

ENGINE DIAGNOSTIC PARAMETERS

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
ALT FUEL HIGH PRESSURE LOCKOFF (HPL)	P0005	This DTC detects an open sensor ground or continuous short to high in either the signal circuit of the High Pressure Fuel Shutoff Relay Control Circuit	Disconnected, Shorted To Ground, Or Shorted To Battery	IGN Volt > 6v And < 18v Engine Speed > 400 Rpm or 0 rpm	1 Second Loop	DTC Type A (Bi-Fuel Switches To Gasoline)
CAMSHAFT SENSOR MISINSTALLED	*P0016	1X Signal This diagnostic will determine if the Cam sensor and high voltage switch have been installed correctly.	Cam signal falling edge out of phase ±27 degrees from crank falling edge.	Engine is running – run flag is true No crank position sensor not valid DTC	30 test failures within a 50 test sample size. Time necessary to complete sample: Varies with engine speed Every crank fall	DTC Type B
(B1S1) HEATED OXYGEN SENSOR HEATER CONTROL CIRCUIT	P0030	This DTC checks the Heater Output Driver circuit for electrical integrity.	Output state shorted or open.	10 > Ignition Voltage > 18 Volts	5 failures out of 12 samples 500ms loop continuous	DTC Type B
(B1S2) HEATED OXYGEN SENSOR HEATER CONTROL CIRCUIT	P0036	This DTC checks the Heater Output Driver circuit for electrical integrity.	Output state shorted or open.	10 > Ignition Voltage > 18 Volts	5 failures out of 12 samples 500ms loop continuous	DTC Type B
(B2S1) HEATED OXYGEN SENSOR HEATER CONTROL CIRCUIT	P0050	This DTC checks the Heater Output Driver circuit for electrical integrity.	Output state shorted or open.	10 > Ignition Voltage > 18 Volts	5 failures out of 12 samples 500ms loop continuous	DTC Type B
(B1S1) HEATED OXYGEN SENSOR HEATER RESISTANCE	P0053	Out-Of-Range (OOR) Resistance: Detects an oxygen sensor heater having an incorrect or out of range (OOR) resistance value.	O2 Heater Resistance < 3.12 ohms OR O2 Heater Resistance > 9.81 ohms (O2 Heater Resistance is corrected to 20 degrees C)	Engine Soak Time > 10 Hours Coolant – IAT < 8°C -30°C < Coolant Temp < 45°C ECM/PCM Internal Engine Off Timer Performance Fault Not Active No ECT faults Active No IAT faults Active Engine run time < .15 seconds	Frequency: Once per valid cold start 1 second loop	DTC Type B

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(B1S2) HEATED OXYGEN SENSOR HEATER RESISTANCE	P0054	Out-Of-Range (OOR) Resistance: Detects an oxygen sensor heater having an incorrect or out of range (OOR) resistance value.	O2 Heater Resistance < 3.12 ohms OR O2 Heater Resistance > 9.81 ohms (O2 Heater Resistance is corrected to 20 degrees C)	Engine Soak Time > 10 Hours Coolant – IAT < 8°C -30°C < Coolant Temp < 45°C ECM/PCM Internal Engine Off Timer Performance Fault Not Active No ECT faults Active No IAT faults Active Engine run time < .15 seconds	Frequency: Once per valid cold start 1 second loop	DTC Type B
(B2S2) HEATED OXYGEN SENSOR HEATER CONTROL CIRCUIT	P0056	This DTC checks the Heater Output Driver circuit for electrical integrity.	Output state shorted or open.	10 > Ignition Voltage > 18 Volts	5 failures out of 12 samples 500ms loop continuous	DTC Type B
(B2S1) HEATED OXYGEN SENSOR HEATER RESISTANCE	P0059	Out-Of-Range (OOR) Resistance: Detects an oxygen sensor heater having an incorrect or out of range (OOR) resistance value.	O2 Heater Resistance < 3.12 ohms OR O2 Heater Resistance > 9.81 ohms (O2 Heater Resistance is corrected to 20 degrees C)	Engine Soak Time > 10 Hours Coolant – IAT < 8°C -30°C < Coolant Temp < 45°C ECM/PCM Internal Engine Off Timer Performance Fault Not Active No ECT faults Active No IAT faults Active Engine run time < .15 seconds	Frequency: Once per valid cold start 1 second loop	DTC Type B
(B2S2) HEATED OXYGEN SENSOR HEATER RESISTANCE	P0060	Out-Of-Range (OOR) Resistance: Detects an oxygen sensor heater having an incorrect or out of range (OOR) resistance value.	O2 Heater Resistance < 3.12 ohms OR O2 Heater Resistance > 9.81 ohms (O2 Heater Resistance is corrected to 20 degrees C)	Engine Soak Time > 10 Hours Coolant – IAT < 8°C -30°C < Coolant Temp < 45°C ECM/PCM Internal Engine Off Timer Performance Fault Not Active No ECT faults Active No IAT faults Active Engine run time < .15 seconds	Frequency: Once per valid cold start 1 second loop	DTC Type B
TAC SYSTEM MAF PERFORMANCE	P0068	Indicates that measured engine airflow does not match estimated engine airflow as established by the TPS.	MAP based airflow - estimated airflow > 150 mg/cyl AND MAF based airflow - estimated airflow > 150 mg/cyl	Engine running = true. Ignition on > 1 sec. RPM > 500. No Throttle Actuation DTC's. No PCM-TACM Serial Data DTC. Both TPS Circuit DTC's are not set. No PCM Processor DTC's No TACM Processor DTC	Both counters are incremented by 2 for every error and decrement by 1 for every pass; both thresholds are 20; both counters must exceed threshold to set DTC. Check runs every 18.75 ms.	DTC Type A For use on vehicles with ETC

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MASS AIR FLOW SYSTEM PERFORMANCE (RATIONALITY)	P0101	This DTC determines if the MAF sensor is stuck within the normal operating range	Calculated Flow – Measured Flow \geq cal (table) Table look up as a function of calculated flow	Engine running TP sensor DTC's not active MAP sensor DTC's not active EVAP DTC's not active MAF sensor high/low DTC's not active Traction control not active Not in DFCO System voltage \geq 11V but \leq 18V Canister Purge DC \leq 100% MAP $\Delta \leq$ 3% TP $\Delta \leq$ 5% Engine vacuum \leq 80 kPa Throttle Position \leq 95% The above must be present for a period of time greater than 1.5 seconds	40 test failures in a 100 test sample Check runs every 100 ms.	DTC Type B
MASS AIR FLOW SENSOR CIRCUIT LOW FREQUENCY	P0102	Detects a continuous short to low or a open in either the signal circuit or the MAF sensor	<u>LOW FREQUENCY TEST:</u> MAF \leq 1200 Hz	<u>LOW FREQUENCY TEST</u> Engine Runtime \geq 2 seconds Engine Speed \geq 400 RPM System Voltage \geq 8 volts The above must be present for a period of time greater than 1 second	<u>LOW FREQUENCY TEST:</u> 6 test failures in a 40 test sample. 1 sample per 100 ms Test is run at every reading of the Mass Air Flow sensor frequency	DTC Type B
MASS AIR FLOW SENSOR CIRCUIT HIGH FREQUENCY	P0103	Detects a continuous short to high in either the signal circuit or the MAF sensor	<u>HIGH FREQUENCY TEST:</u> MAF \geq 13500 Hz	<u>HIGH FREQUENCY TEST:</u> Engine Runtime \geq 2 seconds Engine Speed \geq 400 RPM System Voltage \geq 8 volts The above must be present for a period of time greater than 1 second	<u>HIGH FREQUENCY TEST:</u> 18 test failures in a 24 test sample. 1 sample per 100 ms Test is run at every reading of the Mass Air Flow sensor frequency	DTC Type B

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MAP SENSOR RANGE/ PERFORMANCE(RATIONALITY)	P0106	This DTC determines if the MAP sensor is stuck within the normal operation range	MAP (kPa) > or < predicted MAP (lookup table as a function of TPS and RPM)	Engine Running MAP sensor high/low DTC's not active TP sensor DTC's not active IAC DTC's not active Traction Control not active Engine Speed $\Delta \leq 125$ RPM Throttle Position $\Delta \leq 100\%$ Idle Air $\Delta \leq 10$ g/s Brake Switch State = no change Clutch Switch State = no change Power Steering = Stable PTO = not active AC Clutch State = no change Above stabilized for 1 second Engine Speed ≥ 500 RPM Engine Speed ≤ 5000 RPM	20 test failures within a 30 test sample 1 sample/sec	DTC Type B
MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW	P0107	This DTC detects a continuous short to low or open in either the signal circuit or the MAP sensor.	Raw MAP < .04 volts (3 counts)	TP sensor DTC's not active Engine Running Throttle Position is $\geq 0\%$ when engine speed is ≤ 800 RPM Or Throttle Position is $\geq 12.5\%$ when engine speed is > 800 RPM	320 test failures in a 400 test sample. 1 sample/12.5 ms	DTC Type B
MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH	P0108	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the MAP sensor	Raw MAP > 4.89 Volts (250 counts)	TP sensor DTC's not active Engine Running Engine Run Time based on power up coolant temperature: ≥ 10 sec at $\geq 30^{\circ}\text{C}$ ≥ 80 sec at 15°C ≥ 134 sec at 0°C ≥ 188 sec at -15°C ≥ 242 sec at -30°C ; time is interpolated between temperature points Throttle Position is $\leq 0.996094\%$ when engine speed is ≤ 1200 RPM Or Throttle Position is $\leq 20\%$ when engine speed is > 1200 RPM	320 test failures in a 400 test sample. 1 sample/12.5 ms	DTC Type B

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INTAKE AIR TEMP SENSOR CIRCUIT LOW (HIGH TEMP)	P0112	This DTC detects a continuous short to ground in the IAT signal circuit or the IAT sensor	Raw IAT < .244 Volts	VS sensor DTC's not active ECT sensor DTC's not active Vehicle speed ≥ 25 mph Engine run time > 45 seconds Coolant Temperature < 125°C	25 test failures in a 50test sample 1 sample/500 ms	DTC Type B
INTAKE AIR TEMP SENSOR CIRCUIT HIGH (LOW TEMP)	P0113	This DTC detects a continuous open or short to high in the IAT signal circuit or the IAT sensor	Raw IAT > 4.95 Volts	ECT sensor DTC's not active VS sensor DTC's not active Coolant Temperature ≥ 60 °C Mass Air Flow < 15 g/s Vehicle Speed < 7 mph Engine run time > 120 seconds	25 test failures in a 50 test sample. 1 sample/ 500 ms	DTC Type B
ENGINE COOLANT TEMP SENSOR RATIONALITY (HIGH-SIDED)	P0116	Detects coolant temp sensor stuck in mid range	A failure will be reported if any of the following occur: ECT at powerup > IAT at powerup by 99.9843°C after a minimum 10 hour soak (fast fail). ECT at powerup > IAT at powerup by 15°C after a minimum 10 hour soak and a block heater has not been detected. ECT at powerup > IAT at powerup by 15°C after a minimum 10 hour soak and the time spent cranking the engine without starting is greater than 10 seconds with the fuel level being above a minimum level of 5%.	No VSS DTC's No IAT DTC's No ECT sensor shorted DTC's ECM/PCM Internal Engine Off Timer Performance DTC not active Non-volatile memory failure has not been detected on power-up. Engine off time > 600 minutes (10 hours) Test run this trip = false Test aborted this trip = false Block heater detection: ECT at powerup > IAT at powerup by 15°C Powerup IAT > -7°C Vehicle driven a minimum of 400 seconds above 15 mph and IAT drops more than 8° C from powerup IAT.	1 failure 200 ms loop	DTC Type B
ENGINE COOLANT TEMP SENSOR CIRCUIT LOW (HIGH TEMP)	P0117	This DTC detects a continuous short to ground in the ECT signal circuit or the ECT sensor.	<u>Low Resistance Pull-up</u> Raw ECT < .234 Volts <u>High Resistance Pull-up</u> Raw ECT < .035 Volts	Engine run time > 10 seconds Or Min IAT < 50° C (min IAT is never allowed to go higher than 54.5 degrees C)	45 test failures in a 50 test sample. 1 sample/500 ms	DTC Type B
ENGINE COOLANT TEMP SENSOR CIRCUIT HIGH (LOW TEMP)	P0118	Circuit Continuity This DTC detects a continuous short to high or open in the ECT signal circuit or the ECT sensor.	<u>Low Resistance Pull-up</u> Raw IAT > 4.93 Volts <u>High Resistance pull-up</u> Raw IAT > 4.95 Volts	Engine run time > 60 seconds Or Min IAT ≥ 0° C	45 test failures in a 50 test sample. 1 sample/ 500 ms Continuous	DTC Type B

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THROTTLE POSITION SENSOR 1 CIRCUIT	P0120	1) TACM indicates a continuous or intermittent short or open in either the signal circuit or the TP sensor #1. OR 2) TACM indicates an invalid minimum mechanical position for the TP sensor #1. OR 3) TACM indicated reference voltage out of range.	1) Raw TP sensor signal < 0.376 V or > 4.506 V. OR 2)TP sensor minimum mechanical stop voltage < 0.376 V or > 0.714 V. OR 3) Vref out of range < 4.54 V or > 5.21 V.	Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data. No TACM processor DTC.	1) Counter increments by 4 for every error, decrements by 1 for every pass; threshold is 133. Check runs every 3 ms. 2) One occurrence. Check runs at power-up. 3) Continuous. Counter increments by 1 for every error, decrements by 1 for every pass. Threshold is 10ms. For Ref direct short to ground. 4) Second continuous counter increments by 1 for every error and decrements by 1 for every pass, threshold is 1000 msec. Verify A/D input on Ref to be 5volts +/- tolerance.	DTC Type A For use on vehicles with ETC
TP SENSOR CIRCUIT PERFORMANCE	*P0121	The DTC determines if a TPS sensor is stuck within the normal operating range	<u>Stuck high test:</u> The last throttle position value is > predicted throttle position based on engine RPM. <u>Stuck low test:</u> The last throttle position value is < predicted throttle position based on engine RPM	<u>Test Enable:</u> Engine Coolant Temp ≥ 60° C No TP sensor short DTC's active No IAC DTC's active No MAP DTC's active No MAF DTC's active Engine run time ≥ 120 sec BARO not defaulted MAP delta ≤ 1.5 kPa for ≥ 1 sec IAC ≥ 0 counts but ≤ 310 counts <u>Stuck high test:</u> MAP < 50 kPa <u>Stuck low test:</u> MAP > 65 kPa	<u>Stuck high test:</u> 150 test failures within a 200 test sample <u>Stuck low test:</u> 150 test failures within a 200 test sample 1 sample/100ms	DTC Type B
TP SENSOR CIRCUIT LOW	*P0122	This DTC detects a continuous short to low or open in either the signal circuit or the TP sensor	TP sensor signal voltage < .149 volts (7.6 counts)	None	90 test failures in a 100 test sample size. 1 sample/12.5ms	DTC Type B

