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
Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 1 Sensor A	P0016	This DTC checks the CAM/CRANK signal correlation	Cam pulse occurred outside the 2nd and 7th medium resolution window	If PCM State is run or crank and medium resolution and low resolution signals are correct and no Cam o Crank faults exist.	Medium resolution interrupt	DTC Type B
O2S Heater Control Circuit Bank 1 Sensor 1	P0030	This DTC checks the Heater Output Driver circuit for electrical integrity	Output state shorted or open	• Ignition switch is in crank or run • 9 volts < Ignition Voltage < 18 volts	53 failures out of 63 samples Frequency: 100ms loop Continuous	DTC Type B
O2S Heater Control Circuit Bank 1 Sensor 2	P0036	This DTC checks the Heater Output Driver circuit for electrical integrity	Output state shorted or open	• Ignition switch is in crank or run • 9 volts < Ignition Voltage < 18 volts	50 failures out of 63 samples Frequency: 100ms loop Continuous	DTC Type B
HO2S Heater Resistance Bank 1 Sensor 1	P0053	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	Calculated Heater resistance > 9.3 Ω or < 3.13 Ω	• Coolant – IAT < 8°C • Engine Soak Time > 10 Hours • -30°C < Coolant Temp < 45°C	Once per valid cold start.	DTC Type B
HO2S Heater Resistance Bank 1 Sensor 2	P0054	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	Calculated Heater resistance > 21.17 Ω or < 8.82 Ω	• Coolant – IAT < 8°C • Engine Soak Time > 10 Hours • -30°C < Coolant Temp < 45°C	Once per valid cold start.	DTC Type B
MAP/MAF – Throttle Position Correlation	P0068	Indicates that measured engine airflow does not match estimated engine airflow as established by the TP Sensor.	Absolute of (MAP based airflow – TP Sensor estimated airflow) > 165 mg/cylinder AND Absolute of (MAF based airflow – TP Sensor estimated airflow) > 165 mg/cylinder AND [(MAF failure or MAP failure) OR (NO Throttle DTC AND NO PCM-TACM serial data DTC)]	• Engine running = true. • Ignition on > 2 seconds • RPM > 600 • No Throttle Actuation DTCs. • No PCM-TACM Serial Data DTC. • Both TPS Circuit DTCs are not set. • No PCM Processor DTCs • No TACM Processor DTC	Both fail counters are incremented by 2 for every error and decrement by 1 for every pass; both thresholds are 32; both fail counters must exceed threshold to set DTC. Frequency: 18.75 ms loop Continuous	DTC Type A

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
Mass Airflow (MAF) Sensor Performance	P0101	This DTC determines if the MAF sensor is not within the normal operating range.	(Calculated Flow - Measured Flow) > cal table lookup as a function of calculated flow	• No MAF circuit DTCs failing • No MAP DTCs failing • No TP Sensor DTCs failing • No EVAP DTCs failing • No EGR DTCs failing • No TAC System DTC faults • No ECT DTCs failing • No IAT DTCs failing • PCM State = RUN • Traction Control = Not Active • EGR Flow DTC – Not Active • EGR ≤ 100% • EGR DC ≤ 100% • EVAP Canister Purge Valve Duty Cycle ≤ 100% • Delta MAP ≤ 5.195313 kPa • Delta TP Sensor ≤ 15 % • Engine Vacuum ≤ 80 kPa • TP Sensor ≤ 100% • 9 volts ≤ Ignition Voltage ≤ 18 volts • If ignition voltage ≤ 11.5 volts then undefaulted MAF must be ≤ 40 gps • Enable Criteria Stable Time ≥ 2 seconds	320 test failures in a 400 test sample Frequency: 100 ms loop Continuous	DTC Type B
Mass Air Flow (MAF) Sensor Circuit Low	P0102	This DTC detects a continuous short to low or open in either the signal circuit or the MAF sensor.	MAF sensor signal ≤ 1200 Hz	• Engine Run Time ≥ 0 seconds • RPM ≥ 50 • System Voltage ≥ 8 volts • Ignition is in crank or run • Indicated Throttle Position ≥ 3.496094 percent rotation • Enable Criteria Stable Time ≥ 0.5 seconds	395 test failures in a 400 test sample 1 sample on every reference pulse	DTC Type B
Mass Air Flow (MAF) Sensor Circuit High	P0103	This DTC detects a continuous short to high in either the signal circuit or the MAF sensor.	MAF sensor signal ≥ 11500 Hz	• Engine Run Time ≥ 0 seconds • RPM ≥ 50 • System Voltage ≥ 8 volts • Ignition is in crank or run • Indicated Throttle Position ≥ 3.496094 percent rotation • Enable Criteria Stable Time ≥ 0.5 seconds	395 test failures in a 400 test sample 1 sample on every reference pulse	DTC Type B

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
Manifold Absolute Pressure (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 DTCs not active TP sensor DTCs not active EGR DTCs not active IAC DTCs not active Traction Control not active Engine Speed $\Delta \leq 125$ RPM Throttle Position $\Delta \leq 100\%$ EGR $\Delta \leq 20$ % Idle Air $\Delta \leq 10$ g/s Brake Switch State = no change Clutch Switch State = no change Power Steering (cramping) = Stable 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 (MAP) Sensor Circuit Low	P0107	This DTC detects a continuous out of range low (short to low or open in either the signal circuit or the MAP sensor).	MAP sensor signal < 1.73% (11 kPa)	• No TP Sensor DTCs failing • No TAC system DTCs failing • [(TP Sensor ≥ 0 & Engine Speed ≤ 1000) or (TP Sensor $\geq 12\%$ & Engine Speed > 1000)]	320 test failures in a 400 test sample Continuous: 12.5 ms loop if engine is not running every reference pulse below 3200 rpm when engine is running every other reference pulse above 3200 rpm when engine is running	DTC Type B
Manifold Absolute Pressure (MAP) Sensor Circuit High	P0108	This DTC detects a continuous out of range high (short to high in either the signal circuit or the MAP sensor).	MAP sensor signal > 96% (100kPa)	• No TP Sensor DTCs failing • No TAC system DTCs failing • Controller State = RUN • Engine Run Time based on power up coolant temperature: > 10 sec at $\geq 30°C$ > 80 sec at 15°C > 134 sec at 0°C > 188 sec at –15°C > 242 sec at -30° C; • [(TP Sensor < 1% & Engine Speed ≤ 1200) or (TP Sensor < 20% & Engine Speed > 1200)]	320 test failures in a 400 test sample Continuous: 12.5 ms loop if engine is not running every reference pulse below 3200 rpm when engine is running every other reference pulse above 3200 rpm when engine is running	DTC Type B

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
Intake Air Temperature (IAT) Sensor Circuit Low	P0112	This DTC determines if the IAT sensor is shorted low by checking for an IAT sensor output voltage below a threshold	IAT sensor signal < 0.703% (greater than 130 °C)	• No VSS DTCs failing • No ECT DTCs failing • Vehicle speed ≥ 25.00 mph • Airflow > 10.00 g/s • ECT < 123°C • Engine Run Time > 10 seconds	175 test failures within 1200 test sample s Frequency: 100 ms loop Continuous	DTC Type B
Intake Air Temperature (IAT) Sensor Circuit High	P0113	This DTC determines if the IAT sensor is shorted high or open by checking for an IAT sensor output voltage above a threshold	IAT sensor signal > 99% (less than -36 °C)	• No ECT DTCs failing • No VSS DTCs failing • Vehicle speed < 15.00 mph • Airflow < 10.00 g /s • ECT ≥ 60.00 °C • Engine run time> 180.00 seconds	1100 test failures within a 1200.00 test sample Frequency: 100 ms loop Continuous	DTC Type B
Engine Coolant Temperature (ECT) Sensor Performance	P0116	This DTC detects if the engine coolant sensor is biased high while in range.	A failure will be reported if any of the following occur: Δ Between ECT at power up and IAT at power up > IAT based table lookup value after a minimum 8 hour soak (fast fail). Δ Between ECT at power up and IAT at power up > 15.75°C after a minimum 8 hour soak and a block heater has not been detected. Δ Between ECT at power up and IAT at power up > 15.75°C after a minimum 8 hour soak and the time spent cranking the engine without starting is greater than 5 seconds with the fuel level being above a minimum level of 10%.	• No VSS DTCs • No IAT circuit DTCs • No ECT sensor circuit DTCs • ECM/PCM Internal Engine Off Timer Performance DTC not active • Non-volatile memory failure has not been detected on power-up. • Engine off time > 480 minutes (8 hours) • Test run this trip = false • Test aborted this trip = false Block heater detection: - Δ Between ECT at power up and IAT at power up > 15.75°C - Power up IAT > -7°C - Vehicle driven a minimum of 300 seconds above 25 mph and IAT drops more than 7° C from power up IAT.	Frequency: Once per ignition cycle 100 ms loop	DTC Type B
Engine Coolant Temperature (ECT) Sensor Circuit Low	P0117	Thermistor Analog Voltage This DTC detects if the engine coolant sensor's analog voltage falls below a minimum expected value	ECT sensor signal < 0.5078% of 5V (2.539 volts) or greater than 139 °C	Engine run time > 3.00 seconds OR min IAT ≤ 90°C	240 test failures within a 250.00 test sample Frequency: 100 ms loop Continuous	DTC Type B

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
Engine Coolant Temperature (ECT) Sensor Circuit High	P0118	Thermistor Analog Voltage This DTC detects if the engine coolant sensor's analog voltage exceeds a maximum expected value	ECT sensor signal > 99.4921% of 5V (4.97 volts) or less than -37 °C	Engine run time > 30.00 seconds OR min IAT ≥ 0°C	240 test failures within a 250.00 test sample Frequency: 100 ms loop Continuous	DTC Type B
Throttle Position (TP) Sensor 1 Circuit	P0120	TACM indicates a continuous or intermittent short or open in either the signal circuit or the TP sensor #1. OR TACM indicates an invalid minimum mechanical position for the TP sensor #1. OR TACM indicates 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) Reference Voltage < 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. 3a). Continuous. Counter increments by 1 for every error, decrements by 1 for every pass. Threshold is 10ms. For reference voltage direct short to ground. 3b) 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 reference voltage to be 5volts +/- tolerance.	DTC Type A

