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 Camshaft Position Actuator Solenoid Control Circuit Bank 1	P0010	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Output driver commanded on Ignition switch is in crank or run 11 volts ≤ Run/Crank Ignition Voltage ≤ 18 volts	260 failures out of 300 samples 100ms loop continuous	DTC Type B
Intake Camshaft Position System Performance Bank 1	P0011	Detects a VVT system error by comparing the desired and actual cam positions when VVT is activated	Camshaft position error [absolute value of (desired position - actual position)] > 5° (All Table Positions) Table is a function of Engine RPM and Oil Temperature	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position < 4.5° for 1.0 second (Table is a function of Engine RPM and Oil Temperature) 11 volts ≤ Run/Crank Ignition Voltage ≤ 18 volts Power Take Off (PTO) not active DTCs not active for the following sub-systems: Cam sensors Crank sensors Cam to crank rationality Cam phase output drivers	100 fail counts out of 300 sample counts 100ms loop Continuous	DTC Type B
Exhaust Camshaft Position Actuator Solenoid Control Circuit Bank 1	P0013	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Output driver commanded on Ignition switch is in crank or run 11 volts ≤ Run/Crank Ignition Voltage ≤ 18 volts	260 failures out of 300 samples 100 ms loop continuous	DTC Type B
Exhaust Camshaft Position System Performance Bank 1	P0014	Detects a VVT system error by comparing the desired and actual cam positions when VVT is activated	Camshaft position error [absolute value of (desired position - actual position)]: >5 ° (All Table Positions) Table is a function of Engine RPM and Oil Temperature	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position > 4.5 for 1 seconds 11 volts ≤ Crank Ignition Voltage ≤ 18 volts Power Take Off (PTO) not active DTCs not active for the following sub-systems: Cam sensors Crank sensors Cam to crank rationality	100 fail counts out of 300 sample counts 100ms loop Continuous	DTC Type B
Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 1 Sensor A	P0016	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position	Four cam sensor pulses more than 9 crank degrees before or 12 crank degrees after nominal position in one cam revolution.	No 5 volt reference, camshaft position sensor circuit, or crankshaft position sensor circuit DTCs set Engine speed < 1200 RPM Engine is spinning Crankshaft position signal is in sync. Cam phase state is learned or default	25 failures out of 35 samples Frequency: 1x per cam rotation Continuous	DTC Type B
Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 1 Sensor B	P0017	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position	Four cam sensor pulses more than 10 crank degrees before or 13 crank degrees afternominal position in one cam revolution.	No 5 volt reference, camshaft position sensor circuit, or crankshaft position sensor circuit DTCs set Engine speed < 1200 RPM Engine is spinning Crankshaft position signal is in sync. Cam phase state is learned or default	25 failures out of 35 samples Frequency: 1x per cam rotation Continuous	DTC Type B
Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 2 Sensor A	P0018	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position	Four cam sensor pulses more than 11 crank degrees before or 13 crank degrees after nominal position in one cam revolution.	No 5 volt reference, camshaft position sensor circuit, or crankshaft position sensor circuit DTCs set Engine speed < 1200 RPM Engine is spinning Crankshaft position signal is in sync. Cam phase state is learned or default	25 failures out of 35 samples Frequency: 1x per cam rotation 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
Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 2 Sensor B	P0019	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position	Four cam sensor pulses more than 7.3crank degrees before or 9.1 crank degrees after nominal position in one cam revolution.	No 5 volt reference, camshaft position sensor circuit, or crankshaft position sensor circuit DTCs set Engine speed < 1200 RPM Engine is spinning Crankshaft position signal is in sync. Cam phase state is learned or default	25 failures out of 35 samples Frequency: 1x per cam rotation Continuous	DTC Type B
Intake Camshaft Position (CMP) Actuator Solenoid Control Circuit Bank 2	P0020	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Output driver commanded on Ignition switch is in crank or run 11 volts ≤ Run/Crank Ignition Voltage ≤ 18	260 failures out of 300 samples 100ms loop continuous	DTC Type B
Intake Camshaft Position System Performance - Bank 2	P0021	Detects a VVT system error by comparing the desired and actual cam positions when VVT is activated	Camshaft position error [absolute value of (desired position - actual position)]: >5 ° (All Table Positions) Table is a function of Engine RPM and Oil Temperature	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position > 4.5 for 1 seconds 11 volts ≤ Run/Crank Ignition Voltage ≤ 18 volts Power Take Off (PTO) not active DTC's not active for the following sub-systems: Cam sensors Crank sensors Cam to crank rationality Cam phase output drivers	100 fail counts out of 300sample counts 100ms loop Continuous	DTC Type B
Exhaust Camshaft Position (CMP) Actuator Solenoid Control Circuit Bank 2	P0023	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Output driver commanded on Ignition switch is in crank or run 11 volts ≤ Run/Crank Ignition Voltage ≤ 18 volts	260 failures out of 300 samples 100ms loop continuous	DTC Type B
Exhaust Camshaft Position System Performance - Bank 2	P0024	Detects a VVT system error by comparing the desired and actual cam positions when VVT is activated	Camshaft position error [absolute value of (desired position - actual position)] : 5 ° (All Table Positions) Table is a function of Engine RPM and Oil Temperature	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position > 4.5 for 1 seconds 11 volts ≤ Run/Crank Ignition Voltage ≤ 18 volts Power Take Off (PTO) not active DTC's not active for the following sub-systems: Cam sensors Crank sensors Cam to crank rationality Cam phase output drivers	100 fail counts out of 300 sample counts 100ms loop Continuous	DTC Type B
O2S Heater Control Circuit Bank 1 Sensor 1	P0030	This DTC checks the Heater Output Driver circuit for electrical integrity	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • Engine speed ≥ 400 RPM	20 failures out of 25 samples Frequency: 250ms 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	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • Engine speed ≥ 400 RPM	20 failures out of 25 samples Frequency: 250ms 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
O2S Heater Control Circuit Bank 2 Sensor 1	P0050	This DTC checks the Heater Output Driver circuit for electrical integrity	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • Engine speed ≥ 400 RPM	20 failures out of 25 samples Frequency: 250ms 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.	7.4707 Ω > Calculated Heater resistance > 1.291 Ω	• Coolant – IAT < 8°C • Engine Soak Time > 28800 Seconds • -30 °C < Coolant Temp < 45°C • Coolant Fault = Not Active • Ignition Off Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18 volts	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.	8.5801 Ω > Calculated Heater resistance > 1.9004Ω	• Coolant – IAT < 8°C • Engine Soak Time > 28800 Seconds • -30 °C < Coolant Temp < 45°C • Coolant Fault = Not Active • Ignition Off Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18 volts	Once per valid cold start.	DTC Type B
O2S Heater Control Circuit Bank 2 Sensor 2	P0056	This DTC checks the Heater Output Driver circuit for electrical integrity	Output state shorted or open Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • Engine speed ≥ 400 RPM	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B