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TP SENSOR CIRCUIT HIGH	*P0123	This DTC detects a continuous short to high in either the signal circuit or the TP sensor.	TP sensor signal voltage > 4.89 volts. (249.9 counts)	None	90 test failures in a 100 test sample size. 1 sample/12.5ms	DTC Type B
COOLANT TEMPERATURE BELOW STAT REGULATING TEMPERATURE	P0128	This DTC detects if the engine coolant temperature rises too slowly due to an ECT or cooling system fault	If actual accumulated airflow is > predicted accumulated airflow before engine coolant reaches 75 °C when IAT is > 10° C, and before engine coolant reaches 55°C when IAT is ≤ 10°C but ≥ -7°C.	No MAF, MAP, TP Sensor, IAT, ECT shorted or open, VSS, ECT High Sided Rationality, or Fuel Compensation faults active ECT shorted or open faults not failing IAT ≥ -7°C 90seconds ≤ Engine runtime ≤ 1370 seconds Fuel ethanol percent ≤ 85% ECT at startrun ≤ 70°C for IAT above 10°C; ECT at startrun ≤ 50°C for IAT ≤ 10°C but ≥ -7°C Minimum Average Airflow ≥ 10 gps Vehicle speed ≥ 5 MPH for at least 1.50 miles Maximum airflow added to actual accumulated airflow limited to 75 gps Airflow added to actual accumulated airflow is considered 0 gps below an actual 20 gps.	30 failures to set DTC <u>Frequency:</u> Once per ignition cycle 1 second loop	DTC Type B
(B1S1) HEATED OXYGEN SENSOR CIRCUIT LOW	P0131	Circuit Continuity Detects a HO2S voltage stationary lean (low signal voltage) condition.	Oxygen sensor voltage < 200 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V No injectors disabled Closed loop fueling Ethanol % ≤ 90 0.992 ≤ Equivalence Ratio ≤ 1.014 Fuel Level ≥ 10% 3% ≤ TPS ≤ 70% Above conditions met for 2 sec	310 failures out of 330 samples. Sensor monitored for 5 sets of samples. After 5 sets of failures, related sensors checked for same failure. If related sensor also failing, then no action is taken. 100 ms/sample Continuous	DTC Type B

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(B1S1) HEATED OXYGEN SENSOR CIRCUIT HIGH	P0132	Circuit Continuity Detects a HO2S voltage stationary rich (high signal voltage) condition.	Oxygen sensor voltage > 1050 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Closed loop fueling Ethanol % ≤ 90 0.992 ≤ Equivalence Ratio ≤ 1.014 Fuel Level ≥ 10% 3% ≤ TPS ≤ 70% Above conditions met for 2 seconds	90 failures out of 96 samples. Sensor monitored for 5 sets of samples. After 5 sets of failures, related sensors checked for same failure. If related sensor also failing, then no action is taken. 100 ms/sample Continuous	DTC Type B
(B1S1) HEATED OXYGEN SENSOR CIRCUIT SLOW RESPONSE	P0133	Detects slow symmetrical rich to lean or lean to rich HO2S signal transition rates.	The oxygen sensor transitions between 250 – 625 mV. <u>Bi-Fuel Operation (Bin 10)</u> HO2S sensor average transition time: L/R > 255 ms R/L > 255 ms <u>Dedicated Operation (Bin 8)</u> HO2S sensor average transition time: L/R > 232 ms R/L > 210 ms	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V DTC's P0131, P0132, P0134 and P0135 not Active -1280 °C < Predicted O2 Sensor Temp < 1280 °C No Misfire Faults Active Fuel Level ≥ 10% Ethanol % ≤ 90 ECT > 60 °C Engine runtime > 160 sec CCP Duty Cycle ≥ 0% PRNDL in drive range Closed Loop Fuel Control 1200 ≤ RPM ≤ 3000 20 ≤ Air Flow ≤ 55g/s. TPS ≥ 5% Above conditions met for 1 sec	100 sec Once per trip.	DTC Type B

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(B1S1) HEATED OXYGEN SENSOR CIRCUIT NO ACTIVITY	P0134	Circuit Continuity Detects a HO2S circuit open.	350 mV < B1S1 voltage < 550 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Ethanol % ≤ 90 Engine runtime > 300 sec	570 failures out of 600 samples 100 ms/sample Continuous.	DTC Type B
(B1S1) HEATED OXYGEN SENSOR HEATER CIRCUIT	P0135	Current Monitor: Detects a malfunctioning HO2S heater circuit by monitoring the current through the circuit.	0.25 A < Heater Current < 3.125 A	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Coolant ≥ 50 °C 3 g/s ≤ Airflow ≤ 40 g/s Engine runtime ≥ 300 sec 500 ≤ RPM ≤ 3000 Ethanol % ≤ 90 DTC P0053 not set. All of the above true for at least 2 seconds Heater must be commanded on.	8 failures out of 10 samples Frequency: 2 times per key cycle	DTC Type B
(B1S2) HEATED OXYGEN SENSOR CIRCUIT LOW	P0137	Circuit Continuity Detects a HO2S voltage stationary lean (low signal voltage) condition.	Oxygen sensor voltage < 80 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V No injectors disabled Closed loop fueling Ethanol % ≤ 90 0.992 ≤ Equivalence Ratio ≤ 1.014 Fuel Level ≥ 10% 3% ≤ TPS ≤ 70% Above conditions met for 2 sec	380 failures out of 400 samples Sensor monitored for 5 sets of samples. After 5 sets of failures, related sensors checked for same failure. If related sensor also failing, then no action is taken. 100 ms/sample Continuous	DTC Type B

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(B1S2) HEATED OXYGEN SENSOR CIRCUIT HIGH	P0138	Circuit Continuity Detects a HO2S voltage stationary rich (high signal voltage) condition.	Oxygen sensor voltage > 950 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Closed loop fueling Ethanol % ≤ 90 0.992 ≤ Equivalence Ratio ≤ 1.014 Fuel Level ≥ 10% 3% ≤ TPS ≤ 70% Above conditions met for 2 seconds	380 failures out of 400 samples. Sensor monitored for 5 sets of samples. After 5 sets of failures, related sensors checked for same failure. If related sensor also failing, then no action is taken. 100 ms/sample Continuous	DTC Type B
(B1S2) HEATED OXYGEN SENSOR CIRCUIT NO ACTIVITY	P0140	Circuit Continuity Detects a HO2S circuit open.	410 mV < B1S2 voltage < 490 mV <OR> Post O2 sensor fast pass B1S2 > 550 mV B1S2 < 350 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Ethanol % ≤ 90 Engine runtime > 300 sec Closed Loop Fueling 5% Δ TPS within 1 sec, 6 times DTC P0141 not Active DTC P0054 not Active No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Ethanol % ≤ 90 Engine is running Engine runtime ≤ 200 sec DTC P0141 not Active DTC P0054 not Active	1450 failures out of 1500 samples. 100 ms/sample Once per trip 550 more passing samples than failing samples. 100 ms/sample Once per trip	DTC Type B

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(B1S2) HEATED OXYGEN SENSOR HEATER CIRCUIT	P0141	Current Monitor: Detects a malfunctioning HO2S heater circuit by monitoring the current through the circuit.	0.25 A < Heater Current < 1.375 A	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Coolant ≥ 50 °C 3 g/s ≤ Airflow ≤ 40 g/s Engine runtime ≥ 300 sec 500 ≤ RPM ≤ 3000 Ethanol % ≤ 90 DTC P0053 not set. All of the above true for at least 2 seconds Heater must be commanded on.	8 failures out of 10 samples Frequency: 2 times per key cycle	DTC Type B
ALT FUEL INJECTOR DRIVER MODULE	P0148	Incorrect Fuel Mode	Modules Disagree. PCM Internal Status Disagrees with IDM Reported Status.	IGN Volt > 6V and < 18V Engine Speed > 1 RPM	2 second loop	DTC Type A Bi-Fuel ONLY (Bi-Fuel switches to gasoline)
(B2S1) HEATED OXYGEN SENSOR CIRCUIT LOW	P0151	Circuit Continuity Detects a HO2S voltage stationary lean (low signal voltage) condition.	Oxygen sensor voltage < 200 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V No injectors disabled Closed loop fueling Ethanol % ≤ 90 0.992 ≤ Equivalence Ratio ≤ 1.014 Fuel Level ≥ 10% 3% ≤ TPS ≤ 70% Above conditions met for 2 sec	310 failures out of 330 samples. Sensor monitored for 5 sets of samples. After 5 sets of failures, related sensors checked for same failure. If related sensor also failing, then no action is taken. 100 ms/sample Continuous	DTC Type B

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(B2S1) HEATED OXYGEN SENSOR CIRCUIT HIGH	P0152	Circuit Continuity Detects a HO2S voltage stationary rich (high signal voltage) condition.	Oxygen sensor voltage > 1050 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Closed loop fueling Ethanol % ≤ 90 0.992 ≤ Equivalence Ratio ≤ 1.014 Fuel Level ≥ 10% 3% ≤ TPS ≤ 70% Above conditions met for 2 seconds	90 failures out of 96 samples. Sensor monitored for 5 sets of samples. After 5 sets of failures, related sensors checked for same failure. If related sensor also failing, then no action is taken. 100 ms/sample Continuous	DTC Type B
(B2S1) HEATED OXYGEN SENSOR CIRCUIT SLOW RESPONSE	P0153	Detects slow symmetrical rich to lean or lean to rich HO2S signal transition rates.	The oxygen sensor transitions between 250 – 625 mV. <u>Bi-Fuel Operation (Bin 10)</u> HO2S sensor average transition time: L/R > 255 ms R/L > 255 ms <u>Dedicated Operation (Bin 8)</u> HO2S sensor average transition time: L/R > 232 ms R/L > 210 ms	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V DTC's P0131, P0132, P0134 and P0135 not Active -1280 °C < Predicted O2 Sensor Temp < 1280 °C No Misfire Faults Active Fuel Level ≥ 10% Ethanol % ≤ 90 ECT > 60 °C Engine runtime > 160 sec CCP Duty Cycle ≥ 0% PRNDL in drive range Closed Loop Fuel Control 1200 ≤ RPM ≤ 3000 20 ≤ Air Flow ≤ 55g/s. TPS ≥ 5% Above conditions met for 1 sec	100 sec Once per trip.	DTC Type B

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(B2S1) HEATED OXYGEN SENSOR CIRCUIT NO ACTIVITY	P0154	Circuit Continuity Detects a HO2S circuit open.	350 mV < B2S1 voltage < 550 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Ethanol % ≤ 90 Engine runtime > 300 sec	570 failures out of 600 samples. 100 ms/sample Continuous	DTC Type B
(B2S1) HEATED OXYGEN SENSOR HEATER CIRCUIT	P0155	Current Monitor: Detects a malfunctioning HO2S heater circuit by monitoring the current through the circuit.	0.25 A < Heater Current < 3.125 A	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Coolant ≥ 50 °C 3 g/s ≤ Airflow ≤ 40 g/s Engine runtime ≥ 300 sec 500 ≤ RPM ≤ 3000 Ethanol % ≤ 90 DTC P0053 not set. All of the above true for at least 2 seconds Heater must be commanded on.	8 failures out of 10 samples Frequency: 2 times per key cycle	DTC Type B
(B2S2) HEATED OXYGEN SENSOR CIRCUIT LOW	P0157	Circuit Continuity Detects a HO2S voltage stationary lean (low signal voltage) condition.	Oxygen sensor voltage < 80 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V No injectors disabled Closed loop fueling Ethanol % ≤ 90 0.992 ≤ Equivalence Ratio ≤ 1.014 Fuel Level ≥ 10% 3% ≤ TPS ≤ 70% Above conditions met for 2 sec	380 failures out of 400 samples. Sensor monitored for 5 sets of samples. After 5 sets of failures, related sensors checked for same failure. If related sensor also failing, then no action is taken. 100 ms/sample Continuous	DTC Type B

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(B2S2) HEATED OXYGEN SENSOR CIRCUIT HIGH	P0158	Circuit Continuity Detects a HO2S voltage stationary rich (high signal voltage) condition.	Oxygen sensor voltage > 950 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Closed loop fueling Ethanol % ≤ 90 0.992 ≤ Equivalence Ratio ≤ 1.014 Fuel Level ≥ 10% 3% ≤ TPS ≤ 70% Above conditions met for 2 seconds	380 failures out of 400 samples. Sensor monitored for 5 sets of samples. After 5 sets of failures, related sensors checked for same failure. If related sensor also failing, then no action is taken. 100 ms/sample Continuous	DTC Type B
(B2S2) HEATED OXYGEN SENSOR CIRCUIT NO ACTIVITY	P0160	Circuit Continuity Detects a HO2S circuit open.	410 mV < B2S2 voltage < 490 mV <OR> Post O2 sensor fast pass B2S2 > 550 mV B2S2 < 350 mV	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Ethanol % ≤ 90 Engine runtime > 300 sec Closed Loop Fueling 5% Δ TPS within 1 sec, 6 times DTC P0161 not Active DTC P0060 not Active No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Ethanol % ≤ 90 Engine is running Engine runtime ≤ 200 sec DTC P0161 not Active DTC P0060 not Active	1450 failures out of 1500 samples. 100 ms/sample Once per trip 550 more passing samples than failing samples. 100 ms/sample Once per trip	DTC Type B