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
Engine Coolant Temperature (ECT) Below Thermostat 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 80.00 °C	• No MAF DTCs • No MAP DTCs • No IAT sensor DTCs • No ECT sensor circuit DTCs • No VSS DTCs • ECT Sensor circuit tests not failing • Start up ECT < 75 °C • Minimum Average Airflow > 1 gps • Vehicle speed > 5 MPH for 0.50 miles • 30.00 sec < Engine Run Time < 1800.00 sec • IAT ≥ -7.03 °C • Maximum airflow added to actual accumulated airflow limited to 30 gps Note: the min IAT used above is clamped to a maximum value of 54.5°C	30 failures to set DTC Frequency: Once per ignition cycle 1 second loop	DTC Type B
O2S Circuit Low Voltage Bank 1 Sensor 1	P0131	This DTC determines if the O2 sensor circuit is shorted to low by checking for a lean condition.	O2 sensor voltage < 52.083 millivolts	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Fuel Injector DTCs • No Air Pump DTCs (PZEV only) • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active Specific Enable Criteria • 0.88 ≤ Equivalence ratio ≤ 1.088 • 2.5 % ≤ throttle position ≤ 40.00 % • Fuel state = closed loop • All fuel injectors = ON • Traction Control = not active • ECT < 131°C EGR flow diagnostic intrusive test = Not Active • Catalyst monitor diagnostic intrusive test = Not Active • Post Oxygen Sensor Diagnostic intrusive test= Not Active All of the above met for at least 3 seconds	220 test failures in a 255 test sample. Frequency: Continuous 100 ms loop	DTC Type B

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
O2S Circuit High Voltage Bank 1 Sensor 1	P0132	This DTC determines if the O2 sensor or circuit is shorted to high by checking for a rich condition.	O2 sensor voltage > 1050 millivolts	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Fuel Injector DTCs • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active • No Air Pump DTCs (PZEV only) Specific Enable Criteria • 0.88 ≤ Equivalence Ratio ≤ 1.088 • 0% ≤ throttle position ≤ 45.00 % • Fuel State = Closed loop • EGR flow diagnostic intrusive test = Not Active • Catalyst monitor diagnostic intrusive test= Not Active • Post Oxygen Sensor Diagnostic intrusive test = Not Active All of the above met for at least 3 seconds	85 test failures in a 100 test sample. Frequency: Continuous 100 ms loop	DTC Type B

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
O2S Slow Response Bank 1 Sensor 1	P0133	This DTC determines if the O2 sensor response time is degraded	O2 Sensor Average Transition Time: LRA > 145 ms or RLA > 135 ms	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Air Pump DTCs (PZEV only) • No Fuel Injector DTCs • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active Specific Enable Criteria • EGR flow diagnostic intrusive test = Not Active • Catalyst monitor diagnostic intrusive test = Not Active • Post Oxygen Sensor Diagnostic intrusive test = Not Active • O2 Heater on for ≥ 0 seconds • Bank 1 Sensor1 circuit and heater and heater driver DTCs = Not Active • In one of the following four fueling cells: Purge off, normal; purge off, high flow; purge on, normal; purge on, high flow • Misfire DTC = Not Active • ECT > 65.00 °C • Engine run time > 60.00 seconds • EVAP Canister purge duty cycle ≥ 0.00 % • 15.00 gps ≤ MAF ≤ 29 gps • 1300.00 ≤ RPM ≤ 3000.00 • Throttle position ≥ 2.00 % • Fuel state = closed loop • Transmission (automatic) not in Park, Reverse or Neutral All of the above met for at least 1 second.	90000.00 ms Frequency: Once per trip	DTC Type B

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
O2S Circuit Insufficient Activity Bank 1 Sensor 1	P0134	This DTC determines if the O2 sensor is open.	381.94 millivolts < O2 sensor < 525.17 millivolts	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Air Pump DTCs (PZEV only) • No Fuel Injector DTCs • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active Specific_Enable_Criteria • EGR flow diagnostic intrusive test = Not Active • Catalyst monitor diagnostic intrusive test = Not Active • Post Oxygen Sensor Diagnostic intrusive test = Not Active • Engine run time > 124.00 seconds	250 test failures in a 300 test sample Frequency: Continuous for pre catalyst sensors 100 ms loop rate	DTC Type B
O2S Heater Performance Bank 1 Sensor 1	P0135	This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	The heater full on current is < 0.3125 amps or > 1.426 amps	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Air Pump DTCs (PZEV only) • No Fuel Injector DTCs • 10 volts < system voltage < 18.00 volts • Device control = Not Active Specific Enable_Criteria • Engine Run Time ≥ 100 seconds • ECT ≥ 65° C • 600 ≤ Engine Rpm ≤ 3000 • 4 gps ≤ Mass Airflow ≤ 30 gps • O2 heater not in Device control • O2 heater driver DTC not active All of the above met for at least 2 seconds	8 test failures in 10 test samples Frequency: 2 tests per trip 30 second delay between tests 1 second execution rate	DTC Type B

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
O2S Circuit Low Voltage Bank 1 Sensor 2	P0137	This DTC determines if the O2 sensor circuit is shorted to low by checking for a lean condition	O2 sensor voltage < 52.083 millivolts	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Air Pump DTCs (PZEV only) • No Fuel Injector DTCs • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active Specific Enable Criteria • EGR flow diagnostic intrusive test = Not Active • Catalyst monitor diagnostic intrusive test = Not Active • Post Oxygen Sensor Diagnostic intrusive test = Not Active • 0.88 ≤ Equivalence ratio ≤ 1.088 • 2.5% ≤ throttle position ≤ 45.00 % • Fuel state = closed loop • All fuel injectors = ON • Traction Control = not active • ECT < 131°C All of the above met for at least 3 seconds	510 test failures in a 600 test sample Frequency: Continuous 100 ms loop	DTC Type B

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
O2S Circuit High Voltage Bank 1 Sensor 2	P0138	This DTC determines if the O2 sensor or circuit is shorted to high by checking for a rich condition.	O2 sensor voltage > 1050 millivolts	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Air Pump DTCs (PZEV only) • No Fuel Injector DTCs • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active Specific Enable Criteria • EGR flow diagnostic = Not Active • Catalyst monitor diagnostic = Not Active • Post Oxygen Sensor Diagnostic = Not Active • 0.88 ≤ Equivalence Ratio ≤ 1.088 • 2.5% ≤ throttle position ≤ 45.00 % • Fuel State = Closed loop All of the above met for at least 3 seconds	510 test failures in a 600 test sample Frequency: Continuous 100 ms loop	DTC Type B

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
O2S Circuit Insufficient Activity Bank 1 Sensor 2	P0140	This DTC determines if the O2 sensor is open.	381.94 millivolts < O2 sensor < 525.17 millivolts for regular open test 350 millivolts < O2 sensor < 550 millivolts to fail the fast pass open test (must fail the regular open test in order to fail the DTC; regular open test is run if fast pass is not run or if fast pass fails)	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Air Pump DTCs (PZEV only) • No Fuel Injector DTCs • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active Specific_Enable_Criteria • EGR flow diagnostic = Not Active • Catalyst monitor diagnostic = Not Active • Post Oxygen Sensor Diagnostic = Not Active • O2S Heater Performance Bank 1 Sensor 2 not active • O2S Heater Control Circuit Bank 1 Sensor 2 not active • PCM State = run Fast Pass: • Engine run time ≤ 75 seconds) (Fast pass cannot report a fail; if Fast pass fails, the regular open test is run) Regular Open Test • Engine run time > 124 seconds • Fuel state = closed loop • Minimum of 3 occurrences of a delta TP sensor ≥ 5.2 % during diagnostic test	850 test failures in a 1000 test sample for regular open test (sample counts – failure counts) < 150 within 75 seconds of engine run time to fail the fast pass test (regular open test is run when fast pass fails; to fail DTC the regular open test must fail) Frequency: Once/trip for post catalyst sensors 100 ms loop	DTC Type B

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
O2S Heater Performance Bank 1 Sensor 2	P0141	This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	The heater full on current is < 0.2148438 amps or > 0.957031 amps	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Air Pump DTCs (PZEV only) • No Fuel Injector DTCs • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active Specific Enable_Criteria • Engine Run Time ≥ 100 seconds • ECT ≥ 65° C • 600 ≤ Engine Rpm ≤ 3000 • 4 gps ≤ Mass Airflow ≤ 30 gps • O2 heater not in Device control • O2 heater driver DTC not active All of the above met for at least 2 seconds	8 test failures in 10 test samples Frequency: 2 tests per trip 30 second delay between tests 1 second execution rate	DTC Type B

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 System Too Lean Bank 1	P0171	Determines if the fuel control system is in a lean condition.	The EWMA of long term fuel trim (LTM) samples ≥ 1.17 (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.	• No Misfire DTCs • No Bank1 Sensor1 O2 Sensor DTC's • No EVAP DTCs • No Fuel Injector DTCs • No IAC, MAF, or MAP DTCs • No EGR DTCs • No A.I.R. DTCs • Engine speed > 500 rpm and < 6000 rpm • BARO > 70 kPa • ECT > -38.89°C and ECT < 132°C • MAP > 5 kPa and < 105 kPa • IAT > -20.5 °C and < 150°C • Mass Airflow > 0.5 g/s and < 510 g/s • Vehicle speed < 82 mph • Closed Loop Fueling • Long Term Fuel Trim Learning enabled • Not in Device Control • EGR Flow Diagnostic Intrusive Test = Not Active • Catalyst Monitor Diagnostic Intrusive Test = Not Active • Post O2 Diagnostic Intrusive Test = Not Active • Evap diagnostic is at any stage except the "tank pull down" portion of the test. • Fuel Level > 10 % (must be < 10% for at least 10 seconds to disable; default is to enable if fuel sender is broken)	<u>Frequency:</u> Continuous 100 ms loop	DTC Type B

