the same range as the previous test that failed.

READING DIAGNOSTIC TROUBLE CODES

The procedure for reading diagnostic trouble code(s) (DTC) is to use a diagnostic scan tool. When reading DTC(s), follow instructions supplied by tool manufacturer.

Clearing Diagnostic Trouble Codes

Important: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory. If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the ``warm-up” cycles with no further faults detected, the DTC will automatically be cleared from the engine control module (ECM) memory.

To clear DTCs, use the diagnostic scan tool. When a scan tool is not available, DTCs can also be cleared by disconnecting one of the following sources for at least thirty (30) seconds:

Notice: To prevent system damage, the ignition key must be OFF when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery ECM connectors, etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on-board memory data, such as preset radio tuning.)

DTC Modes

On On-Board Diagnostic (OBD) passenger cars there are five options available in the scan tool DTC mode to display the enhanced information available. A description of the new modes, DTC Info and Specific DTC, follows. After selecting DTC, the following menu appears:

- DTC Info.
- Specific DTC.
- Freeze Frame.
- Fail Records (not all applications).
- Clear Info.

The following is a brief description of each of the sub menus in DTC Info and Specific DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the scan tool.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information. There are seven choices. The service manual may instruct the technician to test for

DTCs in a certain manner. Always follow published service procedures.

To get a complete description of any status, press the ``Enter” key before pressing the desired F-key. For example, pressing ``Enter” then an F-key will display a definition of the abbreviated scan tool status.

DTC Status

This selection will display any DTCs that have not run during the current ignition cycle or have reported a test failure during this ignition up to a maximum of 33 DTCs. DTC tests which run and pass will cause that DTC number to be removed from the scan tool screen.

Fail This Ign. (Fail This Ignition)

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the ECM's history memory. It will not display Type B DTCs that have not requested the Malfunction Indicator Lamp (MIL). It will display all type A and B DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

Last Test Fail

This selection will display only DTCs that have failed the last time the test ran. The last test may have run during a previous ignition cycle if a type A or type B DTC is displayed. For type C and type D DTCs, the last failure must have occurred during the current ignition cycle to appear as Last Test Fail.

MIL Request

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B DTCs only after the MIL has been requested.

Not Run SCC (Not Run Since Code Clear)

This option will display up to 33 DTCs that have not run since the DTCs were last cleared. Since the displayed DTCs have not run, their condition (passing or failing) is unknown.

Test Fail SCC (Test Failed Since Code Clear)

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed more than 40 warm-up cycles before this option is selected will not be displayed.

Specific DTC Mode

This mode is used to check the status of individual diagnostic tests by DTC number. This selection can be accessed if a DTC has passed, failed or both. Many OBD DTC mode descriptions are possible because of the extensive amount of information that the diagnostic executive monitors regarding each test. Some of the many possible descriptions follow with a brief explanation.

The ``F2” key is used, in this mode, to display a description of the DTC. The ``Yes” and ``No” keys may also be used to display more DTC status information. This selection will only allow entry of DTC numbers that are supported by the vehicle being tested. If an attempt is, made to enter DTC numbers for tests which the diagnostic executive does not recognize, the requested information will not be displayed correctly and the scan tool may display an error message. The same applies to using the DTC trigger option in the Snapshot mode. If an invalid DTC is entered, the scan tool will not trigger.

Failed Last Test

This message display indicates that the last diagnostic test failed for the selected DTC. For type A and type B DTCs, this message will be displayed during subsequent ignition cycles until the test passes or DTCs are cleared. For type C and type D DTCs, this message will clear when the ignition is cycled.

Failed Since Clear

This message display indicates that the DTC has failed at least once within the last 40 warm-up cycles since the last time DTCs were cleared.

Failed This Ig. (Failed This Ignition)

This message display indicates that the diagnostic test has failed at least once during the current ignition cycle. This message will clear when DTCs are cleared or the ignition is cycled.

History DTC

This message display indicates that the DTC has been stored in memory as a valid fault. A DTC displayed as a History fault may not mean that the fault is no longer present. The history description means that all the conditions necessary for reporting a fault have been met (maybe even currently), and the information was stored in the control module memory.

MIL Requested

This message display indicates that the DTC is currently causing the MIL to be turned ON. Remember that only type A and type B DTCs can request the MIL. The MIL request cannot be used to determine if the DTC fault conditions are currently being experienced. This is because the diagnostic executive will require up to three trips during which the diagnostic test passes to turn OFF the MIL.

Not Run Since Cl (Not Run Since Cleared)

This message display indicates that the selected diagnostic test has not run since the last time DTCs were cleared. Therefore, the diagnostic test status (passing or failing) is unknown. After DTCs are cleared, this message will continue to be displayed until the diagnostic test runs.

Not Run This Ig. (Not Run This Ignition)

This message display indicates that the selected diagnostic test has not run during this ignition cycle.

Test Ran and Passed

This message display indicates that the selected diagnostic test has done the following:

- Passed the last test.
- Run and passed during this ignition cycle.
- Run and passed since DTCs were last cleared.

If the indicated status of the vehicle is ``Test Ran and Passed" after a repair verification, the vehicle is ready to be released to the customer.

If the indicated status of the vehicle is ``Failed This Ignition" after a repair verification, then the repair is incomplete and further diagnosis is required.