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(B2S2) HEATED OXYGEN SENSOR HEATER CIRCUIT	P0161	Current Monitor: Detects a malfunctioning HO2S heater circuit by monitoring the current through the circuit.	0.25 A < Heater Current < 1.375 A	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V Coolant ≥ 50 °C 3 g/s ≤ Airflow ≤ 40 g/s Engine runtime ≥ 300 sec 500 ≤ RPM ≤ 3000 Ethanol % ≤ 90 DTC P0053 not set. All of the above true for at least 2 seconds Heater must be commanded on.	8 failures out of 10 samples Frequency: 2 times per key cycle	DTC Type B
BANK 1 FUEL TRIM SYSTEM LEAN	P0171	Determines if the fuel control system is in a lean condition	<u>Gasoline Operation</u> The EWMA of long term fuel trim (LTM) samples ≥ 1.246 for at least 2 seconds <u>CNG Operation</u> The EWMA of long term fuel trim (LTM) samples ≥ 1.27 for at least 2 seconds (Note: EWMA stands for “Exponentially Weighted Moving Average”) Notes: 1. At least 24 seconds of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 15 seconds of data in the current fuel trim cell must accumulate on each trip before the LTM for that cell is considered usable in the EWMA calculation.	<ul style="list-style-type: none"> • No Misfire DTC’s • No EVAP DTC’s • No Fuel Injector DTC’s • No Fuel Composition DTC’s • No IAC, MAF, or MAP DTC’s • No B1S1 O2 DTC’s • Engine speed > 400 rpm but < 6500 rpm • BARO > 70 kpa • ECT > -40°C but < 139°C • MAP > 15 kpa but < 105 kpa • IAT > -20 °C but < 152°C • Mass Airflow > 1.0 g/s but < 250 g/s • Vehicle speed < 82 mph • Long Term Fuel Trim Learning enabled • CCP DC ≤ 8% when canister vent is closed • Closed Loop Reset not active. • Fuel Level ≥ 15 % (gasoline) or 10% (CNG) (must be <threshold for at least 10 seconds to disable; default is to enable if fuel sender is broken) 	100 ms loop Continuous	DTC Type B

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BANK 1 FUEL TRIM SYSTEM RICH	P0172	Determines if the fuel control system is in a rich condition	<p>The EWMA of long term fuel trim (LTM) samples ≤ 0.825 (gasoline) or ≤ 0.820 (CNG)</p> <p>Once the above occurs, purge is ramped off to determine if excess purge is the cause. Therefore, the following must also occur to report a failure:</p> <p>The EWMA of LTM samples with purge off ≤ 0.83 for at least 2 seconds during each of 3 intrusive segments.</p> <p>General Notes:</p> <ol style="list-style-type: none"> At least 24 seconds of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 15 seconds of data in the current fuel trim cell must accumulate on each trip before the LTM for that cell is considered usable in the EWMA calculation. <p>Intrusive Notes:</p> <ol style="list-style-type: none"> Segments can last up to 16 seconds, and are separated by the smaller of a 30 second purge-on time or enough time to purge 18 grams of vapor. A maximum of 5 completed segments are allowed for each intrusive test, and up to 20 intrusive attempts allowed per trip. After an intrusive test report is completed, another intrusive test cannot occur for 300 seconds to allow sufficient time to purge excess vapors from the canister. During this period, fuel trim will pass if the EWMA of LTM samples ≥ 0.83 for at least 60 seconds, indicating that the canister has been purged. Performing intrusive tests too 	<ul style="list-style-type: none"> No Misfire DTC's No B1S1 O2 Sensor DTC's No EVAP DTC's No Fuel Injector DTC's No IAC, MAF, or MAP DTC's Engine speed > 400 rpm but < 6500 rpm BARO > 70 kpa ECT > -40°C but < 139°C MAP > 15 kpa but < 105 kpa IAT > -20 °C but < 152°C Mass Airflow > 1.0 g/s but < 250 g/s Vehicle speed < 82 mph Long Term Fuel Trim Learning enabled CCP DC $\leq 8\%$ when canister vent is closed Closed Loop Reset not active. <p>Intrusive Enable Criteria</p> <ul style="list-style-type: none"> The EWMA of long term fuel trim (LTM) samples ≤ 0.825 RPM > 375 Mass Airflow > 3 g/s but < 250 g/s MAP > 15 kpa but < 105 kpa Virtual Flex Fuel Sender Learn Algorithm is not intrusive (L59 RPO only). <p>Temporary Intrusive Test Inhibit Criteria</p> <ul style="list-style-type: none"> If intrusive test segment exceeds 16 consecutive seconds (in this case, purge valve is opened for the smaller of 30 seconds or enough time to purge 18 grams of vapor). 	<p>If rich fail counter is ≥ 3 before pass counter ≥ 3, diagnostic fails.</p> <p>100 ms loop Continuous</p>	DTC Type B

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BANK 2 FUEL TRIM SYSTEM LEAN	P0174	Determines if the fuel control system is in a lean condition	<p><u>Gasoline Operation</u> The EWMA of long term fuel trim (LTM) samples ≥ 1.246 for at least 2 seconds</p> <p><u>CNG Operation</u> The EWMA of long term fuel trim (LTM) samples ≥ 1.27 for at least 2 seconds</p> <p>(Note: EWMA stands for “Exponentially Weighted Moving Average”)</p> <p>Notes: 2. At least 24 seconds of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 15 seconds of data in the current fuel trim cell must accumulate on each trip before the LTM for that cell is considered usable in the EWMA calculation.</p>	<ul style="list-style-type: none"> • No Misfire DTC’s • No B2S1 O2 Sensor DTC’s • No EVAP DTC’s • No Fuel Injector DTC’s • No Fuel Composition DTC’s • No IAC, MAF, or MAP DTC’s • Engine speed > 400 rpm but < 6500 rpm • BARO > 70 kpa • ECT > -40°C but < 139°C • MAP > 15 kpa but < 105 kpa • IAT > -20 °C but < 152°C • Mass Airflow > 1.0 g/s but < 250 g/s • Vehicle speed < 82 mph • Long Term Fuel Trim Learning enabled • CCP DC $\leq 8\%$ when canister vent is closed • Closed Loop Reset not active. • Fuel Level $\geq 15\%$ (gasoline) or 10% (CNG) (must be <threshold for at least 10 seconds to disable; default is to enable if fuel sender is broken) 	100 ms loop Continuous	DTC Type B

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BANK 2 FUEL TRIM SYSTEM RICH	P0175	Determines if the fuel control system is in a rich condition	<p>The EWMA of long term fuel trim (LTM) samples ≤ 0.825(gasoline) or ≤ 0.820 (CNG)</p> <p>Once the above occurs, purge is ramped off to determine if excess purge is the cause. Therefore, the following must also occur to report a failure:</p> <p>The EWMA of LTM samples with purge off ≤ 0.83 for at least 2 seconds during each of 3 intrusive segments.</p> <p>General Notes:</p> <ol style="list-style-type: none"> At least 24 seconds of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 15 seconds of data in the current fuel trim cell must accumulate on each trip before the LTM for that cell is considered usable in the EWMA calculation. <p>Intrusive Notes:</p> <ol style="list-style-type: none"> Segments can last up to 16 seconds, and are separated by the smaller of a 30 second purge-on time or enough time to purge 18 grams of vapor. A maximum of 5 completed segments are allowed for each intrusive test, and up to 20 intrusive attempts allowed per trip. After an intrusive test report is completed, another intrusive test cannot occur for 300 seconds to allow sufficient time to purge excess vapors from the canister. During this period, fuel trim will pass if the EWMA of LTM samples ≥ 0.83 for at least 60 seconds, indicating that the canister has been purged. Performing intrusive tests too 	<ul style="list-style-type: none"> No Misfire DTC's No O2 Sensor DTC's No EVAP DTC's No Fuel Injector DTC's No IAC, MAF, or MAP DTC's Engine speed > 400 rpm but < 6500 rpm BARO > 70 kpa ECT > -40°C but < 139°C MAP > 15 kpa but < 105 kpa IAT > -20 °C but < 152°C Mass Airflow > 1.0 g/s but < 250 g/s Vehicle speed < 82 mph Long Term Fuel Trim Learning enabled CCP DC $\leq 8\%$ when canister vent is closed Closed Loop Reset not active. <p>Intrusive Enable Criteria</p> <ul style="list-style-type: none"> The EWMA of long term fuel trim (LTM) samples ≤ 0.825 RPM > 375 Mass Airflow > 3 g/s but < 250 g/s MAP > 15 kpa but < 105 kpa Virtual Flex Fuel Sender Learn Algorithm is not intrusive (L59 RPO only) <p>Temporary Intrusive Test Inhibit Criteria</p> <ul style="list-style-type: none"> If intrusive test segment exceeds 16 consecutive seconds (in this case, purge valve is opened for the smaller of 30 seconds or enough time to purge 18 grams of vapor). 	<p>If rich fail counter is ≥ 3 before pass counter ≥ 3, diagnostic fails.</p> <p>100 ms loop Continuous</p>	DTC Type B

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ALT FUEL RAIL TEMPERATURE RANGE /PERFORAMNCE	P0186	Determine Circuit Range/ Performance of the Rail Temperature Sensor	<p>One of the following rationality tests must occur to fail the test:</p> <p>Stuck Sensor Rationality: * Start-up Rail Temp is <= 2 C different from present Rail Temp. * Start-up IAT > 10 C delta from present IAT (if above 20 C). Delta IAT scales from 40 C to 10 C when the present IAT is -10 C to 20 C. * -10 C > IAT > 120C * CTS > 85 C * Engine runtime > 800 sec</p> <p>Sensor Scaling Rationality: * Start-up Rail Temp is > 2 C different from present Rail Temp. * Start-up IAT > 10 C different from start-up Rail Temp. * Soak Time > 10 hours</p>	* IGN Volt > 4 V * Rail Temp DTC's P0187, P0188 not set, * IAT DTC's P0111, P0112, P0113 not set, * ECT DTC's P0116, P0117, P0118 not set, * Analog PWM P1207 not set, * Initial Read Delay over = 1 sec, * No switch from gasoline to Alt fuel this key cycle. * Soak Time > 8 hours	2 s Once per trip	DTC Type B Default = IAT (Disable long term learn)
ALT FUEL TEMPERATURE SENSOR (RAIL) LOW FAULT	P0187	Determines if the Rail Temperature Sensor is in a low condition	Rail Temperature Sensor Voltage < 0.102 volts	* IGN Volt > 4 V * P1207 Not Active * Initial Read Delay over = 1 sec	5 second loop	DTC Type B Default = IAT (Disable long term learn)
ALT FUEL TEMPERATURE SENSOR (RAIL) HIGH FAULT	P0188	Determines if the Rail Temperature Sensor is in a high condition	Rail Temperature Sensor Voltage > 4.95 Volts	* IGN Volt > 4 V * IAT > -10 C * P0112, P0113, 1207 Not Active * Initial Read Delay over = 1 sec	5 second loop	DTC Type B Default = IAT (Disable long term learn)
ALT FUEL PRESSURE SENSOR PERFORMANCE (RAIL)	P0191	Determine Circuit Range/ Performance of the Rail Pressure Sensor	<p>* Rail Pressure < 207 kPa to 276 kPa (30 to 40 psia), depending on MAF. * TankP >= 2068 kPa (300psia) * Rail Pressure Sensor Voltage > 0.102 volts</p> <p>OR</p> <p>* Rail Pressure > 620 kPa (90 psia) * Rail Pressure Sensor Voltage < 4.95 Volts</p>	* Engine RPM >= 100 * P0005, P0192, P0193, P0336, P1207, P1209, P1431, P1432, P1433, P2665 Not Active * HPL, LPL Open * MAF <= 200 g/s * CTS >= 20 C	3 seconds Once per trip	DTC Type A (Bi-Fuel switches to gasoline)
ALT FUEL PRESSURE SENSOR (RAIL) LOW FAULT	P0192	Determines if the Rail Pressure Sensor is in a low condition	Rail Pressure Sensor Voltage < 0.102 volts	* Engine RPM > 100 * P0191 Not Active	2.5 second loop	DTC Type B Default = 45psig (Disable long term learn)

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ALT FUEL PRESSURE SENSOR (RAIL) HIGH FAULT	P0193	Determines if the Rail Pressure Sensor is in a high condition	Rail Pressure Sensor Voltage > 4.95 Volts	* Engine RPM > 100 * P0191 Not Active	2.5 second loop	DTC Type B Default = 45psig (Disable long term learn)
INJECTOR CONTROL CIRCUIT	P0200	This DTC checks the Injector Control Circuit for electrical integrity.	Output state shorted or open.	Engine speed > 400 rpm. 6 V < System voltage < 18 V	10 failures out of 100 samples 1 sample / 500 msec Continuous.	DTC Type B
THROTTLE POSITION SENSOR 2 CIRCUIT	P0220	1) TACM indicates a continuous or intermittent short or open in either the signal circuit or the TP sensor #2. OR 2) TACM indicates an invalid minimum mechanical position for the TP sensor #2. OR 3) TACM indicated reference voltage out of range.	1) Raw TP sensor signal < 0.282 V or > 4.60 V. OR 2) TP sensor minimum mechanical stop voltage < 0.282 V or > 0.813V OR 3) Vref > 0.5 V	Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data. No TACM processor DTC.	1) Counter increments by 4 for every error, decrements by 1 for every pass; threshold is 133. Check runs every 3 ms. 2) One occurrence. Check runs at power-up. 3) Continuous. Counter increments by 1 for every error, decrements by 1 for every pass. Threshold is 10ms. For Ref direct short to ground.	DTC Type A For use on vehicles with ETC
FUEL PUMP CONTROL CIRCUIT	P0230	This DTC checks the Fuel Pump Control Circuit for electrical integrity.	Output state shorted or open.	Engine speed > 400 rpm. 6 V < System voltage < 18 V	5 failures out of 100 samples 1 sample per 500 msec Continuous.	DTC Type B