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 System Too Rich Bank 1	P0172	Determines if the fuel control system is in a rich condition.	The EWMA of long term fuel trim (LTM) samples $\leq$ 0.77 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: The EWMA of LTM samples with purge off $\leq$ 0.765 during 3 of 5 intrusive segments. General 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. Passive Note: 1. If the conditions in the General Notes above are achieved and the non-purge threshold of 0.765 has been exceeded before purge is enabled, a passive failure result will be reported and no intrusive test is run. If a passive result of "pass" is achieved, an intrusive test will be run later in the trip if and when those conditions are met.	• No Misfire DTCs • No Bank1 Sensor1 O2 Sensor DTC's • No EVAP DTCs • No Fuel Injector DTCs • No IAC, MAF, or MAP DTCs • No EGR DTCs • No A.I.R. DTCs • Engine speed > 500 rpm and < 6000 rpm • BARO > 70 kPa • ECT > -38.89°C and < 132°C • MAP > 5 kPa and < 105 kPa • IAT > -20.5 °C and < 150°C • Mass Airflow > 0.5 g/s and < 510 g/s • Vehicle speed < 82 mph • Closed Loop Fueling • Long Term Fuel Trim Learning enabled • EGR Flow Diagnostic Intrusive Test = Not Active • Catalyst Monitor Diagnostic Intrusive Test = Not Active • Post O2 Diagnostic Intrusive Test = Not Active • Evap diagnostic is at any stage except the "tank pull down" portion of the test.	If rich segment fail counter is $\geq$ 3 before segment pass counter $\geq$ 3, the diagnostic fails. Frequency: Continuous 100 ms loop	DTC Type B

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 System Too Rich Bank 1 (Continued)	P0172	Determines if the fuel control system is in a rich condition.	Intrusive Notes: 1. Segments can last up to 60 seconds, and are separated by the smaller of a 24 second purge-on time or enough time to purge 18 grams of vapor. 2. A maximum of 5 completed segments are allowed for each intrusive test, and up to 20 intrusive attempts allowed per trip. 3. 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 $\geq$ 0.765 for at least 200 consecutive seconds, indicating that the canister has been purged. Performing intrusive tests too frequently may also affect EVAP and FTP emissions, and the execution frequency of other diagnostics.	Intrusive Enable Criteria • Not in Device Control • The EWMA of long term fuel trim (LTM) samples $\leq$ 0.77 • RPM > 500 • Mass Airflow > 0.5 g/s but < 510 g/s • MAP > 5 kPa but < 105 kPa Temporary Intrusive Test Inhibit Criteria If intrusive test segment exceeds 60 consecutive seconds. (in this case, purge valve is opened for 10 seconds)	If rich segment fail counter is $\geq$ 3 before segment pass counter $\geq$ 3, the diagnostic fails. Frequency: Continuous 100 ms loop	
Injector 1 Control Circuit	P0201	This DTC checks the Fuel Injectors for electrical integrity	Output state is shorted or open	• Ignition switch is in crank or run • 9 < Ignition Voltage < 18 • Injector commanded on > 0.5 seconds	50 failures out of 63 samples Frequency: Continuous 100 ms loop	DTC Type B
Injector 2 Control Circuit	P0202	This DTC checks the Fuel Injectors for electrical integrity	Output state is shorted or open	• Ignition switch is in crank or run • 9 < Ignition Voltage < 18 • Injector commanded on > 0.5 seconds	50 failures out of 63 samples Frequency: Continuous 100 ms loop	DTC Type B
Injector 3 Control Circuit	P0203	This DTC checks the Fuel Injectors for electrical integrity	Output state is shorted or open	• Ignition switch is in crank or run • 9 < Ignition Voltage < 18 • Injector commanded on > 0.5 seconds	50 failures out of 63 samples Frequency: Continuous 100 ms loop	DTC Type B

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
Injector 4 Control Circuit	P0204	This DTC checks the Fuel Injectors for electrical integrity	Output state is shorted or open	• Ignition switch is in crank or run • 9 < Ignition Voltage < 18 • Injector commanded on > 0.5 seconds	50 failures out of 63 samples Frequency: Continuous 100 ms loop	DTC Type B
Injector 5 Control Circuit	P0205	This DTC checks the Fuel Injectors for electrical integrity	Output state is shorted or open	• Ignition switch is in crank or run • 9 < Ignition Voltage < 18 • Injector commanded on > 0.5 seconds	50 failures out of 63 samples Frequency: Continuous 100 ms loop	DTC Type B
Injector 6 Control Circuit	P0206	This DTC checks the Fuel Injectors for electrical integrity	Output state is shorted or open	• Ignition switch is in crank or run • 9 < Ignition Voltage < 18 • Injector commanded on > 0.5 seconds	50 failures out of 63 samples Frequency: Continuous 100 ms loop	DTC Type B
Throttle Position (TP) Sensor 2 Circuit	P0220	TACM indicates a continuous or intermittent short or open in either the signal circuit or the TP sensor #2. OR TACM indicates an invalid minimum mechanical position for the TP sensor #2. OR TACM indicates 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) 4.54 V < Reference voltage < 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 Reference voltage direct short to ground.	DTC Type A

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
Engine Misfire Detected Cylinder 1 Misfire Detected Cylinder 2 Misfire Detected Cylinder 3 Misfire Detected Cylinder 4 Misfire Detected Cylinder 5 Misfire Detected Cylinder 6 Misfire Detected	P0300 P0301 P0302 P0303 P0304 P0305 P0306	These DTCs will determine if a random misfire or a cylinder specific misfire is occurring by monitoring crankshaft velocity.	Deceleration index Vs. Engine Speed Vs. Load and Camshaft Position Emission Failure Threshold = 1.0% Catalyst Damage Threshold = 5 – 31.875% Misfire depending on engine speed and engine load	• DTCs not active for VSS, CKP, CMP, TP, MAP, ECT, MAF, TAC system sensors. • P0315 (Crankshaft Position System Variation Not Learned) not active or engine speed < 1200. • Any Fuel cutoff not active. • Brake torque or Power 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). • -6.99 °C < ECT < 123.9844 ° C. • If ECT at startup < -6.99 °C, then disable until ECT > 21.09 °C. • 475 RPM < Engine speed < 5600 RPM. • 9.00 volts < System voltage < 18 volts. • + Throttle position delta < 100 % per 50 ms. • - Throttle position delta < 100 % per 50 ms. • Abnormal engine speed is not present. • 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 2) TP Sensor > 1.4% or VSS < 20 MPH. • Detectable engine speed and engine load region. • EGR Intrusive test not active. • CMP sensor is in sync with CKP sensor. • Automatic transmission is not shifting or automatic transmission is shifting and TPS ≤ 95% • PRNDL indication did not change (not used). • Misfire Diagnostic is not requesting to disable TCC when transmission is in hot mode. • Abusive Engine Speed is not used. • Crankshaft Ring Filter inactive (after a low level misfire, another misfire may not be detectable until crankshaft ringing ceases) Applies only if rough road detection enabled: • Excessive drive wheel slip is not detected (enablement occurs if {Non Drive Wheel Speed > 255 MPH} or {Drive Wheel Speed - Non Drive Wheel Speed > 255 MPH} and {wheel speed data is valid}) • ABS is not active, TCS is not active.	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 (this number is 1 in this application). 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)

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
Crankshaft Position System Variation Not Learned (CASE)	P0315	Determines if the Crankshaft Position System Variation has not been learned.	Sum of Compensation Factors are ≤ 2.997 or ≥ 3.0043	Manufacturers Enable Counter must be zero.	0.50 seconds Frequency: Continuous 100 ms loop	DTC Type A
Knock Sensor (KS) Circuit Bank 1	P0325	This diagnostic will detect a failed internal PCM component associated with knock control	Output voltage is high and stays relatively constant	Enable Conditions • No VSS DTCs • No TP Sensor DTCs • No TAC System DTCs • No ECT DTCs • No Crank Sensor DTCs • No CMP Sensor DTCs • No MAF DTCs • Engine running longer than 30 seconds • Ignition voltage ≥ 9 volts • Throttle position ≥ 10.00 % • ECT ≥ 60.00 °C • Engine speed between 1000 & 2500 RPM • Engine Load ≥ 40.00 % • Ignition Control Spark retard ≤ 15.01 degrees Determine Fault Region (Instantaneous voltage – average voltage is too small; delta from average ≤ .03125 OR Average voltage – instantaneous voltage is too small; delta from average ≤ 0.03125) and the average voltage ≥ 4.8 volts	Frequency: Every combustion event Continuous 260 test failures out of 300 samples	DTC Type B

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
Knock Sensor (KS) Circuit Low Frequency Bank 1	P0327	This diagnostic will detect a wiring fault with knock sensor 1	Output voltage amplitude is low and stays relatively constant	Enable Conditions • No VSS DTCs • No TP Sensor DTCs • No TAC System DTCs • No ECT DTCs • NO Crank Sensor DTCs • No CMP Sensor DTCs • No MAF DTCs • Engine running longer than 30 seconds • Ignition voltage ≥ 9 volts • Throttle position ≥ 10.00 % • ECT ≥ 60.00 °C • Engine speed between 1000 & 2500 RPM • Engine Load ≥ 40.00 % • Ignition Control Spark retard ≤ 15.01 degrees Determine Fault Region (Instantaneous voltage – average voltage is too small; delta from average ≤ .03125 OR Average voltage – instantaneous voltage is too small; delta from average ≤ 0.03125) and the average voltage < 4.8 volts	Every combustion event Continuous 260 test failures out of 300 samples	DTC Type B

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
Knock Sensor (KS) Circuit Low Frequency Bank 2	P0332	This diagnostic will detect a wiring fault with knock sensor 2	Output voltage amplitude is low an stays relatively constant	Enable Conditions • No VSS DTCs • No TP Sensor DTCs • No TAC System DTCs • No ECT DTCs • NO Crank Sensor DTCs • No CMP Sensor DTCs • No MAF DTCs • Engine running longer than 30 seconds • Ignition voltage ≥ 9 volts • Throttle position ≥ 10.00 % • ECT ≥ 60.00 °C • Engine speed between 1000 & 2500 RPM • Engine Load ≥ 40.00 % • Ignition Control Spark retard ≤ 15.01 degrees Determine Fault Region (Instantaneous voltage – average voltage is too small; delta from average ≤ .03125 OR Average voltage – instantaneous voltage is too small; delta from average ≤ 0.03125) and the average voltage < 4.8 volts	Every combustion event Continuous 260 test failures out of 300 samples	DTC Type B
Crankshaft Position (CKP) Sensor A Circuit	P0335	This diagnostic determines whether a fault exists with crank position sensor circuit signal	If 6 low res pulses have been seen and 0 med res pulses have been seen AND 1 cam has been seen and 0 med res pulses have been seen	Engine run time > 3 seconds	Low res interrupt - for low res check 100 ms - for cam check 40 failures out of 50 samples	DTC Type B
Crankshaft Position (CKP) Sensor A Performance	P0336	This diagnostic determines whether a performance fault exists with crank position sensor signal	If 6 low res pulses have been seen and a number of med res pulses other than 0 or 36 have been seen AND 1 cam has been seen and a number of med res pulses other than 0 or 36 have been seen	Engine run time > 3 seconds	Low res interrupt - for low res check 100 ms - for cam check 40 failures out of 50 samples	DTC Type B