HO2S Heater Resistance Bank 2 Sensor 1	P0059	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	7.4707 Ω > Calculated Heater resistance > 1.291 Ω	• Coolant – IAT < 8°C • Engine Soak Time > 28800 Seconds • -30 °C < Coolant Temp < 45°C • Coolant Fault = Not Active • Ignition Off Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18 volts	Once per valid cold start.	DTC Type B
HO2S Heater Resistance Bank 2 Sensor2	P0060	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	8.5801 Ω > Calculated Heater resistance > 1.9004Ω	• Coolant – IAT < 8°C • Engine Soak Time > 28800 Seconds • -30 °C < Coolant Temp < 45°C • Coolant Fault = Not Active • Ignition Off Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18 volts	Once per valid cold start.	DTC Type B
MAP/MAF/Throttle Position Correlation	P0068	Detect when manifold absolute pressure and measured airflow do not match estimated engine airflow as established by the TPS	Difference between measured MAP and estimated MAP < X kPa Difference between measured MAF and estimated MAF < Y grams/sec X, Y depend on throttle position, and maximum of X, and Y are 100kPa, 511gram/sec.	Engine running No PCM processor, throttle actuation DTCs Both TPS circuits DTCs are set	187.5 msec Continuous in the main processor	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 stuck within the normal operating range	(Measured Flow – Modeled air Flow) Filtered > 16 AND (Measured Manifold Air Pressure – Manifold Model 2 pressure) Filtered > 20	Engine rpm =>400 and <= 8000 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active Crank sensor DTCs not active Engine Coolant DTCs not active Intake Air Temp. DTCs not active Engine Coolant > 69 deg C and < 125 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous The Mass Air Flow reading and Mass Air Flow calculation are performed during the same 12.5 ms loop	DTC Type B
Mass Air Flow (MAF) Sensor Circuit Low	P0102	Detects a continuous short to low or a open in either the signal circuit or the MAF sensor	MAF ≤ 1421 **Hz (~ .7 g/s)**	Engine Running > 1 seconds Engine Speed ≥ 300 RPM System Voltage ≥ 11 volts The above must be present for a period of time greater than 1 seconds	50 test failures in 63 test samples 1 sample every Lo Res event	DTC Type B
Mass Air Flow (MAF) Sensor Circuit High	P0103	Detects a continuous short to high in either the signal circuit or the MAF sensor	MAF ≥ 14500 Hz **(~ 1000 g/s)**	Engine Running > 1 seconds Engine Speed ≥ 300 RPM System Voltage ≥ 11 volts The above must be present for a period of time greater than 1 seconds	20 test failures in 25 test samples 1 sample every Lo Res event	DTC Type B
Manifold Absolute Pressure (MAP) Sensor Performance	P0106	This DTC determines if the MAP sensor is stuck within the normal operation range	(Measured MAP - Manifold Model 1 pressure) filtered > 20 AND (Measured MAP – Manifold Model 2 pressure) filtered > 20	Engine rpm =>400 and <= 8000 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active Crank sensor DTCs not active Engine Coolant DTCs not active Intake Air Temp. DTCs not active Engine Coolant > 69 deg C and < 125 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous The MAP reading and the Manifold Model calculations are performed in the same Lo Res loop	DTC Type B
Manifold Absolute Pressure (MAP) Sensor Circuit Low	P0107	This DTC detects a continuous short to low or open in either the signal circuit or the MAP sensor.	MAP voltage < 1% of Vref (0.05 volts)	TP sensor DTCs not active Engine speed ≤ 400 RPM Or Throttle Position is ≥ 0% when engine speed is ≤ 800 RPM Or Throttle Position is ≥ 12.5 % when engine speed is > 800 RPM No 5v ref. DTCs	320 test failures in 400 test samples 1 sample/12.5 ms	DTC Type B
Manifold Absolute Pressure (MAP) Sensor Circuit High	P0108	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the MAP sensor	MAP voltage > 98.5% of Vref (4.925 volts)	TP sensor DTCs not active Engine Running > run time based on power-up coolant temperature Throttle Position is ≤ 1 % when engine speed is ≤ 1200 RPM Or Throttle Position is ≤ 20 % when engine speed is > 1200 RPM	320 test failures in 400 test samples 1 sample/12.5 ms	DTC Type B
Intake Air Temperature (IAT) Sensor Circuit Low	P0112	This DTC detects a continuous short to ground in the IAT signal circuit or the IAT sensor	Raw IAT < 45 ohms **(> 150°C)**	VS sensor DTCs not active ECT sensor DTCs not active Engine run time > 10 seconds Coolant Temperature < 150°C	50 test failures in 63 test samples 1 sample/100 msec	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 High	P0113	This DTC detects a continuous open or short to high in the IAT signal circuit or the IAT sensor	Raw IAT > 163000 ohms **(< -60°C)**	MAF sensor DTCs not active ECT sensor DTCs not active VS sensor DTCs not active Engine run time > 10 seconds	50 test failures in 63 test samples 1 sample/100 msec	DTC Type B
Engine Coolant Temperature (ECT) Sensor Performance	P0116	Detects coolant temp sensor stuck in mid range	A failure will be reported if any of the following occur: ECT at power up > IAT at power up by an IAT based table lookup value after a minimum 10-hour soak (fast fail). ECT at power up > IAT at power up by 15°C after a minimum 8-hour soak and a block heater has not been detected. ECT at power up > IAT at power up by 15°C after a minimum 10 hour soak and the time spent cranking the engine without starting is greater than 10 seconds with the fuel level being above a minimum level of 5%.	No VSS DTCs No IAT DTCs No ECT sensor shorted 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 > 10 hours Test run this trip = false Test aborted this trip = false Block heater detection: ECT at power up > IAT at power up by 15°C Power up IAT > -7°C Vehicle driven a minimum of 400 seconds above 24 kph and IAT drops more than 8° C from power up IAT.	1 failure 500 ms loop	DTC Type B
Engine Coolant Temperature (ECT) Sensor Circuit Low	P0117	This DTC detects a continuous short to ground in the ECT signal circuit or the ECT sensor.	Raw ECT < 45 ohms **(> 150°C)**	Engine run time > 10 seconds Or IAT ≤ 50° C	5 test failures in 6 test samples 1 sample/sec Continuous	DTC Type B
Engine Coolant Temperature (ECT) Sensor Circuit High	P0118	Circuit Continuity This DTC detects a continuous short to high or open in the ECT signal circuit or the ECT sensor.	Raw ECT > 450000 ohms **(< -40°C)**	Engine run time > 10 seconds Or IAT ≥ 0° C	5 test failures in 6 test samples 1 sample/sec Continuous	DTC Type B
Throttle Position (TP) Sensor 1 Circuit	P0120	Detects a continuous or intermittent short or open in TP sensor #1 circuit	TPS < 0.325 V OR TPS > 4.75 V	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Throttle Position (TP) Sensor 1 Performance	P0121	The DTC determines if a TPS sensor is stuck within the normal operating range	Filtered throttle error > 350 kPa/grams per second	Engine rpm =>400 and <= 8000 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active Crank sensor DTCs not active Engine Coolant DTCs not active Intake Air Temp. DTCs not active Engine Coolant > 69 deg C and < 125 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous Calculations are performed every 12.5 ms	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
Throttle Position (TP) Sensor 1 Circuit Low	P0122	Detects a continuous or intermittent OOR lo TPS1	TPS < 0.325 V (100% throttle = 0.6 V)	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Throttle Position (TP) Sensor 1 Circuit High	P0123	Detects a continuous or intermittent OOR high TPS1	TPS > 4.75 V (0% throttle = 4.38V)	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Engine Coolant Temperature (ECT) Below Thermostat Regulating Temperature	P0128	Under driving conditions, target coolant temperature should be achieved based on amount of cumulative airflow ingested, and based on startup coolant temperature	A table defines maximum cumulative airflow based on startup coolant temperature and IAT at which target coolant temperature must have been reached Power up IAT ≥ 10 deg C ECT Target = 71°C OR Power up IAT < 10 deg C ECT Target = 55°C	• 15 grams /second < Airflow < 45 grams/second • Engine runtime < 1370seconds • Engine runtime > 120 seconds • IAT > -7°C • Vehicle speed > 8 kph for 2.4 kilometers • Startup ECT< 66°C if Power up IAT ≥ 10 deg C • Startup ECT< 50°C if Power up IAT < 10 deg C • No ECT, Throttle, IAT, VSS, MAF or MAP faults	Once per trip Time based on flow	DTC Type B