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RANDOM MISFIRE DETECTED	P0300	These DTC's will determine if a random or a cylinder specific misfire is occurring by monitoring crankshaft velocity.	Deceleration index Vs Engine speed Vs Load and Camshaft Position <u>Gasoline Operation (Bin 10):</u> Emission Failure Threshold = 2.125% Catalyst Damage Threshold = 5% to 10.625% depending on engine speed and engine load <u>Bi-Fuel CNG Operation (Bin 10):</u> Emission Failure Threshold = 2.5% Catalyst Damage Threshold = 5% to 10.625% depending on engine speed and engine load <u>Dedicated CNG Operation (Bin 8):</u> Emission Failure Threshold = 1.125% Emission Failure Threshold at idle conditions only = 2.5% Catalyst Damage Threshold = 5% to 10.625% depending on engine speed and engine load	<ul style="list-style-type: none"> • Engine run time > 2 crankshaft revolutions. • DTCs not active for VSS, CKP, TP, MAP, ECT, CMP, IAT and MAF sensors. • No engine protection faults. • No Electronic Throttle Control Faults. • P0315 (Crankshaft Position System Variation Not Learned) not active or engine speed < 1000 RPM. • Fuel cutoff not active. • Power management is not active. • Brake torque management not active. • Fuel level > 10% (disablement ends 500 engine cycles after a low fuel level condition ceases, and fuel disable does not occur with a fuel sensor DTC). • -7°C < ECT < 130°C. • If ECT at startup < -7°C, then disable until ECT > 21°C. • 425 RPM > Engine Speed > 5300 RPM (CNG) • 400 RPM > Engine Speed > 5300 RPM (Gasoline) • 11 volts < System voltage < 18 volts. • + Throttle position delta < 50% per 100 ms. • - Throttle position delta < 50% per 100 ms. • Power Take Off is disabled • Abnormal engine speed is not present. • ABS rough road not detected. • ABS is not active. • Positive and zero torque (except the CARB approved 3000 rpm to redline triangle). Positive and zero torque is detected when both is true: 1) engine load > zero torque cal (cal a function of engine speed and temperature), and 2) TPS > 1 or VSS < 30. • Detectable engine speed and engine load region. • CAM sensor is in sync with CKP sensor. • Misfire Diag is not requesting to disable TCC when transmission is in hot mode. • Crankshaft Ring Filter inactive (after a low level misfire, another misfire may not be detectable until crankshaft ringing ceases) • Not an automatic transmission shift with a Throttle position > 95%. 	Emission Exceedence = (5) failed 200 revolution blocks of 16. Failure reported with (1) Exceedence in 1st (16) 200 revolution block, or (4) Exceedences thereafter. 1st Catalyst Exceedence = Number of 200 revolution blocks as data supports for catalyst damage. 2nd and subsequent Catalyst Exceedences = (1) 200 revolution block with catalyst damage. Failure reported with (3) Exceedences in FTP, or (1) Exceedence outside FTP. <u>Frequency:</u> Continuous	DTC Type B (MIL Flashes with Catalyst Damaging Misfire)
CRANKSHAFT POSITION SYSTEM VARIATION NOT LEARNED	P0315	Monitor for valid crankshaft error compensation factors	Sum of Compensation Factors are ≥ 4.001 or ≤ 3.999	OBD Manufacturer Enable Counter = 0	0.50 seconds <u>Frequency:</u> Continuous 100 ms loop	DTC Type A
KNOCK SENSOR CIRCUIT	P0325	This diagnostic will detect a failed internal PCM component associated with knock control	Instant noise level greater than a defined value or instantaneous knock signal greater than 254 counts for a defined time.	Engine run time ≥ 10 sec Ignition voltage ≥ 10 Volts	24 failed tests within 30 tests. Each test is 500 msec.	DTC Type B

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KNOCK SENSOR 1 CIRCUIT LOW	P0327	Check knock sensor filtered noise level - front knock sensor	Delta filtered noise level outside of defined range. Filtered noise counts ≤ 20	No Coolant Sensor DTC's No TP sensor DTC's 1500 ≤ engine rpm ≤ 3000 ECT ≥ 60° C TP Sensor ≥ 0% Engine run time ≥ 10 sec Ignition voltage > 10 Volts	24 failed tests within 30 tests. Each test is 25 msec.	DTC Type B
KNOCK SENSOR 2 CIRCUIT LOW	P0332	Check knock sensor filtered noise level - rear knock sensor	Delta filtered noise level outside of defined range. Filtered noise counts ≤ 20	No Coolant Sensor DTC's No TP sensor DTC's 1500 ≤ engine rpm ≤ 3000 ECT ≥ 60° C TP Sensor ≥ 0% Engine run time ≥ 10 sec Ignition voltage > 10 Volts	24 failed tests within 30 tests. Each test is 125 msec. Continuous check	DTC Type B For use on 2 sensor applications
CRANKSHAFT POSITION SENSOR CIRCUIT	P0335	3X signal This diagnostic will detect if there is no output from the crankshaft position sensor.	No output (~0 volts) from the crankshaft position sensor.	Cam is transitioning Sensed mass airflow ≥ 2.8984 No Cam Position Sensor DTC's No Airflow DTC's PCM state = READY or CRANK	30 test failures in a 40 test sample. 200 ms loop Continuous	DTC Type B
CRANKSHAFT POSITION SENSOR CIRCUIT RANGE/PERF.	P0336	3X signal This diagnostic will detect occurrences when engine position is no longer known.	Crank position sensor signal missing for a time ≥ .5 seconds	PCM state = CRANK or RUN	50 test failures in a 3120 test sample. 50 ms loop Continuous	DTC Type B
CAMSHAFT POSITION SENSOR CIRCUIT RANGE/PERF.	P0341	Monitor for cam position state change when expected at crankshaft sync.	CAM signal occurs at the incorrect crankshaft position.	Engine Running or Cranking	15 Failures out of 100 test samples Every low res pulse Continuous	DTC Type B
CAMSHAFT POSITION SENSOR CIRCUIT LOW	P0342	Monitor for continuous low state when state should be high.	Evaluated at crankshaft position synchronization	Engine Running or Cranking	15 Failures out of 100 test samples, engine cranking; 50 failures out of 100 test samples, engine running; every low res pulse Continuous	DTC Type B
CAMSHAFT POSITION SENSOR CIRCUIT HIGH	P0343	Monitor for continuous high state when state should be low.	Evaluated at crankshaft position synchronization	Engine Running or Cranking	15 Failures out of 100 test samples, engine cranking; 50 failures out of 100 test samples, engine running; every low res pulse Continuous	DTC Type B

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IGNITION CONTROL #1 CIRCUIT	P0351	Monitor EST channel A (Cylinder 1)	EST line is Stuck Low, is open, or is Stuck High. If engine speed is < 1500 RPM test failures and samples increment by 1 each time the diagnostic executes. If engine speed is ≥ 1500 RPM test failures and samples increment by 2 each time the diagnostic executes in order to report a failure faster		30 Failures out of 100 500 msec / test Continuous	DTC Type B
IGNITION CONTROL #2 CIRCUIT	P0352	Monitor EST channel B (Cylinder 2)	EST line is Stuck Low, is open, or is Stuck High. If engine speed is < 1500 RPM test failures and samples increment by 1 each time the diagnostic executes. If engine speed is ≥ 1500 RPM test failures and samples increment by 2 each time the diagnostic executes in order to report a failure faster		30 Failures out of 100 500 msec / test Continuous	DTC Type B
IGNITION CONTROL #3 CIRCUIT	P0353	Monitor EST channel C (Cylinder 3)	EST line is Stuck Low, is open, or is Stuck High. If engine speed is < 1500 RPM test failures and samples increment by 1 each time the diagnostic executes. If engine speed is ≥ 1500 RPM test failures and samples increment by 2 each time the diagnostic executes in order to report a failure faster		30 Failures out of 100 500 msec / test Continuous	DTC Type B
IGNITION CONTROL #4 CIRCUIT	P0354	Monitor EST channel D (Cylinder 4)	EST line is Stuck Low, is open, or is Stuck High. If engine speed is < 1500 RPM test failures and samples increment by 1 each time the diagnostic executes. If engine speed is ≥ 1500 RPM test failures and samples increment by 2 each time the diagnostic executes in order to report a failure faster		30 Failures out of 100 500 msec / test Continuous	DTC Type B

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IGNITION CONTROL #5 CIRCUIT	P0355	Monitor EST channel E (Cylinder 5)	EST line is Stuck Low, is open, or is Stuck High. If engine speed is < 1500 RPM test failures and samples increment by 1 each time the diagnostic executes. If engine speed is ≥ 1500 RPM test failures and samples increment by 2 each time the diagnostic executes in order to report a failure faster		30 Failures out of 100 500 msec / test Continuous	DTC Type B
IGNITION CONTROL #6 CIRCUIT	P0356	Monitor EST channel F (Cylinder 6)	EST line is Stuck Low, is open, or is Stuck High. If engine speed is < 1500 RPM test failures and samples increment by 1 each time the diagnostic executes. If engine speed is ≥ 1500 RPM test failures and samples increment by 2 each time the diagnostic executes in order to report a failure faster		30 Failures out of 100 500 msec / test Continuous	DTC Type B
IGNITION CONTROL #7 CIRCUIT	P0357	Monitor EST channel G (Cylinder 7)	EST line is Stuck Low, is open, or is Stuck High. If engine speed is < 1500 RPM test failures and samples increment by 1 each time the diagnostic executes. If engine speed is ≥ 1500 RPM test failures and samples increment by 2 each time the diagnostic executes in order to report a failure faster		30 Failures out of 100 500 msec / test Continuous	DTC Type B
IGNITION CONTROL #8 CIRCUIT	P0358	Monitor EST channel H (Cylinder 8)	EST line is Stuck Low, is open, or is Stuck High. If engine speed is < 1500 RPM test failures and samples increment by 1 each time the diagnostic executes. If engine speed is ≥ 1500 RPM test failures and samples increment by 2 each time the diagnostic executes in order to report a failure faster		30 Failures out of 100 500 msec / test Continuous	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
CATALYTIC CONVERTER LOW OXYGEN STORAGE	P0420	Oxygen Storage.	<p>OSC Time Difference = OSC Worst Pass Thresh - OSC Compensation Factor * (Post Cat O2 Resp Time - Pre Cat O2 Resp Time)</p> <p><u>Gasoline Operation:</u> OSC Time Difference ≥ 0.4296875 OSC Worst Pass Thresh = 4.1625sec</p> <p><u>CNG Operation:</u> OSC Time Difference ≥ 0.5996094 OSC Worst Pass Thresh = 3.3459 sec</p>	<p><u>Trip Enable Criteria</u> No Throttle, Injector, Misfire, CAM, Engine Protection, VSS, EVAP, Oxygen Sensor, IAT, MAP, IAC, Fuel System, EST, ECT, Crank, Purge Control, Purge Circuit or MAF faults IAT > -20°C Green Converter Delay = Not Active Not in PTO</p> <p><u>Valid Idle Period Criteria</u> Engine Speed ≥ 1000 rpm for minimum of 26 sec since end of last idle period Engine Speed < 1000 rpm Vehicle Speed ≤ 2 mph Engine runtime ≥ 300 seconds Not in Device Control Purge control either normal or controlled by Catalyst Monitor Test attempts this trip ≤ 12</p> <p><u>Idle Condition Met Criteria</u> Trip Enable Met, Valid Idle Period Met Predicted Catalyst Temperature ≥ 400°C 0.9 < Short Term Fuel Trim < 1.1 Delta Increase in Short Term Fuel Trim ≤ 0.15 Closed Loop Fueling and LTM Learning is enabled Barometric Pressure > 70 kpa 70°C ≤ ECT ≤ 125.5°C System voltage > 10.9 Volts 0 < Idle Period ≤ 60 seconds IAT < 85°C PRNDL is in Drive Range (default to run if PRNDL is failing) Idle Time is incremented if VSS ≤ 2mph and TPS ≤ 2%</p> <p><u>Test Enable Conditions – must hold true from 3.5 seconds after idle conditions are met to end of test</u> Delta IAC ≤ 399 steps Delta Load ≤ 99% Delta RPM ≤ 12798 2 ≤ MAF ≤ 16 RPM – Desired RPM ≤ 12798 Desired RPM – RPM ≤ 12798 Predicted Catalyst Temperature ≤ 650°C Ethanol ≤ 15%</p> <p><u>Engine Fueling Criteria at Beginning of Idle Period</u> Must be met from between 3.0 and 7 seconds after idle conditions have been met for at least 3.0 seconds Number of pre-O2 switches ≥ 2 Average BPW is within a window based on a table defined by airflow 0.96 ≤ average short term fuel trim ≤ 1.04</p>	<p>1 test attempted per valid idle period</p> <p>Minimum of 1 test per trip.</p> <p>Maximum of 6 tests per trip.</p> <p>Maximum of 6 trips to detect failure when Rapid Step Response is enabled</p> <p>frequency: 12.5 ms continuous</p> <p><u>Rapid Step Response Enable Criteria</u> The difference between current EWMA value and the current OSC time difference ≥ 0.356231864 sec and OSC Time Difference ≥ 0.000 sec. Maximum of 6 tests per trip, maximum of 18 tests to detect failure when rapid step response is enabled.</p> <p><u>Green Converter Delay Criteria</u> Diagnostic will not enable until the next ignition cycle after the following has been met: predicted catalyst temperature ≥ 400° C for 1 hour (non-continuously). (Note that all other enable criteria must be met on the next ignition cycle for the test to run on that ignition cycle)</p>	DTC Type A