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
Camshaft Position (CMP) Sensor Circuit Bank 1 Sensor A	P0340	1X Signal This diagnostic will detect if a fault exists on the camshaft position sensor signal.	If 36 med res pulses have been seen and 0 cam pulses have been seen AND 6 low res pulses have been seen and 0 cam pulses have been seen	• Engine run time > 3 seconds • Engine Speed > 100 • Cam pulse seen or 6 low res pulses seen • The engine run time criteria is not required if PCM State is crank.	Med res interrupt - for med res check Low res interrupt - for low res check 40 failures out of 50 samples	DTC Type B
Camshaft Position (CMP) Sensor Performance Bank 1 Sensor A	P0341	1X Signal This diagnostic will detect if the CMP Sensor signal. Performance is correct	If 36 med res pulses have been seen and 2 or more cam pulses have been seen AND 6 low res pulses have been seen and 2 or more cam pulses have been seen	• Engine run time > 3 seconds • Engine Speed > 100 • Cam pulse seen or 6 low res pulses seen	Med res interrupt - for med res check Low res interrupt - for low res check 40 failures out of 50 samples	DTC Type B
Ignition Coil Circuit	P0350	This diagnostic detects an open or short on the Electronic Spark Timing (EST) output circuits.	Fault is detected	• Engine is running or cranking • No P1350 (Bypass Line Monitor) DTC Active	90 failure out of 100 samples <u>Frequency:</u> Continuous 100 ms loop Once the fault logic detects a failure, the diagnostic is turned off for the rest of the trip.	DTC Type B
Crankshaft Position (CKP) Sensor B Circuit	P0385	This diagnostic determines whether a circuit fault exists with the low res sensor signal	If 36 med res pulses have been seen and 0 low res pulses have been seen AND 1 cam pulse has been seen and 0 low res pulses have been seen	• Engine run time > 3 seconds • Engine Speed > 100 • Cam pulse seen or 6 low res pulses seen	Med res interrupt - for med res check 100 ms - for cam check 40 failures out of 50 samples	DTC Type B
Crankshaft Position (CKP) Sensor B Performance	P0386	This diagnostic determines whether a performance fault exists with the low res sensor signal	If 36 med res pulses have been seen and a number of low res pulses other than 0 or 6 have been seen AND 1 cam pulse has been seen and a number of low res pulses other than 0 or 6 have been seen	• Engine run time > 3 seconds • Engine Speed > 100 • Cam pulse seen or 6 low res pulses seen	Med res interrupt - for med res check 100 ms - for cam check 40 failures out of 50 samples	DTC Type B

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
Exhaust Gas Recirculation (EGR) Flow Insufficient (Quick Test)	P0401	During a closed throttle decel condition, the EGR valve is normally closed. This diagnostic opens the valve to a pre-determined position, and the change in MAP is computed. This change in MAP correlates to the flow rate of the EGR system.	With EGR valve open, the peak + MAP Δ is monitored over a period of time. This value is compared with a threshold from Engine Speed vs. BARO table and the difference computed. The result is statistically filtered (EWMA) and compared to a decision limit. DTC is set when the filtered result exceeds the decision limit of 0.6543 kPa.	Test Enables No fuel injector DTCs set, No CKP DTCs set, No TP sensor DTCs set, No MAP DTCs set, No Baro sensor DTCs set (L32 only), No VSS DTCs set, No ETC DTCs set, No 5 volt reference DTCs set, No IAT sensor DTCs set No ECT sensor DTCs set, No IAC DTCs set, No EGR Pintle Position DTC set, No Misfire DTCs set No MAF DTCs set, No CPP (Clutch) DTCs set, Not in device control, EGR valve icing not occurring, EGR Engine run time expired, Not in Power Enrichment, 75° C < ECT < 151.9531° C BARO > 74 kPa (8,000 ft) -7° C < IAT < 100° C 11 volts < Ignition Voltage < 18 volts Transmission is in 3rd, 4th gear Decel Fuel Cutoff is either inactive (mode 0) or at a commanded spark value of 0 (mode 2) for at least 6.25 ms. 28 MPH < Vehicle speed < 70 MPH Throttle Position is < 0.9% Transmission status is unchanged for 1.5 seconds. Throttle Area Delta < 100 % Stability Mode Enables EGR Position < 1% 1000 RPM < Engine Speed < 1500 RPM MAP Δ < 1.201 kPa 17 kPa < Compensated MAP < 43 kPa Throttle Area Delta < 100% Difference between desired & actual airflow < 1.2 Grams/sec. Intrusive Mode Enables Vehicle Speed Δ < 3 MPH + RPM Δ < 100 RPM - RPM Δ < 200 RPM 75 % < Max EGR Position < 95 % EGR Duty Cycle On Time < 25 Throttle Area Delta < 100%	Test Time 800 ms Frequency 6.26 ms loop Once per trip (typically) Rapid Step Response feature will initiate multiple tests: IF the difference between the current EWMA and the current map difference is > 1.25 to 1.87 kPa (depends on Baro) AND current map difference is > -0.15 to 1.03 kPa (depends on Baro) THEN 4 to 6 tests (depends on Baro) may be run per trip until 21 to 33 tests (depends on Baro) have been completed Fast Initial Response feature will initiate multiple tests upon code clear or a non-volatile memory failure: Several tests per trip will run until 15 to 20 tests (depends on Baro) have been completed.	DTC Type A

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
Exhaust Gas Recirculation (EGR) Solenoid Control Circuit	P0403	This DTC checks the Linear EGR circuit for electrical integrity	Output state invalid	• Ignition switch is in crank or run • 9 volts < Ignition Voltage < 18 volts	20.00 seconds OR chip protection logic indicates a short failure 1 time <u>Frequency:</u> Continuous 100 ms loop <u>Chip protection logic:</u> 5 failures out of 10 samples indicate a short Frequency of this logic is 12.5 ms loop Continuous Once the chip protection logic detects 5 failures out of 10 samples, the driver is turned off for the rest of the trip.	DTC Type B
Exhaust Gas Recirculation (EGR) Open Position Performance	P0404	This diagnostic detects if the pintle position error is too large	Pintle position error [absolute value of (desired position - actual position)] > 20.00 %	Enable Stability Limit Time > 0.2 sec. 5 Volt reference DTCs not active Engine Overtemp DTCs not active Engine is running Off-board device not active Pintle cleaning not active P0401 not intrusive Ignition voltage ≥ 11 volts Desired EGR position > 0% Δ Desired EGR position < 19.5 % for 1 sec.	<u>Frequency:</u> 232 fail counts out of 400 sample counts 100ms loop Continuous	DTC Type B
Exhaust Gas Recirculation (EGR) Position Sensor A Circuit Low Voltage	P0405	This diagnostic detects if the pintle position feedback circuit is open or shorted to ground	EGR feedback sensor signal < 4.0% of 5 volt reference voltage (0.25 Volts)	Enable Stability Limit Time > 0.2 sec. 5 Volt reference DTCs not active Engine is running Off-board device not active Pintle cleaning not active P0401 not intrusive Ignition voltage ≥ 11 volts	<u>Frequency:</u> 50 fail counts out of 55 sample counts 100ms loop Continuous	DTC Type B

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
Exhaust Gas Recirculation (EGR) Position Sensor A Circuit High Voltage	P0406	This diagnostic detects if the pintle position feedback circuit is shorted to high voltage or the 5V return is open.	EGR feedback sensor signal > 94.7% of 5 volt reference voltage (4.735 Volts)	Enable Stability Limit Time > 0.2 sec. 5 Volt reference DTCs not active Engine is running Off-board device not active Pintle cleaning not active P0401 not intrusive Ignition voltage ≥ 11 volts	180 fail counts out of 200 sample counts 100ms loop Continuous	DTC Type B
AIR System Incorrect Flow	P0411	Detects an AIR system insufficient flow condition. This test is run during the phase 1 (pump on, control valve open) portion of the Secondary Air Injection Diagnostic (SAI D).	Test 1 AIR normalized pressure error > 3.5 kPa (higher than predicted pressure) during SAID phase 1 test OR AIR normalized pressure error < -4.2 kPa (lower than predicted pressure) during SAID phase 1 test Test 2 [AIR normalized pressure error > 1.0 kPa (higher than predicted pressure) during SAID phase 1 test OR AIR normalized pressure error < -1.0 kPa (lower than predicted pressure) during SAID phase 1 test] AND The SAI String Length Average is < 12.5 kPa/s (filtered) Notes: The SAI String Length Average is determined by calculating the difference between SAI Pressure Sensor signal reads every 12.5 milliseconds over a 10 second period, during the Phase 1 test. The resulting values are then filtered.	AIR pressure sensor circuit DTCs not active AIR pressure sensor performance DTCs not active MAP sensor DTCs not active AIR pump relay circuit DTC not active AIR control valve relay circuit DTC not active MAF sensor DTCs not active 5 volt reference DTCs not active IAT sensor DTCs not active ECT sensor DTCs not active Misfire DTCs not active catalyst monitor DTCs not active fuel injector DTCs not active EST DTCs not active Internal Processor Fault (P0606) not active AIR operation is allowed this start. BARO > 60 kPa. 70 g/sec < Mass Air Flow < 75 g/sec. 18 volts > System voltage > 9 volts.	SAID phase 1 conditional test weight > 7 seconds Conditional test weight is based on Baro, Mass air flow & System voltage. Once per trip where AIR pump operation is requested at startup.	DTC Type B (L26 PZEV only)

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
AIR Solenoid Relay Control Circuit	P0412	This DTC checks the output driver for electrical integrity	Output state is invalid	• Ignition switch is in crank or run • 9 < Ignition Voltage < 18 • Pump must be commanded on >0.5 seconds	15 failure out of 20 samples OR chip protection logic indicates a short failure 1 time <u>Frequency:</u> Continuous 100 ms loop <u>Chip protection logic:</u> 5 failures out of 10 samples indicate a short Frequency of this logic is 12.5 ms loop Continuous Once the chip protection logic detects 5 failures out of 10 samples, the driver is turned off for the rest of the trip.	DTC Type B (L26 PZEV only)