O2S Circuit Low Voltage Bank 1 Sensor 1	P0131	This DTC determines if the O2 sensor circuit is shorted to low.	O2 sensor voltage < 50 millivolts	<u>Common Enable Criteria</u> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active <u>Specific Enable Criteria</u> • 0.88 ≤ Equivalence ratio ≤ 1.08 • 2.499 % ≤ throttle position ≤ 45.001 % • Fuel state = closed loop with no fault pending • All fuel injectors = ON • Traction Control = not active All of the above met for at least 5 seconds	220 test failures in a 255-sample test <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
O2S Circuit High Voltage Bank 1 Sensor 1	P0132	This DTC determines if the O2 sensor or circuit is shorted to high.	O2 sensor voltage > 1050 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • 0.88 ≤ Equivalence Ratio ≤ 1.08 • 2.499 % ≤ throttle position ≤ 45.001 % • Fuel State = Closed loop with no fault pending All of the above met for at least 2 seconds	170 test failures in a 200 sample test 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	Refer to "O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153) Pass/Fail Thresholds." In Lookup Tables section. Lean voltage threshold = 350 mV Rich voltage threshold = 600 mV	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • O2 Heater on for ≥ 40 seconds • B1S1 green O2 sensor delay has expired • B1S1 DTCs = Not Active • B1S1 learned heater resistance is valid • Misfire DTC = Not Active • ECT > 65 °C • IAT > -40 °C • Engine run time > 60 seconds • EVAP Canister purge duty cycle ≥ 0 % • 17 grams per second ≤ MAF ≤ 37 grams per second • 1250 ≤ RPM ≤ 2550 • Ethanol percentage < 87.199 % • Baro > 69.801 kPa • Throttle position ≥ 3.5 % • Fuel Level > 9.9976 % • Fuel state = closed loop • No fuel level data faults • Transmission (automatic) not in Park, Reverse or Neutral • Transmission gear selection is not defaulted • Baro is not defaulted All of the above met for at least 2.5 seconds	70 seconds 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 circuit is open.	380 millivolts < O2 sensor < 525 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 124 seconds • Ethanol percentage < 87.199 % • No B1S1 heater related DTCs	250 test failures in a 300 test samples Frequency: Continuous 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.	O2 sensor heater current is < 0.25 amps or > 3.125amps	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time ≥ 180 seconds • ECT ≥ 65° C • 500 ≤ Engine Rpm ≤ 3000 • 4.9922 grams per second ≤ Mass Airflow ≤ 30.0078 grams per second • O2 heater not in Device control • B1S1 O2 heater resistance 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 seconds 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 during steady throttle.	O2 sensor voltage < 50 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • 0.88 ≤ Equivalence ratio ≤ 1.08 • 2.499 % ≤ throttle position ≤ 45.001 % • Fuel state = closed loop with no fault pending • All fuel injectors = ON • Traction Control = not active All of the above met for at least 5 seconds	1020 test failures in a 1200-sample test Frequency: Continuous 100 ms loop	DTC Type B
O2S Circuit High Voltage Bank 1 Sensor 2	P0138	This DTC determines if the O2 sensor or circuit is shorted to high	O2 sensor voltage > 1050 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • 0.88 ≤ Equivalence ratio ≤ 1.08 • 2.499 % ≤ throttle position ≤ 45.001 % • Fuel state = closed loop with no fault pending • All fuel injectors = ON • Traction Control = not active All of the above met for at least 2 seconds	820 test failures in a 960 sample test 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 circuit is open.	380 millivolts < O2 sensor < 525 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, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 124 seconds • Ethanol percentage > 87.199% • No B1S2 heater related DTCs • PCM State = run Fast Pass: • Engine run time ≤ 90 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	1080 test failures in a 1200 test samples Minimum of 1 occurrence of a delta TP sensor ≥ 3 % during diagnostic test (sample counts – failure counts) < 180 within 90 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.	O2 sensor heater current is < 0.4258 amps or > 2.875 amps	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time ≥ 180 seconds • ECT ≥ 65° C • 500 ≤ Engine Rpm ≤ 3000 • 4.9922 grams per second ≤ Mass Airflow ≤ 30.0078 grams per second • O2 heater not in Device control • B1S2 O2 heater resistance 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 seconds delay between tests 1 second execution rate	DTC Type B
O2S Circuit Low Voltage Bank 2 Sensor 1	P0151	This DTC determines if the O2 sensor circuit is shorted to low	O2 sensor voltage < 50 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • 0.88 ≤ Equivalence ratio ≤ 1.08 • 2.499 % ≤ throttle position ≤ 45.001 % • Fuel state = closed loop with no fault pending • All fuel injectors = ON • Traction Control = not active All of the above met for at least 5 seconds	220 test failures in a 255-sample test 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 2 Sensor 1	P0152	This DTC determines if the O2 sensor or circuit is shorted to high.	O2 sensor voltage > 1050 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • 0.88 ≤ Equivalence Ratio ≤ 1.08 • 2.499 % ≤ throttle position ≤ 45.001 % • Fuel State = Closed loop with no fault pending All of the above met for at least 3 seconds	170 test failures in a 200 sample test 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 2 Sensor 1	P0153	This DTC determines if the O2 sensor response time is degraded	Refer to "O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153) Pass/Fail Thresholds." In Lookup Tables section. Lean voltage threshold = 350 mV Rich voltage threshold = 600 mV	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • O2 Heater on for ≥ 40 seconds • B2S1 green O2 sensor delay has expired • B2S1 DTCs = Not Active • B2S1 learned heater resistance is valid • Misfire DTC = Not Active • ECT > 65 °C • IAT > -40 °C • Engine run time > 60 seconds • EVAP Canister purge duty cycle ≥ 0 % • 17 grams per second ≤ MAF ≤ 37 grams per second • 1250 ≤ RPM ≤ 2550 • Ethanol percentage < 87.199 % • Baro > 69.801 kPa • Throttle position ≥ 3.5 % • Fuel Level > 9.9976 • Fuel state = closed loop • No fuel level data faults • Transmission (automatic) not in Park, Reverse or Neutral • Transmission gear selection is not defaulted • Baro is not defaulted All of the above met for at least 2.5 seconds	70 seconds 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 2 Sensor 1	P0154	This DTC determines if the O2 sensor circuit is open.	380 millivolts < O2 sensor < 525 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 124 seconds • Ethanol percentage > 87.199 % • No B2S1 heater related DTCs	250 test failures in a 300 test samples Frequency: Continuous for pre catalyst sensors 100 ms loop rate	DTC Type B
O2S Heater Performance Bank 2 Sensor 1	P0155	This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	O2 sensor heater current is < 0.25 amps or > 3.125 amps	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time ≥ 180 seconds • ECT ≥ 65° C • 500 ≤ Engine Rpm ≤ 3000 • 4.9922 grams per second ≤ Mass Airflow ≤ 30.0078 grams per second • O2 heater not in Device control • B2S1 O2 heater resistance 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 seconds 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 2 Sensor 2	P0157	This DTC determines if the O2 sensor circuit is shorted to low by checking for a lean condition during steady throttle.	O2 sensor voltage < 50 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • 0.88 ≤ Equivalence ratio ≤ 1.08 • 2.499 % ≤ throttle position ≤ 45.001 % • Fuel state = closed loop with no fault pending • All fuel injectors = ON • Traction Control = not active All of the above met for at least 5 seconds	1020 test failures in a 1200-sample test Frequency: Continuous 100 ms loop	DTC Type B