Prior to repairing a vehicle, status information can be used to evaluate the state of the diagnostic test, and to help identify an intermittent problem. The technician can conclude that although the MIL is illuminated, the fault condition that caused the code to set is not present. An intermittent condition must be the cause.

PRIMARY SYSTEM BASED DIAGNOSTICS

There are primary system-based diagnostics which evaluate the system operation and its effect on vehicle emissions. The primary system-based diagnostics are listed below with a brief description of the diagnostic function:

Oxygen Sensor Diagnosis

The fuel control oxygen sensor (O2S 1) is diagnosed for the following conditions:

- 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.

The catalyst monitor heated oxygen sensor (HO2S 2) is diagnosed for the following conditions:

- Heater performance (time to activity on cold start).
- Signal fixed low during steady state conditions or power enrichment (hard acceleration when a rich mixture should be indicated).
- Signal fixed high during steady state conditions or deceleration mode (deceleration when a lean mixture should be indicated).
- Inactive sensor (output steady at approx. 438 mv).

If the O2S 1 pigtail wiring, connector or terminal are damaged, the entire O2S 1 assembly must be replaced. Do not attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have clean reference air provided to it. This clean air reference is obtained by way of the O2S 1 wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade the O2S 1 performance.

Misfire Monitor Diagnostic Operation

The misfire monitor diagnostic is based on crankshaft rotational velocity (reference period) variations. The engine control module (ECM) determines crankshaft rotational velocity using the crankshaft position sensor (CPS) and the camshaft position (CMP) sensor. When a cylinder misfires, the crankshaft slows down momentarily. By monitoring the CPS and CMP sensor signals, the ECM can calculate when a misfire occurs.

For a non-catalyst damaging misfire, the diagnostic will be required to monitor a misfire present for between 1000-3200 engine revolutions.

For catalyst damaging misfire, the diagnostic will respond to misfire within 200 engine revolutions.

Rough roads may cause false misfire detection. A rough road will cause torque to be applied to the drive wheels and drive train. This torque can intermittently decrease the crankshaft rotational velocity. This may be falsely detected as a misfire.

A rough road sensor, or ``G sensor," works together with the misfire detection system. The G sensor produces a voltage that varies along with the intensity of road vibrations. When the ECM detects a rough road, the misfire detection system is temporarily disabled.

Misfire Counters

Whenever a cylinder misfires, the misfire diagnostic counts the misfire and notes the crankshaft position at the time the misfire occurred. These ``misfire counters" are basically a file on each engine cylinder. A current and a history misfire counter are maintained for each cylinder. The misfire current counters (Misfire Cur #1-4) indicate the number of firing events out of the last 200 cylinder firing events which were misfires. The misfire current counter will display real time data without a misfire DTC stored. The misfire history counters (Misfire Hist #1-4) indicate the total number of cylinder firing events which were misfires. The misfire history counters will display 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC P0300 is set, the misfire history counters will be updated every 200 cylinder firing events. A misfire counter is maintained for each cylinder.

If the misfire diagnostic reports a failure, the diagnostic executive reviews all of the misfire counters before reporting a DTC. This way, the diagnostic executive reports the most current information.

When crankshaft rotation is erratic, a misfire condition will be detected. Because of this erratic condition, the data that is collected by the diagnostic can sometimes incorrectly identify which cylinder is misfiring.

Use diagnostic equipment to monitor misfire counter data on OBD compliant vehicles. Knowing which specific cylinder(s) misfired can lead to the root cause, even when dealing with a multiple cylinder misfire. Using the information in the misfire counters, identify which cylinders are misfiring. If the counters indicate cylinders numbers 1 and 4 misfired, look for a circuit or component common to both cylinders number 1 and 4.

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.
- Low fuel.

- Fuel-fouled spark plugs.
- Basic engine fault.

Fuel Trim System Monitor Diagnostic Operation

This 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 averages of short-term fuel trim values and long-term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.

The fuel trim system diagnostic also conducts an intrusive test. This test determines if a rich condition is being caused by excessive fuel vapor from the Evaporative Emission (EVAP) canister. In order to meet OBD requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e., engine idle high due to a small vacuum leak or rough idle due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S 2 DTC may set). Use a scan tool to observe fuel trim counts while the problem is occurring.

A fuel trim DTC may be triggered by a number of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Fuel Trim Cell Diagnostic Weights

No fuel trim DTC will set regardless of the fuel trim counts in cell 0 unless the fuel trim counts in the weighted cells are also outside specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S 2 DTC may set). Use a scan tool to observe fuel trim counts while the problem is occurring.

OCTANE NUMBER CONNECTOR

The octane number connector (white) is located under the passenger seat next to the electronic control module (ECM). The connector is a jumper harness that signals the octane rating of the fuel to the ECM. Four settings are available. The vehicle is shipped from the factory with a label attached to the jumper harness showing the original octane rating on the ECM. The ECM alters fuel delivery and spark timing based on the octane number settings. The following table shows which terminals to jump on the octane number connector to determine the correct fuel octane rating. Terminal 2 is ground on the octane number connector.

Octane Number Selecting (IEFI-6)

	95	91	87	83
ECM Terminal D12	Open	Open	Ground	Ground
ECM Terminal D13	Ground	Open	Open	Ground

Octane Number Selecting (ITMS-6F)

	95	91	87	83
Octane Switch 1 (ECM Terminal D6 and D15)	OFF	OFF	ON	ON
Octane Switch 2 (ECM Terminal C13 and D15)	ON	OFF	OFF	ON