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
AIR Pump Relay Control Circuit	P0418	This DTC checks the output driver for electrical integrity	Output state is shorted, open or over temperature	• Ignition switch is in crank or run • 9< Ignition Voltage < 18	15 failure out of 20 samples for open or over temperature chip protection logic indicates a short failure 1 time <u>Frequency:</u> Continuous 100 ms loop <u>Chip protection logic:</u> 5 failures out of 10 samples indicate a short Frequency of this logic is 12.5 ms loop Continuous Once the chip protection logic detects 5 failures out of 10 samples, the driver is turned off for the rest of the trip.	DTC Type B (L26 PZEV only)

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
Catalyst System Low Efficiency Bank 1	P0420	Oxygen Storage	OSC time difference ≥ 0.1015625 (EWMA filtered) OSC time difference = OSC worst pass threshold - OSC compensation factor * (post cat O2 response time - pre cat O2 response time) OSC worst pass thresh = 2.4875 seconds	*General Enable* • No EVAP, TAC system, MAF, CAM, ECT, CKP, EGR, BARO, AIR, EST, Fuel Injector, Fuel Trim, Idle Air, MAP, IAT, Misfire, O2 Sensor, TP Sensor, VSS or Engine Overtemp Protection Mode DTCs *Valid Idle Period Criteria* • Engine speed < 1100 RPM for a minimum of 30 seconds since end of last idle period. • Engine Speed < 1100 RPM • Engine run time ≥ 350 seconds. • Vehicle Speed ≤ 2 mph • FASD and/ or POS Diagnostic Intrusive Test and/or AIR Diagnostic Intrusive Test not Active • Tests attempted this trip ≤ 6.00 *Idle conditions Met Criteria* General Enable met; Valid Idle Period met • Green Converter Delay = not active • 0 ≤ short term fuel trim ≤ 2 • Δ short term fuel trim since valid idle conditions met ≤ 2 • 530°C ≤ predicted catalyst temperature ≤ 800°C for at least 30 seconds with a closed throttle time ≤ 120 seconds consecutively (closed throttle ⇒ TPS < 1.503906%) • Closed loop fueling • Long term fuel trim learning enabled • Barometric pressure > 70 kPa • 70°C ≤ ECT ≤ 126°C • System voltage > 10.7 volts • 0 < Idle period ≤ 120 seconds ⇒ Idle time is incremented if: Vehicle Speed ≤ 2 mph and Throttle Position ≤ 1.503906% • -20° C < IAT < 100°C • PRNDL is in Drive Range	1 test attempted per valid idle period Minimum of 1 test per trip Maximum of 6 tests per trip Frequency: • 12.5 ms Continuous Rapid Step Response feature will initiate multiple tests: If the difference between current EWMA value and the current OSC time difference ≥ 0.33 seconds and OSC time difference ≥ 0.00 seconds Maximum of 6 tests per trip. Maximum of 18 tests to detect failure when rapid step response is enabled. *Green Converter Delay Criteria* • The diagnostic will not be enabled until the next ignition cycle after the following has been met: Predicted catalyst temperature ≥ 525° C for 3600 seconds 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) • Note: this feature is only enabled when the vehicle is new and cannot be enabled in service	DTC Type A

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
Catalyst System Low Efficiency Bank 1 (Continued)	P0420	Oxygen Storage		*Test Enable Conditions; must hold true from 5 seconds after idle conditions are met to end of test* • Delta IAC ≤ 255 steps • Delta RPM ≤ 12800 • 3 gps ≤ MAF ≤ 12 gps • CCP DC Multiplier ≤ 1 • RPM – Desired RPM Gain ≤ 12800 • Desired RPM – RPM ≤ 12800 • Tests attempted this idle period < 1 • Load change: If during test enable, conditions the engine load changes more than 100.0%, the test starts over. If during the intrusive portion of the test, the load changes by more than 100%, then the test is aborted for that idle period. *Engine Fueling Criteria at Beginning of Idle Period* • Must be met from between 4 and 7 seconds after idle conditions have been met for at least 5 seconds • Number of pre-O2 switches ≥ 4 • Average BPW is within a window based on a table defined by airflow (see table) • 0.94 ≤ average short term fuel trim ≤ 1.06 *After engine fueling criteria has been met: 94.7 ≤ short term fuel trim ≤106.5 within 2.5 seconds.*		DTC Type A
Exhaust Gas Recirculation (EGR) Closed Position Performance	P042E	This diagnostic detects if the valve is stuck open when commanded closed.	Actual pintle position >= 5.5% of 5 volt reference voltage from learned closed position (8.19% EGR position)	Enable Stability Limit Time > 0.2 sec. 5 Volt reference DTCs not active EGR Position Sensor A Circuit High Voltage (P0406) not failing Engine is running Off-board device not active Pintle cleaning not active P0401 not intrusive Ignition voltage ≥ 11 volts Desired EGR position = 0% for 1 sec.	4 failure detections of: 360 fail counts out of 400 sample counts (with pintle movement between failure detections of 40% for at least 1 second open time) Frequency: 100ms loop Continuous	DTC Type B

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
Evaporative Emission (EVAP) System Small Leak Detected (EONV)	P0442	This DTC will detect a small leak (>= 0.020") in the EVAP system between the fuel fill cap and the purge solenoid.	*SMALL LEAK TEST FAIL:* Engine Off Natural Vacuum (EONV) 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 249.1 to 685 Pascals). 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. Fail threshold = 0.65 Re-Pass threshold = 0.35	*TEST ENABLE :* MAP, Baro, MAF DTCs not active Crank Sensor DTC not active VS Sensor DTCs not active No Fuel Tank Pressure Sensor Circuit DTCs No EVAP Canister Purge Solenoid Circuit DTCs No EVAP Canister Vent Solenoid Circuit DTCs No Fuel Level DTCs Coolant Sensor DTCs not active IAT Sensor DTCs not active EVAP Vacuum Sensor Performance DTC 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 ≥10.0% but ≤ 90.0% No thermostat rationality DTCs Estimated ambient temperature at end of drive ≥ 0°C but ≤ 34°C. Drive time ≥ 600 seconds. Drive length ≥ 8.300048828125 km Coolant ≥ 70°C. No fuel filling (fuel level increment ≥ 10%) During EONV test. BARO > 74.0kPa Estimate of Ambient Air Temperature Valid Conditions to be valid: Cold Start Startup Δ˚C(ECT-IAT) <= 8°C if ECT > IAT OR Hot Restart Sufficient drive length to get accurate estimate of ambient air temperature. (at least a minimum of 3 minutes and 3 kilometers)	Once per cold start, during hot soak (up to 2400 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: 8 Run length is 2 to 6 trips after code clear or non-volatile reset

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
Evaporative Emission (EVAP) Purge Solenoid Control Circuit	P0443	This DTC checks the Purge Solenoid Control Circuit for electrical integrity during operation.	The PCM detects that the commanded start of the driver and the actual state of the control circuit do not match.	• Ignition switch is in crank or run • 9 ≤ Ignition Voltage ≤ 18	15 failure out of 20 samples OR Chip protection logic indicates a short failure 1 time <u>Frequency:</u> Continuous 100 ms loop <u>Chip protection logic:</u> 5 failures out of 10 samples indicate a short Frequency of this logic is 12.5 ms loop Continuous Once the chip protection logic detects 5 failures out of 10 samples, the driver is turned off for the rest of the trip.	DTC Type B
Evaporative Emission (EVAP) Vent System Performance	P0446	This DTC will determine if a restriction is present in the vent solenoid, vent filler, vent hose or EVAP canister	Tank Vacuum > 2989.1 Pascals for 5 seconds BEFORE Purge Volume > 6 liters OR Vented Vacuum < -622.7 Pascals or Vented Vacuum > 1245.4 Pascals for 60 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> • No MAP , Baro DTCs • No TP Sensor DTCs • No VSS DTCs • No IAT DTCs • No ECT DTCs • No Fuel Tank Pressure Sensor Circuit DTCs • No Evap Canister Purge solenoid Circuit DTCs • No EVAP Canister Vent Solenoid Circuit DTCs • No Thermostat Rationality DTCs • 10 % ≤ Fuel Level ≤ 90 % • 11.00 V < System Voltage < 18.00 V • 4 °C < IAT < 30°C • ECT < 35 °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
Evaporative Emission (EVAP) Vent Solenoid Control Circuit	P0449	This DTC checks the output driver for electrical integrity during operation.	The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.	• Ignition switch is in crank or run • 9 ≤ Ignition Voltage ≤ 18	50 failures out of 63 samples <u>Frequency:</u> Continuous 100 ms loop	DTC Type A

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.	The tank vacuum sensor voltage is compared to a window about the nominal sensor voltage offset (~1.5 volts) upper voltage threshold (voltage addition above the nominal voltage): 0.2 volts lower voltage threshold (voltage subtraction below the nominal voltage): 0.2 volts 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. Fail threshold = 0.730 Re-Pass threshold = 0.400	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 number of times that it executes can range from zero to two 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 average run length: 6
Fuel Tank Pressure (FTP) Sensor Circuit Low Voltage	P0452	This DTC will detect a fuel tank pressure sensor signal that is too low out of range.	Fuel tank pressure sensor signal < 0.15 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.	• 0.10 second delay after sensor power up for sensor warm-up • PCM State <> crank	Frequency: Continuous 100ms loop If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC	DTC Type B
Fuel Tank Pressure (FTP) Sensor Circuit High Voltage	P0453	This DTC will detect a fuel tank pressure sensor signal that is too high out of range.	Fuel tank pressure sensor signal > 4.85 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.	• 0.10 second delay after sensor power up for sensor warm-up • PCM state <> crank	Frequency: Continuous 100ms loop If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC	DTC Type B