O2S Circuit High Voltage Bank 2 Sensor 2	P0158	This DTC determines if the O2 sensor or circuit is shorted to high by checking for a rich condition during steady throttle.	O2 sensor voltage > 1050 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • 0.88 ≤ Equivalence ratio ≤ 1.08 • 2.499 % ≤ throttle position ≤ 45.001 % • Fuel state = closed loop with no fault pending • All fuel injectors = ON • Traction Control = not active All of the above met for at least 2 seconds	820 test failures in a 960-sample test 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 2 Sensor 2	P0160	This DTC determines if the O2 sensor is open.	380 millivolts < O2 sensor < 525 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, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 124 seconds • Ethanol percentage > 87.199% • No B2S2 heater related DTCs • PCM State = run Fast Pass: • Engine run time ≤ 90 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	1080 test failures in 1200 test samples Minimum of 1 occurrence of a delta TP sensor ≥ 3 % during diagnostic test (sample counts – failure counts) < 180 within 90 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
O2S Heater Performance Bank 2 Sensor 2	P0161	This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	O2 sensor heater current is < 0.4258 amps or > 2.875 amps	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time ≥ 180 seconds • ECT ≥ 65° C • 500 ≤ Engine Rpm ≤ 3000 • 4.9922 grams per second ≤ Mass Airflow ≤ 30.0078 grams per second • O2 heater not in Device control • B2S2 O2 heater resistance 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 seconds 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, based on the EWMA of long-term fuel trim (LTM). (Note: EWMA stands for "Exponentially Weighted Moving Average")	The EWMA of long term fuel trim (LTM) samples ≥ 1.23 1.	• No Misfire, pre-cat O2 Sensor, or EVAP DTC's • No Fuel Injector or Composition (Ethanol) DTC's • No IAC, MAF, MAP, ECT, EGR, or A.I.R. DTC's • No TP Sensor or TAC System DTC's • Engine speed > 400 rpm but < 6000 rpm • BARO > 70 kpa • ECT > -38°C but < 150°C • MAP > 5 kpa but < 255 kpa • IAT > -38°C but < 150°C • Mass Airflow > .5 g/s but < 510 g/s • Vehicle speed < 83.2 mph (134 km/h) • Closed Loop and 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. General Notes: 1. At least 32.5 seconds of LTM data must accumulate on each trip, with at least 25.5 seconds of data in the current fuel trim cell before a pass or fail decision can be made.	The EWMA of long term fuel trim (LTM) samples ≥ 1.23 for ≥ 100 ms 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	P0172	Determines if the fuel control system is in a rich condition, based on the EWMA of long-term fuel trim (LTM). (Note: EWMA stands for "Exponentially Weighted Moving Average")	There exists both a Passive and, if needed, Intrusive rich test. Passive: The EWMA of long term purge-off fuel trim (LTM) samples ≤ .755 Intrusive: If a passive decision cannot be made, and the EWMA of long term purge-on fuel trim (LTM) samples ≤ .76, 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 ≤ .755 for at least 10 seconds during each of 3 intrusive segments. Intrusive Notes: 1. Segments can last up to 60 seconds, and are separated by the smaller of a 10 second purge-on time or enough time to purge 10 grams of vapor. 2. A maximum of 5 completed segments or 20 intrusive attempts are allowed for each intrusive test.	• No Misfire, pre-cat O2 Sensor, or EVAP DTC's • No Fuel Injector or Composition (Ethanol) DTC's • No IAC, MAF, MAP, ECT, EGR, or A.I.R. DTC's • No TP Sensor or TAC System DTC's • Engine speed > 400 rpm but < 6000 rpm • BARO > 70 kpa • ECT > -38°C but < 150°C • MAP > 5 kpa but < 255 kpa • IAT > -38°C but < 150°C • Mass Airflow > .5 g/s but < 510 g/s • Vehicle speed < 83.2 mph (134 km/h) • Closed Loop and 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. General Notes: 1. At least 32.5 seconds of LTM data must accumulate on each trip, with at least 25.5 seconds of data in the current fuel trim cell before a pass or fail decision can be made.General Notes:	Passive: The EWMA of long term purge-off fuel trim (LTM) samples ≤ .755 for ≥ 100ms Intrusive: If rich fail counter is ≥ 3 before pass counter ≥ 3, 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, based on the EWMA of long-term fuel trim (LTM). (Note: EWMA stands for "Exponentially Weighted Moving Average")	Intrusive Notes: (continued) 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 > .76 for at least 200 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.	2. In addition to the above, the Intrusive Test requires at least 50 more seconds of LTM data before a pass or fail decision can be made Intrusive Enable Criteria • Insufficient purge-off data prior to purge-on operation (or passive test not used on this application). • The EWMA of long term purge-on fuel trim (LTM) samples ≤ .76 • RPM > 400 • Mass Airflow > .5 g/s but < 510 g/s • MAP > 5 kpa but 255 kpa Temporary Intrusive Test Inhibit Criteria If intrusive test segment exceeds 60 consecutive seconds. (in this case, purge valve is opened for the smaller of 10 seconds or enough time to purge 10 grams vapor)		
Fuel System Too Lean Bank 2	P0174	Determines if the fuel control system is in a lean condition, based on the EWMA of long-term fuel trim (LTM). (Note: EWMA stands for "Exponentially Weighted Moving Average")	The EWMA of long term fuel trim (LTM) samples ≥ 1.23	• No Misfire, pre-cat O2 Sensor, or EVAP DTC's • No Fuel Injector or Composition (Ethanol) DTC's • No IAC, MAF, MAP, ECT, EGR, or A.I.R. DTC's • No TP Sensor or TAC System DTC's • Engine speed > 400 rpm but < 6000 rpm • BARO > 70 kpa • ECT > -38°C but < 150°C • MAP > 5 kpa but < 255 kpa • IAT > -38°C but < 150°C • Mass Airflow > .5 g/s but < 510 g/s • Vehicle speed < 83.2 mph (134 km/h) • Closed Loop and 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. General Notes: 1. At least 32.5 seconds of LTM data must accumulate on each trip, with at least 25.5 seconds of data in the current fuel trim cell before a pass or fail decision can be made.	The EWMA of long term fuel trim (LTM) samples ≥ 1.23 for ≥ 100 ms 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 2	P0175	Determines if the fuel control system is in a rich condition, based on the EWMA of long-term fuel trim (LTM). (Note: EWMA stands for "Exponentially Weighted Moving Average")	There exists both a Passive and, if needed, Intrusive rich test. Passive: The EWMA of long term purge-off fuel trim (LTM) samples ≤ .755 Intrusive: If a passive decision cannot be made, and the EWMA of long term purge-on fuel trim (LTM) samples ≤ .76, 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 ≤ .755 for at least 10 seconds during each of 3 intrusive segments. Intrusive Notes: 1. Segments can last up to 60 seconds, and are separated by the smaller of a 10 second purge-on time or enough time to purge 10 grams of vapor. 2. A maximum of 5 completed segments or 20 intrusive attempts are allowed for each intrusive test.	