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
CATALYTIC CONVERTER LOW OXYGEN STORAGE	P0430	Oxygen Storage.	<p>OSC Time Difference = OSC Worst Pass Thresh - OSC Compensation Factor * (Post Cat O2 Resp Time - Pre Cat O2 Resp Time)</p> <p><u>Gasoline Operation:</u> OSC Time Difference \geq 0.2333984 OSC Worst Pass Thresh = 3.250000 sec</p> <p><u>CNG Operation:</u> OSC Time Difference \geq 0.4804688 OSC Worst Pass Thresh = 3.181080 sec</p>	<p><u>Trip Enable Criteria</u> No Throttle, Injector, Misfire, CAM, Engine Protection, VSS, EVAP, Oxygen Sensor, IAT, MAP, IAC, Fuel System, EST, ECT, Crank, Purge Control, Purge Circuit or MAF faults IAT > -20°C Green Converter Delay = Not Active Not in PTO</p> <p><u>Valid Idle Period Criteria</u> Engine Speed \geq 1000 rpm for minimum of 26 sec since end of last idle period Engine Speed < 1000 rpm Vehicle Speed \leq 2 mph Engine runtime \geq 300 seconds Not in Device Control Purge control either normal or controlled by Catalyst Monitor Test attempts this trip \leq 12</p> <p><u>Idle Condition Met Criteria</u> Trip Enable Met, Valid Idle Period Met Predicted Catalyst Temperature \geq 400°C 0.9 < Short Term Fuel Trim < 1.1 Delta Increase in Short Term Fuel Trim \leq 0.15 Closed Loop Fueling and LTM Learning is enabled Barometric Pressure > 70 kpa 70°C \leq ECT \leq 125.5°C System voltage > 10.9 Volts 0 < Idle Period \leq 60 seconds IAT < 85°C PRNDL is in Drive Range (default to run if PRNDL is failing) Idle Time is incremented if VSS \leq 2mph and TPS \leq 2% <u>Test Enable Conditions – must hold true from 3.5 seconds after idle conditions are met to end of test</u> Delta IAC \leq 399 steps Delta Load \leq 99% Delta RPM \leq 12798 2 \leq MAF \leq 16 RPM – Desired RPM \leq 12798 Desired RPM – RPM \leq 12798 Predicted Catalyst Temperature \leq 650°C Ethanol \leq 15%</p> <p><u>Engine Fueling Criteria at Beginning of Idle Period</u> Must be met from between 3.0 and 7 seconds after idle conditions have been met for at least 3.0 seconds Number of pre-O2 switches \geq 2 Average BPW is within a window based on a table defined by airflow 0.96 \leq average short term fuel trim \leq 1.04</p>	<p>1 test attempted per valid idle period</p> <p>Minimum of 1 test per trip.</p> <p>Maximum of 6 tests per trip.</p> <p>Maximum of 6 trips to detect failure when Rapid Step Response is enabled</p> <p>frequency: 12.5 ms continuous</p> <p><u>Rapid Step Response Enable Criteria</u> The difference between current EWMA value and the current OSC time difference \geq 0.356231864 sec and OSC Time Difference \geq 0.000 sec. Maximum of 6 tests per trip, maximum of 18 tests to detect failure when rapid step response is enabled.</p> <p><u>Green Converter Delay Criteria</u> Diagnostic will not enable until the next ignition cycle after the following has been met: predicted catalyst temperature \geq 400° C for 1 hour (non-continuously). (Note that all other enable criteria must be met on the next ignition cycle for the test to run on that ignition cycle)</p>	DTC Type A

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
EVAP SYSTEM SMALL LEAK DETECTED	P0442	This DTC will detect a small leak ($\geq 0.020''$) in the EVAP system between the fuel fill cap and the purge solenoid. The engine off natural vacuum method (EONV) is used.	<p><u>SMALL LEAK TEST FAIL:</u> Engine Off Natural Vacuum (EONV) while the engine is off. The total pressure change achieved during the test is normalized against a target value that is based upon fuel level and ambient temperature. (values range from 1.25 to 3.25" water). The normalized value is entered into EWMA (with 0= perfect pass and 1=perfect fail). Once EWMA exceeds the fail threshold, the DTC light is illuminated. The DTC light can be turned off if the EWMA falls below the re-pass threshold for 3 consecutive trips.</p> <p>Fail threshold = 0.71 Re-Pass threshold = 0.53</p>	<p><u>TEST ENABLE :</u> No MAP DTC's No Thermostat Rationality DTC's VS Sensor DTC's not active No Fuel Tank Pressure Sensor circuit DTC's No EVAP Canister Purge Solenoid circuit DTC's No EVAP Canister Vent Solenoid circuit DTC's No Fuel Level DTC's Coolant Sensor DTC's not active IAT Sensor DTC's not active EVAP CCP stuck open DTC not active. EVAP large leak DTC not active. Ignition off timer DTC not active. Canister Vent restriction DTC is not active Fuel Level $>15.0\%$ but $< 85.0\%$ Drive time ≥ 600 seconds. Drive length ≥ 3 miles. Coolant $\geq 70^{\circ}\text{C}$. No fuel filling (fuel level increment $\geq 10\%$) During EONV test. BARO $> 74.0\text{kPa}$ Estimated ambient temperature at end of drive $> 2^{\circ}\text{C}$ but $< 32^{\circ}\text{C}$.</p> <p>Estimate of Ambient Air Temperature Valid Conditions to be valid</p> <ol style="list-style-type: none"> 1. Cold Start Startup $\Delta^{\circ}\text{C}(\text{ECT-IAT}) < 8^{\circ}\text{C}$ if ECT $> \text{IAT}$ <p>OR</p> <ol style="list-style-type: none"> 2. Hot Restart Sufficient drive length to get accurate estimate of ambient air temperature (at least a minimum of 3 minutes and 3 miles) 	Once per trip, during hot soak (up to 2500 sec.). Time since last complete test ≥ 17 hours if EWMA is passing, or ≥ 10 hours if EWMA is failing. No more than 2 attempts per day.	DTC Type A EWMA Average run length is 9 under normal conditions Run length is 2 to 6 trips after code clear or non-volatile reset
EVAP CANISTER PURGE SOLENOID VALVE CIRCUIT	P0443	This DTC checks the Purge Solenoid Control Circuit for electrical integrity	Output state shorted or open.	Engine speed > 400 rpm. $5 \text{ V} < \text{System voltage} < 18 \text{ V}$	10 failures out of 100 samples 500ms loop continuous	DTC Type B

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EVAP CANISTER VENT BLOCKED	P0446	This DTC will determine if a restriction is present in the vent solenoid, vent filler, vent hose or EVAP canister	Tank Vacuum > 12.00 "H2O for 5 seconds BEFORE Purge Volume > 10 liters OR Vented Vacuum < -2.5 in. H2O or Vented Vacuum > 5 in. H2O for 15 seconds 2 liters of fuel must be consumed after setting the DTC active the first time to set the DTC active the second time.	<u>General Test Enable</u> <ul style="list-style-type: none"> • No MAP DTC's • No TP Sensor DTC's • No VSS DTC's • No IAT DTC's • No ECT DTC's • No Fuel Tank Pressure Sensor Circuit DTC's • No Evap Canister Purge solenoid Circuit DTC's • No EVAP Canister Vent Solenoid Circuit DTC's • No Thermostat Rationality DTC's • 15 % < Fuel Level < 85. % • 10.00 V < System Voltage < 18.00 V • 4 °C < IAT < 30°C • ECT < 30 °C • BARO > 74.00 kPa (8000 ft) 	Once per cold start Time is dependent on driving conditions Max. before test abort is 1000 seconds	DTC Type B
EVAP VENT SOLENOID CONTROL CIRCUIT	P0449	This DTC checks the Evap Vent Solenoid Control Circuit for electrical integrity	Output state shorted or open.	Engine speed > 400 rpm. 6 V < System voltage < 18 V	10 failures out of 100 samples 500ms loop continuous	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
FUEL TANK PRESSURE (FTP) SENSOR CIRCUIT PERFORMANCE	P0451	The DTC will be set if the fuel tank vacuum sensor is out of range when it tries to re-zero prior to the phase-1 or phase-2 portions of the engine-off natural vacuum small leak test.	<p>The tank vacuum sensor voltage is compared to a window about the nominal sensor voltage offset (~1.5 volts)</p> <p>upper voltage threshold (voltage addition above the nominal voltage): 0.2 volts</p> <p>lower voltage threshold (voltage subtraction below the nominal voltage): 0.2 volts</p> <p>The difference between tank vacuum sensor voltage and the nominal offset voltage is then normalized against the appropriate threshold listed above to produce a ratio between 0.0 and 1.0. This normalized re-zero ratio is then filtered with a EWMA (with 0= perfect pass and 1=perfect fail). Once EWMA exceeds the fail threshold, the DTC light is illuminated. The DTC light can be turned off if the EWMA falls below the re-pass threshold for 3 consecutive trips.</p> <p>Fail threshold = 0.73 Re-Pass threshold = 0.40</p>	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	<p>This test is executed during an engine-off natural vacuum small leak test. The number of times that it executes can range from zero to two per engine-off period.</p> <p>The length of the test is determined by the refueling rationality test which can take up to 600 seconds to complete.</p>	<p>DTC Type A EWMA</p> <p>average run length: 6</p>
EVAP SYSTEM PRESSURE LOW	P0452	This DTC will detect a fuel tank pressure sensor signal that is too low out of range.	<p>Fuel tank pressure sensor signal < 0.1 volts produces a failing sample. Otherwise, the sample is considered passing.</p> <p>If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC.</p>	<ul style="list-style-type: none"> 0.10 second delay after sensor power up for sensor warm-up PCM State <> crank 	<p><u>Frequency:</u> Continuous 100ms loop</p>	<p>DTC Type B</p>

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EVAP SYSTEM PRESSURE HIGH	P0453	This DTC will detect a fuel tank pressure sensor signal that is too high out of range.	Fuel tank pressure sensor signal > 4.9 volts produces a failing sample. Otherwise, the sample is considered passing. If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC.	<ul style="list-style-type: none"> 0.10 second delay after sensor power up for sensor warm-up PCM state <> crank 	Frequency: Continuous 100ms loop	DTC Type B
EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR/SWITCH INTERMITTENT	P0454	This DTC will detect intermittent tank vacuum sensor signals that would have caused the engine-off natural vacuum small leak test to abort due to an apparent re-fueling event.	If an abrupt change in tank vacuum is detected the engine-off natural vacuum test is aborted due to an apparent refueling event. Subsequent to the abort, a refueling rationality test is executed to confirm that a refueling event occurred. If a refueling is confirmed, then the test sample is considered passing. Otherwise, the sample is considered failing indicating an intermittent signal problem. The abrupt change is defined as a change > 0.45 and < 1.0 "H2O vacuum in the span of 1.0 seconds. A refueling event is confirmed if the fuel level has a persistent change of 10.0 % for 30 seconds. The test will report a failure if 2 out of 3 samples are failures.	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	This test is executed during an engine-off natural vacuum small leak test. The test can only execute up to once per engine-off period. The length of the test is determined by the refueling rationality test which can take up to 600 seconds to complete.	DTC Type A

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
EVAP. EMISSION CONTROL SYSTEM MALFUNCTION	P0455	This DTC will detect a weak vacuum condition (large leak or purge blockage) in the Evap system.	<p>Purge volume > 14.00 liters BEFORE Tank vacuum < 11 "H₂O</p> <p>2 liters of fuel must be consumed after setting the DTC active the first time to set the DTC active the second time.</p> <p><u>Weak Vacuum Follow-up Test</u> (fuel cap replacement test) Weak Vacuum Test failed previous trip and this trip. Passes if tank vacuum > 11" H₂O.</p> <p>Note: Weak Vacuum Follow-up Test can only report a pass.</p>	<p><u>General Test Enable</u></p> <ul style="list-style-type: none"> No MAP DTC's No TP Sensor DTC's No VSS DTC's No IAT DTC's No ECT DTC's No Fuel Tank Pressure Sensor Circuit DTC's No Evap Canister Purge solenoid Circuit DTC's No EVAP Canister Vent Solenoid Circuit DTC's No Thermostat Rationality DTC's 15 % < Fuel Level < 85. % 10.00 V < System Voltage < 18.00 V 4 °C < IAT < 30°C ECT < 30 °C BARO > 74.00 kPa (8000 ft) (L59 only) - The virtual flex fuel sensor algorithm may cause the large leak test to abort under certain refueling scenarios. <p style="text-align: center;"><u>Cold Start Test</u></p> <ul style="list-style-type: none"> IAT < 30°C Cold temperature Δ(ECT-IAT): < 8 °C if ECT > IAT Cold Test Timer < 1000 seconds 	<p>Once per cold start</p> <p>Time is dependent on driving conditions</p> <p>Max. before test abort is 1000 seconds</p> <p><u>Weak Vacuum Follow-up Test</u> On 2nd trip with large leak detected, the follow-up test is limited to 600 seconds. Once the MIL is on, the follow-up test runs indefinitely.</p>	DTC Type B
GASOLINE FUEL LEVEL NO CHANGE, STUCK IN RANGE	P0461	This DTC will detect a fuel sender stuck in range.	For single tank, if delta fuel volume change is less than 3 liters over accumulated 150 miles.	No VSS DTC's set runs continuously		DTC Type B
GASOLINE FUEL LEVEL STUCK LOW	P0462	This DTC will detect a fuel sender stuck out of range low	Fuel level A/D counts less than 20 A/D counts for 30 seconds	runs continuously		DTC Type B
GASOLINE FUEL LEVEL STUCK HIGH	P0463	This DTC will detect a fuel sender stuck out of HIGH	Fuel level A/D counts more than 150 A/D counts for 30 seconds	runs continuously		DTC Type B

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FUEL LEVEL SENSOR A CIRCUIT INTERMITTENT	P0464	This DTC will detect intermittent fuel level sensor signals that would have caused the engine-off natural vacuum small leak test to abort due to an apparent re-fueling event.	<p>If a change in fuel level is detected the engine-off natural vacuum test is aborted due to an apparent refueling event. Subsequent to the abort, a refueling rationality test is executed to confirm that a refueling event occurred. If a refueling is confirmed, then the test sample is considered passing. Otherwise, the sample is considered failing indicating an intermittent signal problem.</p> <p>The refuel event is defined as a change of 10.0 % fuel level during the engine-off test.</p> <p>A refueling event is confirmed if the fuel level has a persistent change of 10.0 % for 30 seconds.</p> <p>The test will report a failure if 2 out of 3 samples are failures.</p>	<ul style="list-style-type: none"> This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes 	<p>This test is executed during an engine-off natural vacuum small leak test. The test can only execute up to once per engine-off period.</p> <p>The length of the test is determined by the refueling rationality test which can take up to 600 seconds to complete.</p>	DTC Type A