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 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 of 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 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. The test will report a failure if 2 out of 3 samples are failures.	DTC Type A
Evaporative Emission (EVAP) System Large Leak Detected	P0455	This DTC will detect a weak vacuum condition (large leak or purge blockage) in the Evap system.	Purge volume > 12.00 liters BEFORE Tank vacuum ≤ 2740 Pascals 2 liters of fuel must be consumed after setting the DTC active the first time to the DTC active the second time. Weak Vacuum Follow-up Test (fuel cap replacement test) Weak Vacuum Test failed previous trip and this trip. Passes if tank vacuum > 2740 Pascals Note: Weak vacuum Follow-up Test can only report a pass.	General Test Enable • No MAP, Baro DTCs • No TP Sensor DTCs • No VSS DTCs • No IAT DTCs • No ECT DTCs • No Fuel Tank Pressure Sensor DTCs • No Evap Canister Purge solenoid DTCs • No EVAP Canister Vent Solenoid DTCs • No Thermostat Rationality DTCs • 10 % ≤ Fuel Level ≤ 90 % • 11.00 V ≤ System Voltage ≤ 18.00 V • 4 °C ≤ IAT ≤ 30°C • ECT ≤ 35 °C • BARO ≥ 74.00 kPa (8000 ft) Cold Start Test • IAT < 30°C • Cold temperature Δ(ECT-IAT) ≤ 8 °C if ECT > IAT • Cold Test Timer < 1000 seconds	Once per cold start Time is dependent on driving conditions Max. before test abort is 1000 seconds	DTC Type B
Fuel Level Sensor Circuit Low	P0462	This DTC will detect a fuel sender stuck out of range low.	Fuel level A/D counts less than 25 A/D counts for 10 seconds	• runs continuously		DTC Type B

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 Level Sensor Circuit High	P0463	This DTC will detect a fuel sender stuck out of range high.	Fuel level A/D counts more than 153 A/D counts for 25 seconds	• runs continuously		DTC Type B
Fuel Level Sensor 1 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.	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. The refuel event is defined as a change of 10.0 % fuel level during the engine-off test. A refueling event is confirmed if the fuel level has a persistent change of 10.0 % for 30 seconds.	• 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 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. The test will report a failure if 2 out of 3 samples are failures.	DTC Type A
Cooling Fan 1 Control Circuit	P0480	This DTC checks the output driver for electrical integrity	Output state is invalid	• Ignition switch is in crank or run • 9 < Ignition Voltage < 18 • Fan must be commanded on >0.5 seconds	15 failure out of 20 samples OR chip protection logic indicates a short failure 1 time <u>Frequency:</u> Continuous 100 ms loop <u>Chip protection logic:</u> 5 failures out of 10 samples indicate a short Frequency of this logic is 12.5 ms loop Continuous Once the chip protection logic detects 5 failures out of 10 samples, the driver is turned off for the rest of the trip.	DTC Type B

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
Cooling Fan 2 Control Circuit	P0481	This DTC checks the output driver for electrical integrity	Output state is invalid	• Ignition switch is in crank or run • 9 < Ignition Voltage < 18 • Fan must be commanded on >0.5 seconds	15 failure out of 20 samples OR chip protection logic indicates a short failure 1 time <u>Frequency:</u> Continuous 100 ms loop <u>Chip protection logic:</u> 5 failures out of 10 samples indicate a short Frequency of this logic is 12.5 ms loop Continuous Once the chip protection logic detects 5 failures out of 10 samples, the driver is turned off for the rest of the trip.	DTC Type B
Evaporative Emission (EVAP) System Flow During Non-Purge	P0496	This DTC will determine if the purge solenoid is leaking to engine manifold vacuum.	Tank Vacuum > 2490.9 Pascals for 5.00 sec BEFORE Test time > 60 seconds (cold start)	<u>General Test Enable</u> • No MAP , Baro DTCs • No TP Sensor DTCs • No VSS DTCs • No IAT DTCs • No ECT DTCs • No Fuel Tank Pressure Sensor circuit DTCs • No EVAP canister purge valve solenoid circuit DTCs • No EVAP Canister Vent Solenoid circuit DTCs • No Thermostat Rationality DTCs • 10 % <= Fuel Level <= 90 % • 11.00 V <= System Voltage <= 18.00 V • 4 °C <= IAT <= 30°C • ECT < 35 °C • BARO >= 74.00 kPa (8000 ft)	Once per cold start. Cold start: max time is 1000 seconds	DTC Type B

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
Idle Air Control (IAC) System - RPM Too Low	P0506	This DTC will determine if a low idle exists.	RPM < (Desired RPM – a value from a look up table based on ECT) ECT value -40 300 -28 300 -16 300 -4 300 8 300 20 300 32 100 44 100 56 100 68 100 80 100 92 100 104 100 116 100 128 100 140 100 152 100	*Test Enable:* • EVAP Canister Purge Valve Stuck Open or Solenoid Control Circuit DTCs not active • No ECT DTCs • No Fuel Injector DTCs • No TAC system DTCs • No IAT DTCs • No Fuel Trim DTCs • No MAF DTCs • No TP Sensor DTCs • No Misfire DTCs • No VSS DTCs • No MAP , Baro DTCs • ECT ≥ -40.00 °C • System Voltage ≥ 9.00 V and ≤ 18.00 V • IAT ≥ -40.00 °C • Engine run time ≥ 1.00 seconds • BARO ≥ 60.00 kPa • TP Sensor ≤ 0.80% • VSS ≤ 3.00 MPH • Catalyst Diagnostic Intrusive Test = not active • Post O2 Diagnostic Intrusive Test = not active • Transmission state hasn't changed in last 0.1 seconds • Above met for a time ≥ 5 seconds to enable diagnostic.	8.00 seconds per test 4 tests to fail; must leave enable criteria between each test Frequency: Continuous after enable 100ms loop	DTC Type B

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
Idle Air Control (IAC) System - RPM Too High	P0507	This DTC will determine if a high idle exists. Results in Limited Authority Mode if vehicle has Electronic Throttle Control	RPM > (Desired RPM + value from look up table based on ECT) ECT value -40 300 -28 300 -16 300 -4 300 8 300 20 300 32 200 44 200 56 200 68 175 80 175 92 175 104 175 116 175 128 175 140 175 152 175	*Test Enable:* • EVAP Canister Purge Valve Stuck Open or Solenoid Control Circuit DTCs not active • No ECT DTCs • No Fuel Injector DTCs • No TAC system DTCs • No IAT DTCs • No Fuel Trim DTCs • No MAF DTCs • No TP Sensor DTCs • No Misfire DTCs • No VSS DTCs • No MAP , Baro DTCs • ECT ≥ -40.00 °C • System Voltage ≥ 9.00 V but ≤ 18.00 V • IAT ≥ -40.00 °C • Engine run time ≥ 1.00 seconds • BARO ≥ 60.00 kPa • TP Sensor ≤ 0.80% • VSS ≤ 3.00 MPH • Catalyst Diagnostic Intrusive Test = not active • Post O2 Diagnostic Intrusive Test = not active • Transmission state hasn't changed in last 0.1 seconds • Above met for a time ≥ 5 seconds to enable diagnostic.	8.00 seconds per test 4 tests to fail; must leave enable criteria between each test Frequency: Continuous after enable 100ms loop	DTC Type A
Control Module Read Only Memory (ROM)	P0601	This DTC will be stored if the calibration check sum is incorrect	Output state invalid	• PCM state = crank or run • Ignition voltage ≥ 5 volts • Engine speed < 5000	1 failure Frequency: 50 ms loop Continuous	DTC Type A
Control Module Not Programmed	P0602	This DTC will be stored if the PCM is a service PCM that has not been programmed.	Output state invalid	• PCM state = crank or run • PCM is identified through calibration as a Service PCM	Test is run at Powerup Test also runs: Frequency: 100ms loop Continuous	DTC Type A

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
Control Module Random Access Memory (RAM)	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 failure at key-up initialization. This check is on all GMPX RAM. OR Fault counter increments by 10 for every error, decrements by 1 for every pass; fail threshold = 20. This check is on the Desired Throttle Position RAM location and runs 12.5 ms continuous OR Fault counter increments by 10 for every error, decrements by 1 for every pass; fail threshold = 20. This check is on all GMPX RAM and runs 100 ms continuous	DTC Type A
ECM/PCM Processor	P0606	Indicates that the PCM has detected a TACM internal processor integrity fault	TACM 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
5 Volt Reference 1 Circuit	P0641	This DTC detects if the 5 Volt supply is too high or too low	Voltage state invalid (Voltage > 4.7 volts or voltage < 4.39 volts)	• PCM state = run	Failed for 10.00 sec <u>Frequency:</u> 100ms loop Continuous	DTC Type B

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
Malfunction Indicator Lamp (MIL) Control Circuit	P0650	This DTC checks the output driver for electrical integrity	Output state is shorted, open or over temperature	• Ignition switch is in crank or run • 9< Ignition Voltage < 18	15 failure out of 20 samples for open or over temperature chip protection logic indicates a short failure 1 time <u>Frequency:</u> Continuous 100 ms loop <u>Chip protection logic:</u> 5 failures out of 10 samples indicate a short Frequency of this logic is 12.5 ms loop Continuous Once the chip protection logic detects 5 failures out of 10 samples, the driver is turned off for the rest of the trip.	DTC Type B No MIL
5 Volt Reference 2 Circuit	P0651	This DTC detects if the 5 Volt supply is too high or too low	Voltage state invalid (Voltage > 4.7 volts or voltage < 4.4 volts)	• PCM state = run	Failed for 10.00 sec <u>Frequency:</u> 100ms loop Continuous	DTC Type B
Accelerator Pedal Position (APP) System	P1125	PCM determines a limp home mode of operation due to multiple accelerator pedal sensor faults.	This DTC is set when: 1) 1 or more APP sensors are out of range (< 0.7 volts or > 4.5 volts), OR 2) Both APP sensors disagree (> 0.225 volts)	• 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

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
O2S Insufficient Switching Bank 1 Sensor 1	P1133	This DTC determines if the O2 sensor is no longer sufficiently switching.	Half cycle L/R switches < 40 or Half cycle R/L switches < 40 OR Slope Time L/R switches < 3 or Slope Time R/L switches < 3	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Fuel Injector DTCs • No Air DTCs (PZEV only) • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active Specific Enable Criteria • EGR flow diagnostic Intrusive Test= Not Active • Catalyst monitor diagnostic Intrusive Test= Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • O2 Heater on for ≥ 0 seconds • Bank 1 Sensor1 circuit and heater and heater drive DTCs not Active • In one of the following four fueling cells: Purge off, normal; purge off, high flow; purge on, normal; purge on, high flow • Misfire DTC = Not Active • ECT > 65.00 °C • Engine run time > 60.00 seconds • EVAP canister purge duty cycle ≥ 0.00 % • 15.00 gps ≤ MAF ≤ 29.0 gps • 1300.00 ≤ RPM ≤ 3000.00 • Throttle position ≥ 2.00 % • Fuel state = closed loop • Transmission (automatic) not in Park, Reverse or Neutral All of the above met for at least 1 second.	90000.00 ms Frequency: Once per trip	DTC Type B