• No Misfire, pre-cat O2 Sensor, or EVAP DTC's • No Fuel Injector or Composition (Ethanol) DTC's • No IAC, MAF, MAP, ECT, EGR, or A.I.R. DTC's • No TP Sensor or TAC System DTC's • Engine speed > 400 rpm but < 6000 rpm • BARO > 70 kpa • ECT > -38°C but < 150°C • MAP > 5 kpa but < 255 kpa • IAT > -38°C but < 150°C • Mass Airflow > .5 g/s but < 510 g/s • Vehicle speed < 83.2 mph (134 km/h) • Closed Loop and 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. General Notes: 1. At least 32.5 seconds of LTM data must accumulate on each trip, with at least 25.5 seconds of data in the current fuel trim cell before a pass or fail decision can be made.General Notes:	Passive: The EWMA of long term purge-off fuel trim (LTM) samples ≤ .755 for ≥ 100ms Intrusive: If rich fail counter is ≥ 3 before pass counter ≥ 3, 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 2 (continued)	P0175	Determines if the fuel control system is in a rich condition, based on the EWMA of long-term fuel trim (LTM). (Note: EWMA stands for "Exponentially Weighted Moving Average")	Intrusive Notes: (continued) 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 > .76 for at least 200 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.	2. In addition to the above, the Intrusive Test requires at least 50 more seconds of LTM data before a pass or fail decision can be made Intrusive Enable Criteria • Insufficient purge-off data prior to purge-on operation (or passive test not used on this application). • The EWMA of long term purge-on fuel trim (LTM) samples ≤ .76 • RPM > 400 • Mass Airflow > .5 g/s but < 510 g/s • MAP > 5 kpa but 255 kpa Temporary Intrusive Test Inhibit Criteria If intrusive test segment exceeds 60 consecutive seconds. (in this case, purge valve is opened for the smaller of 10 seconds or enough time to purge 10 grams vapor)		
Injector 1 Control Circuit	P0201	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 2 Control Circuit	P0202	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 3 Control Circuit	P0203	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 4 Control Circuit	P0204	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 5 Control Circuit	P0205	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 6 Control Circuit	P0206	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms 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
Throttle Position (TP) Sensor 2 Circuit	P0220	Detects a continuous or intermittent short or open in TP sensor #2 circuit	0.25 V > TPS > 4.59 V	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the motor processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHCprocess79	DTC Type A
Throttle Position (TP) Sensor 2 Circuit Low	P0222	Detects a continuous or intermittent short or open in TP sensor #2 circuit	TPS < 0.25 V (0% throttle = 0.62 V)	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Throttle Position (TP) Sensor 2 Circuit High	P0223	Detects a continuous or intermittent short or open in TP sensor #2 circuit	TPS > 4.59 V (100% throttle = 4.4 V)	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	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 Pump Primary Circuit	P0230	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage $\geq$ 11 volts, and $\leq$ 18 volts	20 failures out of 25 samples 250ms 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
Random 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 or a cylinder specific misfire is occurring by monitoring crankshaft velocity.	Deceleration index Vs Engine speed Vs Load and Camshaft Position Emission Failure Threshold = 1.00% Catalyst Damage Threshold = 5%.	• Engine run time > 2 crankshaft revolutions. • DTCs not active for VSS, CKP, TP, MAP, ECT, IAT, and MAF sensors. • No engine protection faults. • P0315 (Crankshaft Position System Variation Not Learned) not active or engine speed < 1000 RPM. • Fuel cutoff not active. • Power management is not active. • Not an automatic transmission shift with a Throttle position>95% • Brake torque management not active. • Fuel level > 10% (disablement ends 500 seconds after a low fuel level condition ceases, and fuel disable does not occur with a fuel sensor DTC). • -7°C < ECT < 124°C. • If ECT at startup < -7°C, then disable until ECT > 21°C. • 525 RPM < Engine speed <3000RPM in Park/Neutral or 7000 RPM in Drive/Reverse. • 9 volts < System voltage < 18 volts. •) • Positive and zero torque (except the CARB approved 3000 rpm to redline triangle). Positive and zero torque is detected when both is true: 1) engine load > zero torque cal (cal a function of engine speed and temperature), and 2) TPS > 1 or VSS < 48 KPH. • Detectable engine speed and engine load region. • Misfire Diagnostic. is not requesting to disable TCC when transmission is in hot mode. • Crankshaft Ring Filter inactive (after a low level misfire, another misfire may not be detectable until crankshaft ringing ceases)	Emission Exceedence = (5) failed 200 revolution blocks of 16. Failure reported with (1) Exceedence in 1st (16) 200-revolution block, or (4) Exceedences thereafter. 1st Catalyst Exceedence = Number of 200 revolution blocks as data supports for catalyst damage. 2nd and subsequent Catalyst Exceedences = (1) 200 revolution block with catalyst damage. Failure reported with (3) Exceedences in FTP, or (1) Exceedence outside FTP. Frequency: Continuous	DTC Type B (MIL Flashes with Catalyst Damaging Misfire)
Crankshaft Position System Variation Not Learned (CASE)	P0315	Determines if the Crankshaft Position System Variation has not been learned.	Sum of Compensation Factors ≤ 2.997009 or ≥ 3.004303	OBD Manufacturer Enable Counter = 0	Frequency: Continuous 100 ms loop	DTC Type A
Knock Sensor (KS) Module Performance	P0324	This diagnostic will detect a failed internal ECM component associated with knock control	Any Cylinder's Avg. Gain Signal > 5V if RPM > 2000 OR All Cylinder's Actual Signals < 0.00879V if RPM > 1500	Temporarily disabled ('Indeterminate' state reported) for samples in which P0325, P0327, P0328, P0330, P0332, or P0333 report 'Failed' state.	50 fail counts out of 63 sample counts 100ms sample rate 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
Knock Sensor (KS) Circuit Bank 1	P0325	This diagnostic checks for an open to the knock sensor	Gated Low Pass Filter Voltage > 4V or < 1.24 V	Coolant ≥ -40°C and Engine Run Time ≥ 2 seconds PTO not active Temporarily disabled ('Indeterminate' state reported) for samples in which P0327 or P0328 report 'Failed' state.	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Performance Bank 1	P0326	This diagnostic checks for an overactive knock sensor caused by noisy engine components (e.g. lifters)	Fast Retard ≥ 8°	Engine Speed ≥ 550 MAP ≥ 25 kPa No throttle fault No PTO active Fast spark retard active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit Low Bank 1	P0327	This diagnostic checks for an out of range low knock sensor signal	Sensor Input Signal Line > 2.86 V or Sensor Return Signal Line < 1.48 V	Coolant ≥ -40°C and Engine Run Time >≥ 2 seconds PTO not active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit High Bank 1	P0328	This diagnostic checks for an out of range high knock sensor signal	Sensor Input Signal Line < 2.02 V or Sensor Return Signal Line > 3.76 V	Coolant ≥ -40°C and Engine Run Time ≥ 2 seconds PTO not active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit Bank 2	P0330	This diagnostic checks for an open to the knock sensor	Gated Low Pass Filter Voltage > 4V or < 1.24 V	Coolant ≥ -40°C and Engine Run Time ≥ 2 seconds PTO not active. Temporarily disabled ('Indeterminate' state reported) for samples in which P0332 or P0333 report 'Failed' state.	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit Low Bank 2	P0332	This diagnostic checks for an out of range low knock sensor signal	Sensor Input Signal Line > 2.86 V or Sensor Return Signal Line < 1.48 V	Coolant ≥ -40°C and Engine Run Time ≥ 2 seconds PTO not active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit High Bank 2	P0333	This diagnostic checks for an out of range high knock sensor signal	Sensor Input Signal Line < 2.02 V or Sensor Return Signal Line > 3.76 V	Coolant ≥ -40°C and Engine Run Time ≥ 2 seconds PTO not active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Crankshaft Position (CKP) Sensor A Circuit	P0335	This diagnostic determines whether a fault exists with crank position sensor signal	1. No crankshaft position sensor pulses received for 4 seconds 2. No crankshaft position sync 3. No crankshaft position sensor pulses received	1. Engine cranking and either CMP pulses being received or MAF > 3 grams per second 2. Engine is spinning and no 5V reference DTCs set 3. Engine is spinning and no 5V reference or cam position sensor DTCs set	1. Continuous - 12.5 ms 2. Continuous - 12.5 ms 3. Continuous - 12.5 ms 2 test failures out of 10 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