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EVAP SYSTEM FLOW DURING NON-PURGE	P0496	This DTC will determine if the purge solenoid is leaking to engine manifold vacuum.	Tank Vacuum > 10 "H2O for 5.00 sec BEFORE Test time > 60 seconds (cold start)	<u>General Test Enable</u> <ul style="list-style-type: none"> • No MAP DTC's • No TP Sensor DTC's • No VSS DTC's • No IAT DTC's • No ECT DTC's • No Fuel Tank Pressure Sensor circuit DTC's • No EVAP canister purge valve solenoid circuit DTC's • No EVAP Canister Vent Solenoid circuit DTC's • No Thermostat Rationality DTC's • 15 % < Fuel Level < 85. % • 10.00 V < System Voltage < 18.00 V • 4 °C < IAT < 30°C • ECT < 30 °C • BARO > 74.00 kPa (8000 ft) <p style="text-align: center;">Cold Start Test</p> <ul style="list-style-type: none"> • IAT < 30°C • Cold temperature Δ(ECT-IAT): < 8 °C if ECT > IAT • Cold Test Timer < 1000 seconds 	Once per cold start. Cold start: max time is 1000 seconds	DTC Type B

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IDLE SYSTEM - LOW ENGINE SPEED	P0506	This DTC will determine if a low idle exists.	RPM < Desired RPM by an amount determined in a look up table based on engine coolant <table border="1"> <thead> <tr> <th><u>ECT</u></th> <th><u>value</u></th> </tr> </thead> <tbody> <tr><td>56</td><td>-150</td></tr> <tr><td>68</td><td>-100</td></tr> <tr><td>80</td><td>-100</td></tr> <tr><td>92</td><td>-100</td></tr> <tr><td>104</td><td>-100</td></tr> <tr><td>116</td><td>-100</td></tr> <tr><td>128</td><td>-3200</td></tr> <tr><td>140</td><td>-3200</td></tr> <tr><td>152</td><td>-3200</td></tr> </tbody> </table>	<u>ECT</u>	<u>value</u>	56	-150	68	-100	80	-100	92	-100	104	-100	116	-100	128	-3200	140	-3200	152	-3200	No Throttle, Electronic Throttle Control, VS speed, ECT, Fuel System, MAF, MAP, IAT, CCP solenoid or valve stuck open, fuel injector or misfire faults active. ECT ≥ 60.00 °C System Voltage ≥ 9.00 V but ≤ 18.00 V IAT ≥ -10.00 °C Engine run time ≥ 60.00 seconds BARO ≥ 65.00 kPa TP Sensor ≤ 0.3515625 % VSS ≤ 1.00 MPH Catalyst Diagnostic Intrusive Test = not active Post O2 Diagnostic Intrusive Test = not active Electronic Throttle Control not forcing limited idle No Parasitic load change Above met for a time ≥ 2 seconds to enable diagnostic.	5.00 seconds per test 1 test to fail; must leave enable criteria between each test <u>Frequency:</u> Continuous after enable 100ms loop	DTC Type B
<u>ECT</u>	<u>value</u>																									
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152	-3200																									
IDLE SYSTEM - HIGH ENGINE SPEED	P0507	This DTC will determine if a high idle exists.	RPM > Desired RPM by an amount determined in a look up table based on engine coolant <table border="1"> <thead> <tr> <th><u>ECT</u></th> <th><u>value</u></th> </tr> </thead> <tbody> <tr><td>56</td><td>250</td></tr> <tr><td>68</td><td>200</td></tr> <tr><td>80</td><td>200</td></tr> <tr><td>92</td><td>200</td></tr> <tr><td>104</td><td>200</td></tr> <tr><td>116</td><td>200</td></tr> <tr><td>128</td><td>3200</td></tr> <tr><td>140</td><td>3200</td></tr> <tr><td>152</td><td>3200</td></tr> </tbody> </table>	<u>ECT</u>	<u>value</u>	56	250	68	200	80	200	92	200	104	200	116	200	128	3200	140	3200	152	3200	No Throttle, Electronic Throttle Control, VS speed, ECT, Fuel System, MAF, MAP, IAT, CCP solenoid or valve stuck open, fuel injector or misfire faults active. ECT ≥ 60.00 °C System Voltage ≥ 9.00 V but ≤ 18.00 V IAT ≥ -10.00 °C Engine run time ≥ 60.00 seconds BARO ≥ 65.00 kPa TP Sensor ≤ 0.3515625 % VSS ≤ 1.00 MPH Catalyst Diagnostic Intrusive Test = not active Post O2 Diagnostic Intrusive Test = not active Electronic Throttle Control not forcing limited idle No Parasitic load change Above met for a time ≥ 2 seconds to enable diagnostic.	5.00 seconds per test 1 test to fail; must leave enable criteria between each test <u>Frequency:</u> Continuous after enable 100ms loop	DTC Type B
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56	250																									
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104	200																									
116	200																									
128	3200																									
140	3200																									
152	3200																									
PCM – FLASH EEPROM CHECKSUM ERROR	P0601	Indicates that PCM is unable to correctly read data from the flash memory.	Calculated checksum does not match expected checksum for the program.	Ignition in Run or Crank.	One occurrence. Check is performed at power-up and every 100 milliseconds thereafter.	DTC Type A																				

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PCM – PROGRAMMING ERROR	P0602	Indicates that the PCM is not flashed.	PCM not flashed.	Ignition on. PCM is identified through calibration as a service PCM	1 test failure Check is performed at power-up and every 100 milliseconds thereafter.	DTC Type A
PCM RAM FAILURE	P0604	Indicates that PCM is unable to correctly write and read data to and from RAM	Data read does not match data written	Ignition in Run or Crank	One occurrence. Check is performed at power-up and every 100 milliseconds thereafter.	DTC Type A
PCM INTEGRITY	P0606	Indicates that the PCM has detected an ETC internal processor integrity fault	ETC has process sequencing error, dual path consistency error, clock error, or computer is not operating properly	Ignition in Run/Crank or during key-off	Fault sets within 200 msec Runs every 18.75 msec	DTC Type A
ALT FUEL INJECTOR DRIVER MODULE (COMM)	P0611	Determines if the Injector Driver Module is in an out of range high condition	Injector Driver Module frequency is out of range.	* Engine RPM >= 1 * P1207, P1209 Active	1 second loop	DTC Type A (Bi-Fuel switches to gasoline)
5 VOLT REFERENCE A CIRCUIT	P0641	Determines if the supply voltage for the 5 volt reference is within an acceptable limit.	Voltage state invalid (Voltage > 4.7 volts or voltage < 4.39 volts)	Engine is running	Condition present > 2 seconds 200 ms loop Continuous.	DTC Type B
MALFUNCTION INDICATOR LAMP CONTROL CIRCUIT MALF	P0650	This DTC checks the Malfunction Indicator Lamp Control Circuit for electrical integrity	Output state shorted or open.	Engine speed > 400 rpm. 6 V < System voltage < 18 V	10 failures out of 100 samples 500ms loop continuous	DTC Type B No MIL
5 VOLT REFERENCE B CIRCUIT	P0651	Determines if the supply voltage for the 5 volt reference is within an acceptable limit	Voltage state invalid (Voltage > 4.7 volts or voltage < 4.39 volts)	Engine is running	Condition present > 2 seconds 200 ms loop Continuous.	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
PRNDL SWITCH	P0706	Check for PRNDL switch malfunction – stuck in park or neutral	PRNDL indicates Park or Neutral when engine conditions indicate it should not. Note that PRNDL defaults to PSM position or Drive 4, depending on trans, when P0706 is Active.	Ignition voltage ≥ 6 and < 18 V No Throttle, VSS or unknown ratio faults Engine runtime ≥ 60 seconds TP $\geq 5\%$ VS ≥ 20 mph Engine torque ≥ 50 ft/lbs. Gear ≥ 3 Not in PTO	Stuck in PN for 100 samples out of 150 samples. 500 msec loop Continuous	DTC Type C
ALT FUEL INJECTOR DRIVER MODULE (INPUTS)	P1020	Monitor the Injector Control Circuit	Disconnected, shorted to ground, or shorted to battery	* IGN Volt $> 6V$ and $< 18V$ * P0148, P0611, P1209 Not Active * RPM > 0 * Fuel Cut-off Not Active	3.55 - 4.75 sec Continuous	DTC Type A (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (OUTPUT - CYLINDER 1)	P1021	Auxiliary Injector 1 Control Circuit	Disconnected, shorted to ground, or shorted to battery	IGN Volt $> 6V$ and $< 18V$ RPM ≥ 1 CNG Mode Active	3.55 - 4.75 sec Continuous	DTC Type A (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (OUTPUT - CYLINDER 2)	P1022	Auxiliary Injector 2 Control Circuit	Disconnected, shorted to ground, or shorted to battery	IGN Volt $> 6V$ and $< 18V$ RPM ≥ 1 CNG Mode Active	3.55 - 4.75 sec Continuous	DTC Type A (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (OUTPUT - CYLINDER 3)	P1023	Auxiliary Injector 3 Control Circuit	Disconnected, shorted to ground, or shorted to battery	IGN Volt $> 6V$ and $< 18V$ RPM ≥ 1 CNG Mode Active	3.55 - 4.75 sec Continuous	DTC Type A (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (OUTPUT - CYLINDER 4)	P1024	Auxiliary Injector 4 Control Circuit	Disconnected, shorted to ground, or shorted to battery	IGN Volt $> 6V$ and $< 18V$ RPM ≥ 1 CNG Mode Active	3.55 - 4.75 sec Continuous	DTC Type A (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (OUTPUT - CYLINDER 5)	P1025	Auxiliary Injector 5 Control Circuit	Disconnected, shorted to ground, or shorted to battery	IGN Volt $> 6V$ and $< 18V$ RPM ≥ 1 CNG Mode Active	3.55 - 4.75 sec Continuous	DTC Type A (Bi-Fuel switches to gasoline)

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ALT FUEL INJECTOR DRIVER MODULE (OUTPUT - CYLINDER 6)	P1026	Auxiliary Injector 6 Control Circuit	Disconnected, shorted to ground, or shorted to battery	IGN Volt > 6V and < 18V RPM >= 1 CNG Mode Active	3.55 - 4.75 sec Continuous	DTC Type A (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (OUTPUT - CYLINDER 7)	P1027	Auxiliary Injector 7 Control Circuit	Disconnected, shorted to ground, or shorted to battery	IGN Volt > 6V and < 18V RPM >= 1 CNG Mode Active	3.55 - 4.75 sec Continuous	DTC Type A (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (OUTPUT - CYLINDER 8)	P1028	Auxiliary Injector 8 Control Circuit	Disconnected, shorted to ground, or shorted to battery	IGN Volt > 6V and < 18V RPM >= 1 CNG Mode Active	3.55 - 4.75 sec Continuous	DTC Type A (Bi-Fuel switches to gasoline)
ACCELERATOR PEDAL POSITION SYSTEM	P1125	PCM determines a limp home mode of operation due to multiple accelerator pedal sensor faults.	This DTC is set when: 1) 2 or more APP sensors are out of range, OR 2) all 3 APP sensors disagree, OR 3) one APP sensor is out of range AND the other 2 APP sensors disagree.	Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data. No TACM processor DTC.	One occurrence. Check runs every 18.75 ms.	DTC Type A For use on vehicles with ETC

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(B1S1) HEATED OXYGEN SENSOR TOO FEW R/L OR L/R SWITCHES	P1133	Detects sensors that are initially slow to respond to changes in commanded A/F (but have normal transition times) by monitoring the number of R/L and L/R switches.	<p>The oxygen sensor switches between 250 – 625 mV.</p> <p><u>Gasoline Operation:</u> Number of switches: L/R switches < 30 R/L switches < 30</p> <p><u>Bi-Fuel CNG Operation (Bin 10):</u> Number of switches: L/R switches < 105 R/L switches < 105</p> <p><u>Dedicated CNG Operation (Bin 8):</u> Number of switches: L/R switches < 135 R/L switches < 135</p>	<p>No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V DTC's P0131, P0132, P0134 and P0135 not Active -1280 °C < Predicted O2 Sensor Temp < 1280 °C No Misfire Faults Active Fuel Level ≥ 10% Ethanol % ≤ 90 ECT > 60 °C Engine runtime > 160 sec CCP Duty Cycle ≥ 0% PRNDL in drive range Closed Loop Fuel Control 1200 ≤ RPM ≤ 3000 20 ≤ Air Flow ≤ 55g/s. TPS ≥ 5%</p> <p>Above conditions met for 1 sec</p>	<p>100 sec Once per trip.</p>	<p>DTC Type B</p>

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(B1S1) HEATED OXYGEN SENSOR TRANSITION TIME DIFFERENCE	P1134	Detects slow asymmetrical faults by monitoring the difference between R/L and L/R average response times.	The oxygen sensor transitions between 250 – 625 mV. HO2S sensor average transition time difference (R/L minus L/R): <u>Gasoline Operation:</u> Max +115 ms Min -120 ms <u>Bi-Fuel CNG Operation (Bin 10):</u> Max +118 ms Min -120 ms <u>Dedicated CNG Operation (Bin 8):</u> Max +85 ms Min -43 ms	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V DTC's P0131, P0132, P0134 and P0135 not Active -1280 °C < Predicted O2 Sensor Temp < 1280 °C No Misfire Faults Active Fuel Level ≥ 10% Ethanol % ≤ 90 ECT > 60 °C Engine runtime > 160 sec CCP Duty Cycle ≥ 0% PRNDL in drive range Closed Loop Fuel Control 1200 ≤ RPM ≤ 3000 20 ≤ Air Flow ≤ 55g/s. TPS ≥ 5% Above conditions met for 1 sec	100 sec Once per trip.	DTC Type B