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
O2S Transition Time Ratio Bank 1 Sensor 1	P1134	This DTC determines if the O2 sensor transition time between rich to lean and lean to rich is degraded	Transition time difference < -60 OR Transition time difference > 73	Common Enable Criteria • No TP Sensor DTCs • No MAP DTCs • No ECT DTCs • No MAF DTCs • No IAT DTCs • No Evap DTCs • No Fuel Injector DTCs • EGR flow diagnostic Intrusive Test = Not Active • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • 10.0 volts < system voltage < 18.00 volts • Device control = Not Active Specific Enable Criteria • O2 Heater on for ≥ 0 seconds • Bank 1 Sensor1 circuit and heater and heater drive DTCs = Not Active • In one of the following four fueling cells: Purge off, normal; purge off, high flow; purge on, normal; purge on, high flow • Misfire DTC = Not Active • ECT > 65.00 °C • Engine run time > 60.00 seconds • EVAP canister purge duty cycle ≥ 0.00 % • 15.00 gps ≤ MAF ≤ 29.0 gps • 1300.00 ≤ RPM ≤ 3000.00 • Throttle position ≥ 2.00 % • Fuel state = closed loop • Transmission (automatic) not in Park, Reverse or Neutral All of the above met for at least 1 second.	90.s Frequency: Once per trip	DTC Type B
Engine Coolant Over Temperature - Protection Mode Active	P1258	This DTC indicates that the engine is or has been in camel mode, where the coolant has gotten so hot that the engine is being run first on one bank of injectors, and then on the other bank, in an effort to save the engine.	Injectors are turned off due to ECT > 131°C	• ECT shorts tests not failing • Engine is running • Engine run time > 5 seconds	Frequency: 1 second Continuous	DTC Type A

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
Bypass Line Monitor	P1350	This diagnostic detects an open or short on the Electronic Spark Timing (EST) output circuits.	Fault is detected	• Engine is running or cranking • No P0350 (Ignition Coil Circuit) DTC Active.	90 failure out of 100 samples <u>Frequency:</u> Continuous 100 ms loop Once the fault logic detects a failure, the diagnostic is turned off for the rest of the trip.	DTC Type B
Cold Start Emissions Reduction System Fault	P1400	Model based test computes exhaust thermal energy from elevated idle speed and retarded spark advance. Detects if the cold start emission reduction system has failed resulting in the delivered thermal energy being out of range.	(Average desired accumulated exhaust energy - Average measured accumulated exhaust energy) < -5 kJ/s OR (Average desired accumulated exhaust energy - Average measured accumulated exhaust energy) > 0.3 kJ/s	• Cold start emission reduction strategy is active. • Vehicle speed < 2 mph. • Throttle position < 0.5%. • Airflow per cylinder > 40 mg. • No DTCs set for the following systems: MAP, MAF, IAT, ECT, Misfire, Electronic Spark Timing, Crank sensor, Idle, Fuel Injection, TP sensor, VSS, 5 volt reference, PCM Memory, AIR (PZEV only).	100 ms loop Runs once per trip when the cold start emission reduction strategy is active. Test completes after 15 seconds of accumulated qualified data.	DTC Type A

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
Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance	P1516	Indicates that the TAC Module has detected a throttle positioning error OR TACM cannot determine throttle positioning OR Both TP Sensors are invalid	Absolute value of the throttle error: ≥2 degrees for >200 ms with no change in Commanded Throttle Position. OR ≥2 degrees for >500 ms for throttle command changes ≥ 2 degrees. OR ≥ 5 degrees for >200 ms for throttle command changes ≥ 5 degrees. OR ≥ 5 degrees for > 300 ms as commanded throttle changes continuously (no step change) OR Commanded DTP has been stable for 5 seconds, and TACM can not hold +/- 2 degree tolerance for 200ms. OR PCM processor DTCs. OR TACM processor DTC. OR Both TP Sensor Circuit DTCs are set. OR PCM-TACM Serial Data DTC with 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

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
Control Module Throttle Actuator Position Performance	P2101	Indicates that the PCM has detected a throttle positioning error	Absolute value of the throttle error > 6%. [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 TP Sensor Circuit DTCs are not set. • No PCM Processor DTCs. • No TACM Processor DTC.	High counter increments by 2 for every throttle error > 6%; decrements by 1 if 0% < throttle error <5%; decrements by 5 if -6% < throttle error <0%; clears if throttle error < -6%. Check runs every 18.75 ms with TACM - PCM valid message received. Low counter increments by 2 for every throttle error < -6%; decrements by 1 if -6%< throttle error <0%; decrements by 5 if 0%< throttle error <6%; clears if throttle error > 6%. Check runs every 18.75 ms with TACM - PCM valid message received.	DTC Type A

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

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
Accelerator Pedal Position (APP) Sensor 1 Circuit	P2120	TACM indicates a continuous or intermittent short or open in either the signal circuit or the APP sensor #1. OR TACM indicates an invalid minimum mechanical position for the APP sensor #1. OR TACM indicates 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) Reference Voltage < 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
Accelerator Pedal Position (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 indicates 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) Reference voltage < 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

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
Throttle Position (TP) Sensor 1-2 Correlation	P2135	TACM indicates a continuous or intermittent correlation fault between TP sensors #1 and #2. OR TACM indicates an invalid minimum mechanical position correlation between TP sensor #1 and #2.	1) Absolute value of (TP Sensor 1 raw – TP Sensor 2 raw) >6.0%. OR 2) Absolute value of (TP Sensor 1 min learnt – TP Sensor 2 min learned) >6.0%.	• 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 every error, decrements by 1 for every pass: threshold is 133 Check runs every 3ms.	DTC Type A
Accelerator Pedal Position (APP) Sensor 1-2 Correlation	P2138	TACM indicates a continuous or intermittent correlation fault between APP sensors #1 and #2 OR TACM indicates an invalid minimum mechanical position correlation between APP sensor #1 and #2.	1) Absolute value of (normalized APP sensor #2 - normalized APP sensor #1) > 6.0% OR 2) absolute value of (APP sensor 1 min learnt - APP sensor 2 min learned) >6.0%	• 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 every error, decrements by 1 for every pass: threshold is 1333 Check runs every 3ms.	DTC Type A

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
O2 Sensor Circuit Stuck Lean Range/Performance Bank 1 Sensor 2	P2270	This DTC determines if the post catalyst O2 sensor is stuck in a normal voltage range and thereby can no longer be used for post oxygen sensor fuel control or for catalyst monitoring. The diagnostic includes an intrusive test. The intrusive test delivered fuel to achieve the required rich threshold.	Post catalyst O2 sensor cannot achieve voltage ≥ 724.83 millivolts	Common Enable Criteria • No O2 circuit, heater, response or heater driver DTCs active • No TP Sensor DTCs • No MAF DTCs • No ECT DTCs • No MAP DTCs • No IAT DTCs • No EVAP DTCs • No Fuel Injector DTCs • No Fuel Trim DTCs • No Misfire DTCs • No BARO DTCs • No AIR DTCs • 10.0 volts ≤ system voltage ≤ 18 volts • Engine Runtime ≥ 300 seconds • Green Converter Delay = not active Specific Enable Criteria: • Must be in one of the following fuel cells: Purge Decel; Non-Purge Decel • 625 rpm ≤ Engine Speed ≤ 1750 rpm • 3.2 gps ≤ Airflow ≤ 15 gps • 25 mph ≤ Vehicle Speed ≤ 85 mph • EGR Flow diagnostic intrusive test not active • Fuel state = closed loop All of the above met for at least 1 second, and then: • 95.3 ≤ Short term fuel trim ≤ 104.7 • Purge Duty Cycle = 0% for at least 4 seconds	Accumulated Mass Airflow up to 500 grams during stuck lean test. Frequency: One test per trip	DTC Type B

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
O2 Sensor Circuit Stuck Rich Range/Performance Bank 1 Sensor 2	P2271	This DTC determines if the post catalyst O2 sensor is stuck in a normal voltage range and thereby can no longer be used for post oxygen sensor fuel control or for catalyst monitoring. The diagnostic includes an intrusive test. The intrusive test increases or reduces delivered fuel to achieve the required lean threshold.	Post catalyst O2 sensor cannot achieve voltage ≤ 150 millivolts	Common Enable Criteria • No O2 circuit, heater, response or heater driver DTCs active • No TP Sensor DTCs • No MAF DTCs • No ECT DTCs • No MAP DTCs • No IAT DTCs • No EVAP DTCs • No Fuel Injector DTCs • No Fuel Trim DTCs • No Misfire DTCs • No BARO DTCs • No AIR DTCs • 10.0 volts ≤ system voltage ≤ 18 volts • Engine Runtime ≥ 300 seconds • Green Converter Delay = not active Specific Enable Criteria: • Must be in one of the following fuel cells: Purge Decel; Non-Purge Decel • 625 rpm ≤ Engine Speed ≤ 1750 rpm • 3.2 gps ≤ Airflow ≤ 15 gps • 25 mph ≤ Vehicle Speed ≤ 85 mph • EGR Flow diagnostic intrusive test not active • Fuel state = closed loop All of the above met for at least 1 second, and then: • 95.3 ≤ Short term fuel trim ≤ 104.7 • Purge Duty Cycle = 0% for at least 4 seconds	Accumulated Mass Airflow up to 400 grams during stuck rich test. Frequency: One test per trip	DTC Type B
AIR System Pressure Sensor A Circuit	P2430	Detects a stuck-in-range AIR pressure sensor signal.	Stuck in Range Average Error < 0.5 AND Stuck in Range Variance < 1.0	No active DTC P0412 set. No active DTC P0418 set. No active DTC P0606 set. No active DTC P2432 set. No active DTC P2433 set. No active 5 volt reference DTCs set. AIR pressure sensor circuit fault not failing AIR pump is commanded ON	Stuck in Range Cumulative Info > 5 sec. Once per trip where AIR pump operation is requested at startup.	DTC Type B (L26 PZEV only)