Crankshaft Position (CKP) Sensor A Performance	P0336	This diagnostic determines whether a performance fault exists with crank position sensor signal	1. Twenty crank resyncs occur within 25 seconds 2. 51 > number of crank pulses received in one engine revolution >65	1. Engine speed > 450 RPM 2. Engine is spinning and no 5V reference or cam position sensor DTCs set	1. Continuous – 4 test failures 2. Continuous – 8 test failures out of 10 samples	DTC Type B
Camshaft Position (CMP) Sensor Circuit Bank 1 Sensor A	P0340	This diagnostic will detect if a fault exists on the camshaft position sensor signal.	1. No Cam pulses received during first 12 MEDRES events 2. No Cam pulses received for 100 engine cycles 3. No Cam pulses received 4. No Cam pulses received	1. Crank is synchronized and no 5V ref DTCs set 2. Crank is synchronized and no 5V ref DTCs set 3. Engine is cranking and either crank pulses are received or MAF > 3 grams per second 4. Engine is spinning and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 4 seconds 4. Continuous – 1.5 seconds	DTC Type B
Camshaft Position (CMP) Sensor Performance Bank 1 Sensor A	P0341	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	1. 6 > number of cam pulses received in 12 MEDRES events > 6 (automatic trans) or 8 (manual trans) 2. 398 > number of cam pulses received in 100 engine cycles > 402	1. Crank is synchronized and no 5V ref DTCs set 2. Crank is synchronized and no 5V ref DTCs set Footnote: MEDRES events typically occur twice per cylinder event.	1. Continuous 2. Continuous – 8 test failures out of 10 samples	DTC Type B
Camshaft Position (CMP) Sensor Circuit Bank 2 Sensor A	P0345	This diagnostic will detect if a fault exists on the camshaft position sensor signal.	1. No Cam pulses received during first 12 MEDRES events 2. No Cam pulses received for 100 engine cycles 3. No Cam pulses received 4. No Cam pulses received	1. Crank is synchronized and no 5V ref DTCs set 2. Crank is synchronized and no 5V ref DTCs set 3. Engine is cranking and either crank pulses are received or MAF > 3 grams per second 4. Engine is spinning and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 4 seconds 4. Continuous – 1.5 seconds	DTC Type B
Camshaft Position (CMP) Sensor Performance Bank 2 Sensor A	P0346	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	1. 4 > number of cam pulses received in 12 MEDRES events > 6 2. 398> number of cam pulses received in 100 engine cycles > 402	1. Crank is synchronized and no 5V ref DTCs set 2. Crank is synchronized and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples	DTC Type B
Ignition Coil 1 Control Circuit	P0351	This DTC checks the circuit for electrical integrity during operation. EST channel A (Cylinder 1 and 4)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage > 6.0 volts	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Ignition Coil 2 Control Circuit	P0352	This DTC checks the circuit for electrical integrity during operation. EST channel B (Cylinder 2 and 5)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage > 6.0 volts	50 fail counts out of 63 sample counts 100ms sample rate Continuous ms / sample	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
Ignition Coil 3 Control Circuit	P0353	This DTC checks the circuit for electrical integrity during operation. EST channel C (Cylinder 3 and 6)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage > 6.0 volts	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Ignition Coil 4 Control Circuit	P0354	This DTC checks the circuit for electrical integrity during operation. (Cylinder 4)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage > 6.0 volts	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Ignition Coil 5 Control Circuit	P0355	This DTC checks the circuit for electrical integrity during operation. (Cylinder 5)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage > 6.0 volts	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Ignition Coil 6 Control Circuit	P0356	This DTC checks the circuit for electrical integrity during operation. (Cylinder 6)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage > 6.0 volts	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Camshaft Position (CMP) Sensor Circuit Bank 1 Sensor B	P0365	This diagnostic will detect if a fault exists on the camshaft position sensor signal.	1. No Cam pulses received during first 12 MEDRES events 2. No Cam pulses received for 100 engine cycles 3. No Cam pulses received 4. No Cam pulses received	1. Crank is synchronized and no 5V ref DTCs set 2. Crank is synchronized and no 5V ref DTCs set 3. Engine is cranking and either crank pulses are received or MAF > 3 grams per second 4. Engine is spinning and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 4 seconds 4. Continuous – 1.5 seconds	DTC Type B
Camshaft Position (CMP) Sensor Performance Bank 1 Sensor B	P0366	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	1. 4 > number of cam pulses received in 24 MEDRES events > 6 2. 398> number of cam pulses received in 100 engine cycles > 402	1. Crank is synchronized and no 5V ref DTCs set 2. Crank is synchronized and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples	DTC Type B
Camshaft Position (CMP) Sensor Circuit Bank 2 Sensor B	P0390	This diagnostic will detect if a fault exists on the camshaft position sensor signal.	1 No Cam pulses received during first 12 MEDRES events 2 No Cam pulses received for 100 engine cycles 3. No Cam pulses received 4. No Cam pulses received	1. Crank is synchronized and no 5V ref DTCs set 2. Crank is synchronized and no 5V ref DTCs set 3. Engine is cranking and either crank pulses are received or MAF > 3 grams per second 4. Engine is spinning and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 4 seconds 4. Continuous – 1.5 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
Camshaft Position (CMP) Sensor Performance Bank 2 Sensor B	P0391	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	1. 4 > number of cam pulses received in 12 MEDRES events > 6 2. 398> number of cam pulses received in 100 engine cycles > 402	1 Crank is synchronized and no 5V ref DTCs set 4. Crank is synchronized and no 5V ref DTCs set	1 Continuous 2. Continuous – 8 test failures out of 10 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
Catalyst System Low Efficiency Bank 1	P0420	Oxygen Storage	Normalized Ratio OSC Value < 0.35 (EWMA filtered) Normalized Ratio OSC Value Calculation Information and Definitions = 1. Raw OSC Calculation = (post cat O2 Resp time - pre cat O2 Resp time) 2. BestFailing OSC value from a calibration table (based on temp and exhaust gas flow) 3. WorstPassing OSC value (based on temp and exhaust gas flow) Normalized Ratio Calculation = (1-2) / (3-2) A Normalized Ratio of 1 essentially represents a good part and a ratio of 0 essentially represents a very bad part.	