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(B2S1) HEATED OXYGEN SENSOR TOO FEW R/L OR L/R SWITCHES	P1153	Detects sensors that are initially slow to respond to changes in commanded A/F (but have normal transition times) by monitoring the number of R/L and L/R switches.	<p>The oxygen sensor switches between 250 – 625 mV.</p> <p><u>Gasoline Operation:</u> Number of switches: L/R switches < 30 R/L switches < 30</p> <p><u>Bi-Fuel CNG Operation (Bin 10):</u> Number of switches: L/R switches < 105 R/L switches < 105</p> <p><u>Dedicated CNG Operation (Bin 8):</u> Number of switches: L/R switches < 135 R/L switches < 135</p>	<p>No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V DTC's P0131, P0132, P0134 and P0135 not Active -1280 °C < Predicted O2 Sensor Temp < 1280 °C No Misfire Faults Active Fuel Level ≥ 10% Ethanol % ≤ 90 ECT > 60 °C Engine runtime > 160 sec CCP Duty Cycle ≥ 0% PRNDL in drive range Closed Loop Fuel Control 1200 ≤ RPM ≤ 3000 20 ≤ Air Flow ≤ 55g/s. TPS ≥ 5%</p> <p>Above conditions met for 1 sec</p>	<p>100 sec Once per trip.</p>	<p>DTC Type B</p>

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(B2S1) HEATED OXYGEN SENSOR TRANSITION TIME DIFFERENCE	P1154	Detects slow asymmetrical faults by monitoring the difference between R/L and L/R average response times	The oxygen sensor transitions between 250 – 625 mV. HO2S sensor average transition time difference (R/L minus L/R): <u>Gasoline Operation:</u> Max +115 ms Min -120 ms <u>Bi-Fuel CNG Operation (Bin 10):</u> Max +118 ms Min -120 ms <u>Dedicated CNG Operation (Bin 8):</u> Max +85 ms Min -43 ms	No Throttle, IAT, Injector, Coolant, Air Flow, Purge Control, MAP, Fuel Composition or Engine Protect faults Active. Catalyst Monitor Test not Intrusive Not in Device Control Post Oxygen Sensor Diagnostic not Intrusive 10 V ≤ System Voltage ≤ 18 V DTC's P0131, P0132, P0134 and P0135 not Active -1280 °C < Predicted O2 Sensor Temp < 1280 °C No Misfire Faults Active Fuel Level ≥ 10% Ethanol % ≤ 90 ECT > 60 °C Engine runtime > 160 sec CCP Duty Cycle ≥ 0% PRNDL in drive range Closed Loop Fuel Control 1200 ≤ RPM ≤ 3000 20 ≤ Air Flow ≤ 55g/s. TPS ≥ 5% Above conditions met for 1 sec	100 sec Once per trip.	DTC Type B
ALT FUEL SYSTEM	P1204	Excessive Crank Time Using Alternative Fuel	Crank Time > 8 sec	* IGN Volt > 6V and < 18V * P0005, P0146, P0191, P0192, P0193, P0611, P1020 to P1028, P1209, P2146, P2665 Not Active * CNG Mode Active	> 8 sec crank time with no engine run on alternative fuel	DTC Type B Bi Fuel ONLY (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (ANALOG LINE)	P1207	Monitor Fuel Injector Analog Feedback Circuit	Inactive OR Out of Range PWM	IGN Volt >= 4 V	2 second loop	DTC Type B (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (DIAG. LINE)	P1209	Monitor Fuel Injector Diagnostic Feedback Circuit	Inactive OR Out of Range PWM	* IGN Volt > 6V and < 18V * Engine Speed >= 1 RPM	2 second loop	DTC Type A (Bi-Fuel switches to gasoline)
ALT FUEL SYSTEM	P1204	Excessive Crank Time Using Alternative Fuel	Crank Time > 8 sec	* IGN Volt > 6V and < 18V * P0005, P0146, P0191, P0192, P0193, P0611, P1020 to P1028, P1209, P2146, P2665 Not Active * CNG Mode Active	> 8 sec crank time with no engine run on alternative fuel	DTC Type B Bi Fuel ONLY (Bi-Fuel switches to gasoline)

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ALT FUEL INJECTOR DRIVER MODULE (ANALOG LINE)	P1207	Monitor Fuel Injector Analog Feedback Circuit	Inactive OR Out of Range PWM	IGN Volt \geq 4 V	2 second loop	DTC Type B (Bi-Fuel switches to gasoline)
ALT FUEL INJECTOR DRIVER MODULE (DIAG. LINE)	P1209	Monitor Fuel Injector Diagnostic Feedback Circuit	Inactive OR Out of Range PWM	* IGN Volt $>$ 6V and $<$ 18V * Engine Speed \geq 1 RPM	2 second loop	DTC Type A (Bi-Fuel switches to gasoline)
ENGINE PROTECTION MODE ACTIVE	P1258	Monitor for engine protection mode active.	Coolant temperature \geq 129.4°C for more than 10 seconds.	No coolant sensor DTC's.	Set immediately upon engine protection mode active. 1 second loop continuous	DTC Type A
ABS ROUGH ROAD MALFUNCTION	P1380	This diagnostic detects if the ABS controller is indicating a fault. When this occurs, misfire will continue to run.	ABS controller sends a message to PCM indicating that a failure has occurred in the ABS module	VS \geq 5mph RPM \leq 7000 Engine Load \leq 60%	450 failures out of 500 samples 100 msec loop continuous	DTC Type C (DTC can only set when a P0300 Light Request is True)
ABS SYSTEM ROUGH ROAD DETECTION COMMUNICATION FAULT	P1381	This diagnostic detects if the rough road information is no longer being received from the ABS module. When this occurs, misfire will continue to run.	Serial data messages are lost	VS \geq 5mph RPM \leq 7000 Engine Load \leq 60%	450 failures out of 500 samples 100 msec loop continuous	DTC Type C (DTC can only set when a P0300 is Light Request is True)
ALT FUEL TANK PRESSURE NO CHANGE	P1431	Monitor for Tank Pressure Circuit Range/ Performance	The Tank Pressure must change 200 psi over 50 miles of driving on Alt Fuel to pass.	* Alt Fuel Operation * Alt Fuel engine runtime $>$ 5 sec * Ignition Voltage $>$ 5 V * Above conditions met for 1 sec * IAT DTC's P0111, P0112, P0113 not set, * Tank DTC's P1432, 1433 not set, * Analog PWM P1207 not set	2 sec Once per Trip	DTC Type A Default = 0psi (Bi-Fuel switches to gasoline)
ALT FUEL PRESSURE SENSOR (TANK) LOW INPUT	P1432	Monitor for Tank Pressure Sensor Circuit Low Input	Tank Pressure Sensor $<$ 0.102 volts	* IGN Volt $>$ 4 V * P1207 Not Active * Initial Read Delay over = 1 sec	2 second loop	DTC Type B Default = 0psi (Bi-Fuel switches to gasoline)

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ALT FUEL PRESSURE SENSOR (TANK) HIGH INPUT	P1433	Monitor for Tank Pressure Sensor Circuit High Input	Tank Pressure Sensor > 4.95 Volts	* CNG Fuel Temp < 30°C * Analog PWM DTC (P1207) Not set * IGN Volt > 4 V * Initial Read Delay over = 1 sec * IAT DTC (P0111, P0112, P0113) Not set * Tank DTC's (P1431, P1432) Not set * IAT < 27C OR * IAT >= 27 C * Distance traveled this key cycle is > 20 Mi	2 second loop	DTC Type B Default = 0psi (Bi-Fuel switches to gasoline)
COMMAND vs ACTUAL THROTTLE PERF. (TAC MODULE)	P1516	Indicates that the TAC Module has detected a throttle positioning error OR Either Processor cannot determine throttle positioning OR Both TP Sensors are invalid	ABS (throttle error): a) ≥2 degrees for >200 ms with no change in error sign. OR b) ≥2 degrees for >500 ms for throttle command changes ≥ 2 degrees. OR c) ≥ 5 degrees for >200 ms for throttle command changes ≥ 5 degrees. OR d) ≥ 5 degrees for > 300 ms with no change in error sign. OR 2) PCM processor DTC's. OR 3) TACM processor DTC. OR 4) both TPS Circuit DTC's are set. OR 5) PCM-TACM Serial Data DTC w/ any APP Sensor DTC or TP Sensor DTC. [Throttle error = Measured throttle position - commanded throttle position]	Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data. Not in battery saver mode.	One occurrence. Check runs every 3 ms.	DTC Type A For use on vehicles with ETC

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COMMAND vs ACTUAL THROTTLE PERF. (PCM)	P2101	Indicates that the PCM has detected a throttle positioning error	ABS (throttle error) > 5%. [Throttle error = Measured throttle position - modeled throttle position]	Ignition in Run or Crank TACM determines PCM Desired Throttle Position is valid. Not in battery saver mode. No Airflow Actuation DTC. (Engine Running = true) OR (Ignition Voltage > 8.5 volts). No Throttle Actuation DTC. No PCM-TACM Serial Data DTC. Both TPS Circuit DTC's are not set. No PCM Processor DTC's. No TACM Processor DTC.	High counter increments by 2 for every throttle error > 5%; decrements by 1 if %<t.e.<5%; decrements by 5 if -5%<t.e.<0%; clears if t.e. < -5%. Check runs every 18.75 ms with TACM - PCM valid message received. Low counter increments by 2 for every throttle error < -5%; decrements by 1 if -5%<t.e.<0%; decrements by 5 if 0%<t.e.<5%; clears if t.e. > 5%. Check runs every 18.75 ms with TACM - PCM valid message received.	DTC Type A For use on vehicles with ETC

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TAC MODULE PROCESSOR	P2108	<p>Indicates that TAC Module is unable to correctly read data from the flash memory.</p> <p>Indicates that TAC Module is unable to correctly write and read data to and from RAM.</p> <p>Indicates that the TAC Module has detected an internal processor integrity fault.</p>	<p>1) Power-up test fails to read/write data OR</p> <p>2) Max. allowed Running Resets exceeded OR</p> <p>3) ROM checksum does not match expected checksum OR</p> <p>4) RAM data read does not match data written OR</p> <p>5) Failure of Interrupt process flag to match expected value. OR</p> <p>6) Program is not executed in the proper order OR</p> <p>7) Primary and Redundant RAM variables disagree OR</p> <p>8) Primary and Redundant Indicated Pedal Position calculation difference = 0.0%. OR</p> <p>9) Math/Logic test fails to equate to a predetermined value. OR</p> <p>10) Internal Register data read does not match data written. OR</p> <p>11) Internal Timer fails to increment OR</p> <p>12) Watchdog Timer fails to increment OR</p> <p>13) Failure of Processor Stack pointer to zero at Main Loop.</p>	<p>Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data.</p>	<p>1) One occurrence Check runs at Reset initialization</p> <p>2) 10 occurrences during ignition cycle Check runs at Reset initialization</p> <p>3) One occurrence. Check runs at power up and every 60 seconds thereafter.</p> <p>4) One occurrence. Check runs at power up and every 800 milliseconds thereafter</p> <p>5) - 13) One occurrence. Check runs every 3 milliseconds. Second Watchdog timer runs in 10 millisecond loop.</p>	<p>DTC Type A</p> <p>For use on vehicles with ETC</p>

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APP SENSOR 1 CIRCUIT	P2120	1) TACM indicates a continuous or intermittent short or open in either the signal circuit or the APP sensor #1. OR 2) TACM indicates an invalid minimum mechanical position for the APP sensor #1. OR 3) TACM indicated reference voltage out of range.	1) Raw APP sensor signal < 0.235 V or > 4.487 V. OR 2) APP sensor minimum mechanical stop voltage < 0.235 V. OR 3) Vref out of range < 4.54 V or > 5.21 V.	Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data. No TACM processor DTC.	1) & 2) Counter increments by 4 for every error, decrements by 1 for every pass; threshold is 133. Check runs every 3 ms.	DTC Type A For use on vehicles with ETC
APP SENSOR 2 CIRCUIT	P2125	1) TACM indicates a continuous or intermittent short or open in either the signal circuit or the APP sensor #2. OR 2) TACM indicates an invalid minimum mechanical position for the APP sensor #2. OR 3) TACM indicated reference voltage out of range.	1) Raw APP sensor signal < 0.235 V or > 4.487 V. OR 2) APP sensor minimum mechanical stop voltage > 0.235 V. OR 3) Vref out of range < 4.54 V or > 5.21 V.	Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data. No TACM processor DTC.	1) & 2) Counter increments by 4 for every error, decrements by 1 for every pass; threshold is 180. Check runs every 3 ms.	DTC Type A For use on vehicles with ETC

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THROTTLE POSITION SENSOR 1, 2 RANGE/PERF.	P2135	1) TACM indicates a continuous or intermittent correlation fault between TP sensors #1 and #2. OR 2) TACM indicates an invalid minimum mechanical position correlation between TP sensor #1 and #2. OR 3) TPS1 signal short to TPS2 signal, Any reference, or ground.	1) ABS (TPS1 raw – TPS2 raw) < 6.0%. OR 2) TPS1 sig to TPS2 sig > 0.05V when TPS2 reference = 0.0 V.	Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data. No TACM processor DTC.	1) Counter increments by 4 for every error, decrements by 1 for every pass; threshold is 180. Check runs every 3 ms. 2) One occurrence. Check runs at power-up 3) Counter increments by 4 for ever error, decrements by 1 for every pass: threshold is 1333 Check runs every 3ms.	DTC Type A For use on vehicles with ETC
APP SENSOR 1 AND 2 DISAGREE	P2138	1) TACM indicates a continuous or intermittent correlation fault between APP sensors #1 and #2 OR 2) TACM indicates an invalid minimum mechanical position correlation between APP sensor #1 and #2 OR 3) PPS1 signal short to PPS2 signal	1)ABS(raw APP sensor #2 voltage - raw APP sensor #1 voltage) > 0.269 V. OR 2) PPS1 to PPS2 > 0.05V when PPS2 reference is 0.0 V.	Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data. No TACM processor DTC.	1) Counter increments by 4 for every error, decrements by 1 for every pass; threshold is 180 Check runs every 3 ms. 2) Counter increments by 4 for ever error, decrements by 1 for every pass: threshold is 1333 Check runs every 3ms.	DTC Type A For use on vehicles with ETC
ALT FUEL INJECTOR RELAY	P2146	Injector Positive Voltage Relay Control Circuit	Alt Fuel Injector Relay Disconnected, shorted to ground, or shorted to battery	* IGN Volt > 6V and < 18V * Engine Speed >= 400 RPM	2 second loop	DTC Type A (Bi-Fuel switches to gasoline)