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
AIR System Pressure Sensor A Performance	P2431	Detects a skewed or drifting AIR pressure sensor signal	Difference between AIR Pressure Sensor and Barometric pressure > 10 kPa with AIR pump commanded OFF. OR Difference between AIR Pressure Sensor and Barometric pressure > 50 kPa with AIR pump commanded ON.	No active DTC P0606 set. No active DTC P0412 set. No active DTC P0418 set. No active DTC P2432 set. No active DTC P2433 set. No active 5 volt reference DTCs set. AIR pressure sensor circuit fault not failing	Air Pressure Sensor Performance cumulative info > 30 seconds. Cumulative info is updated at a rated determined by Barometric pressure reading quality. Baro quality is determined by distance traveled since last key-on or part throttle Baro update. Continuous, 100ms loop.	DTC Type B (L26 PZEV only)
AIR System Pressure Sensor A Circuit Low	P2432	Detects a low out-of-range AIR pressure sensor signal	AIR Pressure Sensor signal < 5% of 5V ref. (47.3 kPa)	No active DTC P0606 set. No active 5 volt reference DTCs set.	400 fail counts out of 1000 sample counts. Continuous, 12.5 ms loop.	DTC Type B (L26 PZEV only)
AIR System Pressure Sensor A Circuit High	P2433	Detects a high out-of-range AIR pressure sensor signal	AIR Pressure Sensor signal > 95% of 5V ref (144.5 kPa)	No active DTC P0606 set. No active 5 volt reference DTCs set.	400 fail counts out of 1000 sample counts. Continuous, 12.5 ms loop.	DTC Type B (L26 PZEV only)
AIR System Switch / Valve Stuck Open	P2440	Detects an AIR system control valve stuck open condition. This test is run during the phase 2 (pump on, control valve shut) portion of the SAI diagnostic.	AIR normalized pressure error < -3 kPa (lower than predicted pressure) during SAID phase 2 test	AIR pressure sensor circuit DTCs not active AIR pressure sensor performance DTCs not active MAP sensor DTCs not active AIR pump relay circuit DTC not active AIR control valve relay circuit DTC not active No active MAF sensor DTCs set. No active 5 volt reference DTCs set. No active IAT sensor DTCs set. No active ECT sensor DTCs set. No active Misfire DTCs set. No active catalyst monitor DTCs set. No active fuel injector DTCs set. No active EST DTCs set. No active DTC P0411 set. No active DTC P0606 set. AIR pressure sensor circuit fault pending = False. AIR operation is allowed this start. BARO > 65 kPa. 3 g/sec < Mass Air Flow < 26 g/sec. 18 volts > System voltage > 10.5 volts.	SAID phase 2 conditional test weight > 1.5 seconds Conditional test weight is based on Baro, Mass air flow & System voltage. Once per trip where AIR pump operation is requested at startup.	DTC Type B (L26 PZEV only)

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
AIR System Pump Stuck On	P2444	Detects an AIR pump stuck ON condition. This test is run during the phase 3 (pump off) portion of the SAI diagnostic.	AIR normalized pressure error > 1.5 kPa (higher than predicted pressure) during SAID phase 3 test	AIR pressure sensor circuit DTCs not active AIR pressure sensor performance DTCs not active MAP sensor DTCs not active AIR pump relay circuit DTC not active AIR control valve relay circuit DTC not active No active MAF sensor DTCs set. No active 5 volt reference DTCs set. No active IAT sensor DTCs set. No active ECT sensor DTCs set. No active Misfire DTCs set. No active catalyst monitor DTCs set. No active fuel injector DTCs set. No active EST DTCs set. No active DTC P2440 set No active DTC P0411 set. No active DTC P0606 set AIR pressure sensor circuit fault pending = False. AIR operation is allowed this start. SAID post control time < 14 seconds	Within 5 seconds of the AIR pump being commanded OFF. Once per trip where AIR pump operation is requested at startup.	DTC Type A (L26 PZEV only)
ECM/PCM Internal Engine Off Timer Performance	P2610	This DTC determines if the ignition off timer has failed.	A failure will be reported if any of the following occur: Ignition Off Time < 0 seconds Ignition Off Time > 8 seconds Sample Counter > 25 Ignition Off Time < Old Ignition Off Time <u>On positive timer transition</u> Sample Counter < 7 or Sample Counter > 13 Or (Ignition Off Time - Old Ignition Off Time) ≠ 1 second note: Sample Counter is incremented if Ignition Off Time = Old Ignition Off Time	Test Run This Trip = FALSE Ignition Off Timer Enabled = TRUE (PCM State = Power off; Time in power off ≥ 1.6 seconds)	<u>Frequency:</u> 100 ms loop Continuous	DTC Type B

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
2 Sensor Circuit Range/Performance Bank 1 Sensor 1	P2A00	This DTC determines if the O2 sensor voltage is not meeting the voltage criteria to enable closed loop fueling.	Closed loop fuel control O2 sensor Ready flag set to "Not Ready." O2 sensor voltage must be > 600 millivolts or < 300 millivolts to set closed loop fuel O2 Ready flag. Once set to "Ready," the O2 sensor voltage cannot be > 300 millivolts and < 600 millivolts for > 10 seconds or the O2 Ready flag will be reset to "Not Ready."	• No TP Sensor DTCs • No MAF, IAT DTCs • No MAP DTCs • No ECT DTCs • No EVAP DTCs • No Fuel Injector DTCs • No AIR DTCs • No Bank 1 Sensor 1 O2 DTCs • Engine Run Time ≥ 100 seconds • ECT ≥ 65° C • Traction Control = Not Active • Not in Catalyst Protection Mode • 10.0 volts ≤ Ignition Voltage ≤ 18 volts • 500 ≤ Engine Speed ≤ 3000 • 5gps ≤ Mass Airflow ≤ 30gps • 3% ≤ TP Sensor ≤ 35% • Not in Decel Fuel Cutoff Mode • Not in Power Enrichment • Predicted O2 temp ≥ -1280°C All of the above met for 3 seconds	240 test failures in a 300 test sample Frequency: Continuous 100ms loop	DTC Type B

LOOKUP TABLES

P0101: (Calculated Flow – Measured Flow)

Calculated Airflow	Airflow Delta
Grams_Air_0	15
Grams_Air_40	20
Grams_Air_80	25
Grams_Air_120	35
Grams_Air_160	35
Grams_Air_200	35
Grams_Air_240	35
Grams_Air_280	400
Grams_Air_320	400
Grams_Air_360	400
Grams_Air_400	400

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P0106 – Predicted MAP Max (kPa)

	0 % TPS	10 % TPS	20 %TPS	30 % TPS	40 % TPS	50 % TPS	60 % TPS	70 % TPS	80 % TPS	90 % TPS	100 % TPS
0 RPM	105	105	105	105	105	105	105	105	105	105	105
800 RPM	76.4	97.7	101.7	105	105	105	105	105	105	105	105
1600 RPM	72	89.1	94.2	105	105	105	105	105	105	105	105
2400 RPM	66.2	80.5	84.2	97.99805	105	105	105	105	105	105	105
3200 RPM	60	72.7	75.3	87.00195	102.002	105	105	105	105	105	105
4000 RPM	54.1	64.2	67.3	72.00195	100	105	105	105	105	105	105
4800 RPM	47.8	56.7	60.4	61.00098	88.99902	100	105	105	105	105	105
5600 RPM	40.8	47.8	54.1	57.99805	82.00195	95	105	105	105	105	105

P0106 – Predicted MAP Min (kPa)

	0 % TPS	10 % TPS	20 % TPS	30 % TPS	40 % TPS	50 % TPS	60 % TPS	70 % TPS	80 % TPS	90 % TPS	100 % TPS
0 RPM	22.9	25.8	36.4	25	43.99902	46.00098	47.00195	47.99805	50	55	55
800 RPM	18.1	19.5	26.9	25	43.99902	46.00098	47.00195	47.99805	50	55	55
1600 RPM	13	12.9	21.8	23.99902	43.99902	45	47.00195	47.99805	50	55	55
2400 RPM	10	10	19.2	18.99902	32.00195	45	45	47.99805	50	55	55
3200 RPM	10	10	17.2	15	26.00098	42.99805	45	47.99805	50	55	55
4000 RPM	10	10	15.5	11.00098	22.99805	37.00195	43.99902	45	50	55	55
4800 RPM	10	10	13.2	10	17.99805	28.99902	42.00195	43.99902	50	55	55
5600 RPM	10	10	11.7	10	16.00098	27.99805	40	43.99902	50	55	55

P0300: Catalyst Damaging Misfire Percentages as a Function of Engine Speed and Load Table:

Eng. Load ↓ / Eng. RPM →	0 RPM	1000 RPM	2000 RPM	3000 RPM	4000 RPM	5000 RPM	6000 RPM	7000 RPM
0 Load_In_Percent	31.875%	31.875%	31.875%	31.875%	31.875%	31.875%	31.875%	31.875%
10 Load_In_Percent	31.875%	31.875%	31.875%	31.875%	31.875%	31.875%	31.875%	31.875%
20 Load_In_Percent	31.875%	31.875%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
30 Load_In_Percent	31.875%	31.875%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
40 Load_In_Percent	31.875%	31.875%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
50 Load_In_Percent	31.875%	31.875%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
60 Load_In_Percent	31.875%	31.875%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
70 Load_In_Percent	31.875%	31.875%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
80 Load_In_Percent	31.875%	31.875%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
90 Load_In_Percent	31.875%	31.875%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
100 Load_In_Percent	31.875%	31.875%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%

P0401: Engine Run Time as a Function of Coolant Temperature Table:

Coolant Temperature at Startrun	Engine Run Time (seconds)
Deg_C_m40	120
Deg_C_m30	120
Deg_C_m20	120
Deg_C_m10	120
Deg_C___0	120
Deg_C__10	65
Deg_C__20	50
Deg_C__30	50
Deg_C__40	50
Deg_C__50	50
Deg_C__60	50
Deg_C__70	45
Deg_C__80	35
Deg_C__90	20
Deg_C_100	20
Deg_C_110	20
Deg_C_120	60
Deg_C_130	65
Deg_C_140	70

P0420: Average Base Pulse Width Maximum Allowed Value as a Function of Airflow Table

Airflow in gps	Average BPW in milliseconds

0	100.0029
1	100.0029
2	100.0029
3	100.0029
4	100.0029
5	100.0029
6	100.0029
7	100.0029
8	100.0029
9	100.0029
10	100.0029
11	100.0029
12	100.0029
13	100.0029
14	100.0029
15	100.0029
16	100.0029

P0420: Average Base Pulse Width Minimum Allowed Value as a Function of Airflow Table

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