*General Enable* • No EVAP, PTO not active, 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* • Throttle Position < 2% • Vehicle Speed <= 2.0kph • Engine speed >= 900 RPM for a minimum of 15 seconds since end of last idle period. • Engine run time >= 0 seconds. • Tests attempted this trip < 18.00 The catalyst diagnostic has not yet completed for the current trip. *Catalyst Idle Conditions Met Criteria* General Enable met and the Valid Idle Period Criteria met • Green Converter Delay = Not Active • Induction Air> -20° C • Induction Air < 250° C • FASD and/ or POS Diagnostic Intrusive Test and/or AIR Diagnostic Intrusive Test not Active • RunCrank Voltage > 11 volts • Ethanol Estimation Is NOT in Progress • ECT >= 40° C • ECT <= 127 ° C • Barometric Pressure > 70 KPA • Idle Time is <= 60 seconds ⇒ Idle time is incremented if the vehicle speed <= vehicle speed cal 2.0 kph and the throttle position <= TPS cal 2% as identified in the Valid Idle Period Criteria section. • Short Term Fuel Trim < 1.10 • Short Term Fuel Trim > 0.90 • Predicted catalyst temp ≥ 570°C AND engine airflow > 18 g/s for at least 30 seconds with a closed throttle time ≤ 90 consecutively (closed throttle consideration involves having the TPS < the value as stated in the Valid Idle Period Criteria Section) • Closed loop fueling • 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: • Fueling Related : 12.5 ms • OSC Measurements: 100 ms • Temp Prediction: 1000ms Rapid Step Response (RSR) feature will initiate multiple tests: • If the difference between current EWMA value and the current OSC Normalized Ratio value is >= 0.57 • The current OSC Normalized Ratio value is <= 0.1 Maximum of 6 tests per trip. Maximum of 24 tests to detect failure when RSR is enabled. *Green Converter Delay Criteria* This is part of the check for the Catalyst Idle Conditions Met Criteria section • The diagnostic will not be enabled until the following has been met: Predicted catalyst temperature >= 550° C for 3600 seconds non-continuously. • 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
				Idle Stable Criteria :: Must hold true from after Catalyst Idle Conditions Met to the end of test • MAF >= 3 grams per second • MAF <=15 grams per second *Predicted catalyst temperature* • <= 900 degC *Engine Fueling Criteria at Beginning of Idle Period* The following fueling related must also be met from between 4 and 7 seconds after the Catalyst Idle Conditions Met Criteria has been met for at least 4 seconds prior to allowing intrusive control • Number of pre-O2 switches >= 2 • Short Term Fuel Trim Avg >= 0.96 • Short Term Fuel Trim Avg <= 1.04		

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 2	P0430	Oxygen Storage	Normalized Ratio OSC Value < 0.35 (EWMA filtered) Normalized Ratio OSC Value Calculation Information and Definitions = 1. Raw OSC Calculation = (post cat O2 Resp time - pre cat O2 Resp time) 2. BestFailing OSC value from a calibration table (based on temp and exhaust gas flow) 3. WorstPassing OSC value (based on temp and exhaust gas flow) Normalized Ratio Calculation = (1-2) / (3-2) A Normalized Ratio of 1 essentially represents a good part and a ratio of 0 essentially represents a very bad part.	*General Enable* • No EVAP, PTO not active, 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* • Throttle Position < 2% • Vehicle Speed <= 2.0kph • Engine speed >= 900 RPM for a minimum of 15 seconds since end of last idle period. • Engine run time >= 0 seconds. • Tests attempted this trip < 18.00 The catalyst diagnostic has not yet completed for the current trip. *Catalyst Idle Conditions Met Criteria* General Enable met and the Valid Idle Period Criteria met • Green Converter Delay = Not Active • Induction Air> -20° C • Induction Air < 250° C • FASD and/ or POS Diagnostic Intrusive Test and/or AIR Diagnostic Intrusive Test not Active • RunCrank Voltage > 11 volts • Ethanol Estimation Is NOT in Progress • ECT >= 40° C • ECT <= 127 ° C • Barometric Pressure > 70 KPA • Idle Time is <= 60 seconds ⇒ Idle time is incremented if the vehicle speed <= vehicle speed cal 2.0 kph and the throttle position <= TPS cal 2% as identified in the Valid Idle Period Criteria section. • Short Term Fuel Trim < 1.10 • Short Term Fuel Trim > 0.90 • Predicted catalyst temp ≥ 570°C AND engine airflow > 18 g/s for at least 30 seconds with a closed throttle time ≤ 90 consecutively (closed throttle consideration involves having the TPS < the value as stated in the Valid Idle Period Criteria Section) • Closed loop fueling • 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: • Fueling Related : 12.5 ms • OSC Measurements: 100 ms • Temp Prediction: 1000ms Rapid Step Response (RSR) feature will initiate multiple tests: • If the difference between current EWMA value and the current OSC Normalized Ratio value is >= 0.58 • The current OSC Normalized Ratio value is <= 0.1 Maximum of 6 tests per trip. Maximum of 24 tests to detect failure when RSR is enabled. *Green Converter Delay Criteria* This is part of the check for the Catalyst Idle Conditions Met Criteria section • The diagnostic will not be enabled until the following has been met: Predicted catalyst temperature >= 550° C for 3600 seconds non-continuously. • Note: this feature is only enabled when the vehicle is new and cannot be enabled in service	DTC Type A
				seconds prior to allowing intrusive control • Number of pre-O2 switches >= 2 • Short Term Fuel Trim Avg >= 0.96 • Short Term Fuel Trim Avg <= 1.04		

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	P0442	This DTC will detect a small leak (≥ 0.020") in the EVAP system between the fuel fill cap and the purge solenoid. The engine off natural vacuum method (EONV) is used.	***SMALL LEAK TEST FAIL:*** Engine Off Natural Vacuum (EONV) while the engine is off. The total pressure change achieved during the test is normalized against a target value that is based upon fuel level and ambient temperature. (values range from 249 to 747 Pa). 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 = 0.62 Re-Pass threshold = 0.35	***TEST ENABLE :*** No MAP Sensor DTC's No MAF Sensor DTC's No Thermostat Rationality DTC's VSS DTC's not active No Fuel Tank Pressure Sensor circuit DTC's No Fuel Tank Pressure Sensor Performance DTC's No EVAP Canister Purge Valve Solenoid circuit DTC's No EVAP Canister Vent Solenoid circuit DTC's No Fuel Level Sensor DTC's ECT Sensor DTC's not active IAT Sensor DTC's not active EVAP Canister Purge Valve stuck open DTC not active. EVAP large leak DTC not active. Ignition off timer DTC not active. EVAP Canister Vent restriction DTC is not active 10% ≤ Fuel Level ≤ 90% Drive time ≥ 600 seconds. **Drive length ≥ 8.3 kilometers.** ECT ≥ 70°C. No fuel filling (fuel level increment ≥ 10%) During EONV test. BARO ≥ 74.0kPa Estimated ambient temperature at end of drive ≥ 0°C but ≤ 34°C. Odometer ≥ 16.1 kilometers Note: Conditions for Estimate of Ambient Air Temperature to be valid 1. Cold Start Startup Δ°C(ECT-IAT) ≤ 8°C if ECT > IAT OR 2. 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 trip, 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 is 8 under normal conditions Run length is 2 to 6 trips after code clear or non-volatile reset
Evaporative Emission (EVAP) Canister Purge Solenoid Valve Circuit (ODM)	P0443	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	RunCrankIgnInRange (11 volts ≤ Ignition ≤ 18 volts	20 failures out of 25 samples 250 msec /sample Continuous with solenoid operation	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) 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 Pa for 5 seconds BEFORE Purge Volume ≥ 6 liters OR Vented Vacuum < -622.7 Pa or **Vented Vacuum > 1245 Pa 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.	General Test Enable: No MAP Sensor DTC's No TP Sensor DTC's No VSS DTC's No IAT DTC's No ECT DTC's No Fuel Tank Pressure Sensor circuit DTC's No EVAP Canister Purge Valve solenoid circuit DTC's No EVAP Canister Vent Solenoid circuit DTC's No Thermostat Rationality DTC's 10 % ≤ Fuel Level ≤ 90. % 11 V ≤ System Voltage ≤ 18 V 4 °C ≤Startup IAT ≤ 30°C Startup 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 (ODM)	P0449	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	RunCrankIgnInRange (11 volts ≤ Ignition ≤ 18 volts)	20 failures out of 25 samples 250 msec / sample Continuous with solenoid operation	DTC Type B
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 = 0.73 Re-Pass threshold = 0.40	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 EWMA average run length: 6