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SOAK TIMER (IGNITION OFF TIMER)	P2610	Monitor soak timer for proper increments in positive time at correct rate	1) Initial soak timer value is not between 0 to 5 seconds 2) After initial 4.0 second delay, the soak timer does not increase by 1 second increments 3) Each 1 second increment of the soak timer is not within 1.0 +/- 0.3 seconds 4) The soak timer value decrements by any amount	PCM is powered down DTC will be active on next key cycle if failure detected	Every key down 100 msec loop	DTC Type B
ALT FUEL LOW PRESSURE LOCKOFF (LPL)	P2665	This DTC detects an open sensor ground or continuous short to high in either the signal circuit of the Low Pressure Fuel Shutoff Relay Control Circuit	Disconnected, Shorted To Ground, Or Shorted To Battery	IGN Volt > 6v And < 18v Engine Speed > 400 R or 0 RPM	1 Second Loop	DTC Type A (Bi-Fuel Switches To Gasoline)

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
(B1S2) HEATED OXYGEN SENSOR POSD	P2A01	Detects post sensors that are stuck in range, outside of the open or shorted regions.	<p>Stage1 - Passive Test: During the ignition cycle the O2 signal must exceed the upper bound of the post O2 PID control window set at:</p> <p><u>Gasoline Operation:</u> 710mV, and also drop below 349mV, which is the minimum lean voltage used by the Idle Catalyst diagnostic.</p> <p><u>CNG Operation:</u> 750mV, and also drop below 349mV, which is the minimum lean voltage used by the Idle Catalyst diagnostic.</p> <p>Stage2 - Intrusive Test: If the Stage1 test has not reported a pass during the first 218 seconds, then an 8% lean and/or rich fueling change will be commanded to force the signal to cross the appropriate threshold as described above. The DTC will set if the sensor has not responded to the intrusive rich or lean test after 60.0 seconds.</p>	<p>Stage1 – Passive Test: Engine runtime > 2 sec</p> <p>Stage2 – Intrusive Test: Closed Loop Fuel Control Engine runtime > 218 sec 5 < Airflow < 100 g/s 10 V < System Voltage < 18V 900 < Engine Speed < 5000 RPM 15 < Vehicle speed < 82 mph 0.965 < Short Term Integrator < 1.035 Above conditions met for 3 sec</p> <p>Lean test: Pre sensors must drop below 300mV Rich test: Pre sensors must exceed 600mV</p> <p>Stage2 test order: Lean then Rich</p>	<p>DTC will set if Stage2 test length exceeds 60 sec.</p> <p>Maximum of 100 Stage2 attempts (aborts).</p> <p>Once per trip</p>	DTC Type B

ENGINE DIAGNOSTIC PARAMETERS

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
(B1S2) HEATED OXYGEN SENSOR POSD	P2A04	Detects post sensors that are stuck in range, outside of the open or shorted regions.	<p>Stage1 - Passive Test: During the ignition cycle the O2 signal must exceed the upper bound of the post O2 PID control window set at:</p> <p><u>Gasoline Operation:</u> 710mV, and also drop below 349mV, which is the minimum lean voltage used by the Idle Catalyst diagnostic.</p> <p><u>CNG Operation:</u> 750mV, and also drop below 349mV, which is the minimum lean voltage used by the Idle Catalyst diagnostic</p> <p>Stage2 - Intrusive Test: If the Stage1 test has not reported a pass during the first 218 seconds, then an 8% lean and/or rich fueling change will be commanded to force the signal to cross the appropriate threshold as described above. The DTC will set if the sensor has not responded to the intrusive rich or lean test after 60.0 seconds.</p>	<p>Stage1 – Passive Test: Engine runtime > 2 sec</p> <p>Stage2 – Intrusive Test: Closed Loop Fuel Control Engine runtime > 218 sec 5 < Airflow < 100 g/s 10 V < System Voltage < 18V 900 < Engine Speed < 5000 RPM 15 < Vehicle speed < 82 mph 0.965 < Short Term Integrator < 1.035 Above conditions met for 3 sec</p> <p>Lean test: Pre sensors must drop below 300mV Rich test: Pre sensors must exceed 600mV</p> <p>Stage2 test order: Lean then Rich</p>	<p>DTC will set if Stage2 test length exceeds 60 sec.</p> <p>Maximum of 100 Stage2 attempts (aborts).</p> <p>Once per trip</p>	DTC Type B

ENGINE DIAGNOSTIC PARAMETERS

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
PCM TO TAC MODULE SERIAL DATA CIRCUIT	U0107	Indicates that the serial data line between the PCM and TACM has intermittently or continuously failed.	PCM: No message for 18.75 ms. Corrupted data in the message. Invalid message protocol. PCM processor DTC's. TACM processor DTC. TAC Module: No message for 25 ms. Corrupted data in the message. Invalid message protocol. PCM processor DTC's. TACM processor DTC. Throttle Authority Limit Exceeded.	(Ignition in Run or Crank) AND engine not in crank state. Time since power-up > 0. Ignition in Run or Crank. Ignition voltage > 5.23 V. Valid TACM - PCM serial data.	PCM and TACM continuous No valid message received for 500 ms. PCM Intermittent: Invalid or missing message increments counter by 10; valid message received decrements counter by 1; threshold is 254. TACM Intermittent: Invalid or missing message increments counter by 6; valid message received decrements counter by 1; threshold is 200. Check for invalid messages runs every 18.75 ms. Check for missing messages runs every 25 ms. Throttle Authority Limit Exceeded > 300 ms	DTC Type A For use on vehicles with ETC

2006 6.0L (LQ4) with CNG fuel -or- CNG / gasoline dual-fuel

ENGINE DIAGNOSTIC PARAMETER look up tables

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P0101: (Calculated Flow – Measured Flow) Lookup Table: 6.0L LQ4 (Gasoline and CNG)

Calculated Airflow	Airflow Delta
Grams_Air_0	6.34
Grams_Air_40	10.11
Grams_Air_80	13.67
Grams_Air_120	21.76
Grams_Air_160	25.61
Grams_Air_200	29.62
Grams_Air_240	33.78
Grams_Air_280	38.10
Grams_Air_320	42.58
Grams_Air_360	47.21
Grams_Air_400	52

2006 6.0L (LQ4) with CNG fuel -or- CNG /gasoline dual-fuel

ENGINE DIAGNOSTIC PARAMETER look up tables

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P0106 – Predicted MAP Max Look Up Table; 6.0 LQ4 (Gasoline and CNG)

	0 %	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	100 %
0 RPM	105	105	105	105	105	105	105	105	105	105	105
800 RPM	70	88.99902	102.998	105	105	105	105	105	105	105	105
1600 RPM	53.99902	75	92.00195	105	105	105	105	105	105	105	105
2400 RPM	47.99805	63.99902	77.99805	97.99805	105	105	105	105	105	105	105
3200 RPM	42.00195	55	62.00195	87.00195	102.002	105	105	105	105	105	105
4000 RPM	36.00098	43.99902	47.99805	72.00195	100	105	105	105	105	105	105
4800 RPM	32.00195	32.99805	43.99902	61.00098	88.99902	100	105	105	105	105	105
5600 RPM	30	31.00098	40	57.99805	82.00195	95	105	105	105	105	105

P0106 – Predicted MAP Min Look Up Table; 6.0 LQ4 (Gasoline and CNG)

	0 %	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	100 %
0 RPM	10	10	12.00195	25	43.99902	46.00098	47.00195	47.99805	45	45	40
800 RPM	10	10	12.00195	25	43.99902	46.00098	47.00195	47.99805	45	45	40
1600 RPM	10	10	10	23.99902	43.99902	45	47.00195	47.99805	45	45	40
2400 RPM	10	10	10	18.99902	32.00195	45	45	47.99805	45	45	40
3200 RPM	10	10	10	15	26.00098	42.99805	45	47.99805	45	45	40
4000 RPM	10	10	10	11.00098	22.99805	37.00195	43.99902	45	45	45	40
4800 RPM	10	10	10	10	17.99805	28.99902	42.00195	43.99902	45	45	40
5600 RPM	10	10	10	10	16.00098	27.99805	40	43.99902	45	45	40

2006 6.0L (LQ4) with CNG fuel -or- CNG /gasoline dual-fuel

ENGINE DIAGNOSTIC PARAMETER look up tables

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P0300: Catalyst Damaging Misfire Percentages as a Function of Engine Speed and Load Table: 6.0L LQ4 Gasoline Operation

Eng. Load ↓ / Eng. RPM →	0 RPM	1000 RPM	2000 RPM	3000 RPM	4000 RPM	5000 RPM	6000 RPM	7000 RPM	8000 RPM
0 Load_In_Percent	10.625	10.625	10.625	10.625	8.375	5	5	5	5
10 Load_In_Percent	10.625	10.625	10.625	10	8.375	5	5	5	5
20 Load_In_Percent	10.625	10.625	10.625	8.375	7.125	5	5	5	5
30 Load_In_Percent	10.625	10.625	10.625	8.375	6.25	5	5	5	5
40 Load_In_Percent	10.625	10.625	10.625	8.375	5.5	5	5	5	5
50 Load_In_Percent	10.625	10.625	10.625	6.25	5	5	5	5	5
60 Load_In_Percent	10.625	10.625	10	6.25	5	5	5	5	5
70 Load_In_Percent	10.625	10.625	10	5.5	5	5	5	5	5
80 Load_In_Percent	10.625	10	8.375	5	5	5	5	5	5
90 Load_In_Percent	10	8.375	7.125	5	5	5	5	5	5
100 Load_In_Percent	8.375	7.125	6.25	5	5	5	5	5	5

P0300: Catalyst Damaging Misfire Percentages as a Function of Engine Speed and Load Table: 6.0L LQ4 CNG Operation

Eng. Load ↓ / Eng. RPM →	0 RPM	1000 RPM	2000 RPM	3000 RPM	4000 RPM	5000 RPM	6000 RPM	7000 RPM	8000 RPM
0 Load_In_Percent	10.625	10.625	10.625	10.625	10.625	10.625	10.625	10.625	10.625
10 Load_In_Percent	10.625	10.625	10.625	10.625	10.625	10.625	10.625	10.625	10.625
20 Load_In_Percent	10.625	10.625	10.625	10.625	10.625	10.625	10.625	10.625	10.625
30 Load_In_Percent	10.625	10.625	10.625	10.625	9.75	10.625	10.625	10.625	10.625
40 Load_In_Percent	10.625	10.625	10.625	10.625	8.5	10.625	10.625	10.625	10.625
50 Load_In_Percent	10.625	10.625	10.625	10.625	8.5	9.125	9.125	9.125	9.125
60 Load_In_Percent	10.625	10.625	10.625	10.625	8.5	6.5	6.5	6.5	6.5
70 Load_In_Percent	10.625	10.625	10.625	10.625	7	5	5	5	5
80 Load_In_Percent	10.625	10.625	10.625	10.625	5.625	5	5	5	5
90 Load_In_Percent	10.625	10.625	10.625	10.125	5	5	5	5	5
100 Load_In_Percent	10.625	10.625	10.625	9.25	5	5	5	5	5

2006 6.0L (LQ4) with CNG fuel -or- CNG /gasoline dual-fuel

ENGINE DIAGNOSTIC PARAMETER look up tables

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P0300: Emission Failure Misfire Percentages as a Function of Engine Speed and Load Table: 6.0L (LQ4) Bi-Fuel CNG Operation (Bin 10)

Eng. Load ↓ / Eng. RPM →	0 RPM	1000 RPM	2000 RPM	3000 RPM	4000 RPM	5000 RPM	6000 RPM	7000 RPM	8000 RPM
0 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
10 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
20 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
30 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
40 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
50 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
60 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
70 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
80 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
90 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
100 Load_In_Percent	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5

P0300: Emission Failure Misfire Percentages as a Function of Engine Speed and Load Table: 6.0L (LQ4) Dedicated CNG Operation (Bin 8)

Eng. Load ↓ / Eng. RPM →	0 RPM	1000 RPM	2000 RPM	3000 RPM	4000 RPM	5000 RPM	6000 RPM	7000 RPM	8000 RPM
0 Load_In_Percent	2.5	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
10 Load_In_Percent	2.5	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
20 Load_In_Percent	2.5	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
30 Load_In_Percent	2.5	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
40 Load_In_Percent	2.5	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
50 Load_In_Percent	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
60 Load_In_Percent	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
70 Load_In_Percent	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
80 Load_In_Percent	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
90 Load_In_Percent	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125
100 Load_In_Percent	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125	1.125

2006 6.0L (LQ4) with CNG fuel -or- CNG /gasoline dual-fuel

ENGINE DIAGNOSTIC PARAMETER look up tables

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P0420: Average Base Pulse Width Maximum Allowed Value as a Function of Airflow Table: 6.0L (LQ4) (Gasoline and CNG)

Airflow in gps	Average BPW in milliseconds
0	99
1	99
2	99
3	99
4	99
5	99
6	99
7	99
8	99
9	99
10	99
11	99
12	99
13	99
14	99
15	99
16	99

P0420: Average Base Pulse Width Minimum Allowed Value as a Function of Airflow Table: 6.0L (LQ4) (Gasoline and CNG)

Airflow in gps	Average BPW in milliseconds
0	1
1	1
2	1
3	1
4	1
5	1
6	1
7	1
8	1
9	1
10	1
11	1
12	1
13	1
14	1
15	1
16	1

2006 6.0L (LQ4) with CNG fuel -or- CNG /gasoline dual-fuel

ENGINE DIAGNOSTIC PARAMETER look up tables

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P0430: Average Base Pulse Width Maximum Allowed Value as a Function of Airflow Table: 6.0L (LQ4) (Gasoline and CNG)

Airflow in gps	Average BPW in milliseconds
0	99
1	99
2	99
3	99
4	99
5	99
6	99
7	99
8	99
9	99
10	99
11	99
12	99
13	99
14	99
15	99
16	99

P0430: Average Base Pulse Width Minimum Allowed Value as a Function of Airflow Table: 6.0L (LQ4) (Gasoline and CNG)

Airflow in gps	Average BPW in milliseconds
0	1
1	1
2	1
3	1
4	1
5	1
6	1
7	1
8	1
9	1
10	1
11	1
12	1
13	1
14	1
15	1
16	1