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 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 < 3% of Vref (0.15 volts **or ~ 1681 Pa**) produces a failing sample. Otherwise, the sample is considered passing. The normal operating range of the fuel tank pressure sensor is 0.5 volts (~1245 Pa) to 4.5 volts (~ -3736 Pa).	• 0.10 second delay after sensor power up for sensor warm-up • ECM State <> crank	80 failures out of 100 samples 100ms / sample Continuous	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 > 97% of Vref (4.85 volts **or ~ -4172 Pa**) produces a failing sample. Otherwise, the sample is considered passing. The normal operating range of the fuel tank pressure sensor is 0.5 volts (~1245 Pa) to 4.5 volts (~ -3736 Pa).	• 0.10 second delay after sensor power up for sensor warm-up • ECM state <> crank	80 failures out of 100 samples 100ms / sample Continuous	DTC Type B
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 > 112 Pa and < 249 Pa 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.	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	This test is executed during an engine-off natural vacuum small leak test. The test can only execute up to once per engine-off period. The length of the test is determined by the refueling rationality test, which can take up to 600 seconds to complete. The test will report a failure if 2 out of 3 samples are failures.	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
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 > 20 liters BEFORE Tank vacuum ≤ 2740 Pa 2 liters of fuel must be consumed after setting the DTC active the first time to set the DTC active the second time. Weak Vacuum Follow-up Test (fuel cap replacement test) Weak Vacuum Test failed. Passes if tank vacuum ≥ 2740 Pa. Note: Weak Vacuum Follow-up Test can only report a pass.	General Test Enable No MAP Sensor DTC's No TP Sensor DTC's No VSS DTC's No IAT DTC's No ECT DTC's No Fuel Tank Pressure circuit Sensor DTC's No Fuel Tank Pressure Intermittant DTC's No Evap Canister Purge Valve solenoid circuit DTC's No EVAP Canister Vent Solenoid circuit DTC's No Thermostat Rationality DTC's 10 % ≤ Fuel Level ≤ 90. % 11 V ≤ System Voltage ≤ 18 V BARO ≥ 74.00 kPa (8000 ft) Cold Start Test Startup temperature Δ(ECT-IAT): ≤ 8 °C if ECT > IAT Cold Test Timer ≤ 1000 seconds 4 °C ≤ Startup IAT ≤ 30°C Startup ECT ≤ 35 °C Weak Vacuum Follow-up Test This test can run following a weak vacuum failure or on a hot restart.	Once per cold start Time is dependent on driving conditions Max. before test abort is 1000 seconds Weak Vacuum Follow-up Test With large leak detected, the follow-up test is limited to 1300 seconds. Once the MIL is on, the follow-up test runs indefinitely.	DTC Type B
Fuel Level Sensor 1 Performance	P0461	This DTC will detect a fuel sender stuck in range in the primary fuel tank.	IF Delta Fuel Volume change less than 10 liters over an accumulated 270 Kilometers.	No VSS DTC's set Engine Running	250 ms / sample Continuous	DTC Type B
Fuel Level Sensor 1 Circuit Low Voltage	P0462	This DTC will detect a fuel sender stuck out of range low in the primary fuel tank.	Fuel level Sender % of 5V range < 10 %	RunCrankIgnInRange (11 volts ≤ Ignition ≤ 18 volts)	240 failures out of 300 samples 100ms / sample Continuous	DTC Type B
Fuel Level Sensor 1 Circuit High Voltage	P0463	This DTC will detect a fuel sender stuck out of range high in the primary fuel tank.	Fuel level Sender % of 5V range > 60%	RunCrankIgnInRange (11 volts ≤ Ignition Voltage ≤ 18 volts)	240 failures out of 300 samples 100ms / sample 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
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% fuel level during the engine-off test. A refueling event is confirmed if the fuel level has a persistent change of 10 % 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 up to once per engine-off period. The length of the test is determined by the refueling rationality test, which can take up to 600 seconds to complete. The test will report a failure if 2 out of 3 samples are failures.	DTC Type A
Cooling Fan 1 Relay Control Circuit (ODM)	P0480	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match	RunCrankIgnInRange (11 volts ≤ Ignition ≤ 18 volts Engine speed ≥ 425 rpm	20 failures out of 25 samples 250ms / sample Continuous with fan operation	DTC Type B
Cooling Fan 2 Relay Control Circuit (ODM)	P0481	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match	RunCrankIgnInRange (11 volts ≤ Ignition ≤ 18 volts Engine speed ≥ 425 rpm	20 failures out of 25 samples 250ms / sample Continuous with fan operation	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 > 2491 Pa for 5.00 sec BEFORE Test time > 60 seconds (cold start)	<u>General Test Enable:</u> No MAP Sensor DTC's No TP Sensor DTC's No VSS DTC's No IAT DTC's No ECT DTC's No Fuel Tank Pressure Sensor circuit DTC's No EVAP Canister Purge Valve solenoid circuit DTC's No EVAP Canister Vent Solenoid circuit DTC's No Thermostat Rationality DTC's 10 % ≤ Fuel Level ≤ 90 % 11 V ≤ System Voltage ≤ 18 V 4 °C ≤ Startup IAT ≤ 30°C Startup 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	Determines if a low idle is a result of an engine mechanical problem	Filtered Engine Speed Error > Fault threshold where the fault threshold = 95 Filter coefficient for engine speed error = .00375	No MAF, MAP, Baro, IAT, ECT, TP, Injector, Fuel System, Misfire, EST (spark), ETC, VSS, EGR or Purge DTC's TCM Communication Fault not active Engine Run > 60 sec. ECT > 60 C BARO > 70 kPa IGN. voltage > 11 volts but < 18 volts IAT > -20 C Time since a gear state change > 3 seconds Time since a TCC mode change is > 3 seconds Idle control logic indicates that the engine is in an idle condition Idle conditions present for > 5 seconds to enable diagnostic test Vehicle Speed < 2 Kph Engine overtemperature light not on Clutch pedal must be at the top or the bottom of travel to enable the diagnostic test. PTO (power take-off) must not be active. Off-vehicle device control (service bay control) must not be active.	3 consecutive failures with off-idle conditions in between Continuous 12.5 ms loop	DTC Type B
Idle Air Control (IAC) System - RPM Too High	P0507	This DTC will be stored if Actual RPM is greater than Desired RPM by 200 RPM for 10 sec.	Filtered Engine Speed Error < Fault threshold where the fault threshold = 190	No MAF, MAP, Baro, IAT, ECT, TP, Injector, Fuel System, Misfire, EST (spark), ETC, VSS, EGR or Purge DTC's TCM Communication Fault not active Engine Run > 60 sec. ECT > 60 C BARO > 70 kPa IGN. voltage > 11 volts but < 18 volts IAT > -20 C Time since a gear state change > 3 seconds Time since a TCC mode change is > 3 seconds Idle control logic indicates that the engine is in an idle condition Idle conditions present for > 5 seconds to enable diagnostic test Vehicle Speed < 2 Kph Engine overtemperature light not on Clutch pedal must be at the top or the bottom of travel to enable the diagnostic test. PTO (power take-off) must not be active. Off-vehicle device control (service bay control) must not be active	1 test failure Continuous 12.5 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
Control Module Read Only Memory (ROM)	P0601	This DTC will be stored if the calibration check sum is incorrect	Calculated checksum does not match stored checksum	• PCM state = crank or run • Ignition voltage ≥ 5 volts	1 failure if it occurs during the first ROM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background	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.	Service calibration installed	• Ignition on • PCM is identified through calibration as a Service PCM	1 test failure Tested once on controller power-up	DTC Type A
Control Module Long Term Memory Reset	P0603	Non-volatile memory checksum error at controller power-up	Checksum at power-up does not match checksum at power-down	Ignition on	1 test failure Tested once on controller power-up	DTC Type A
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	1 failure if it occurs during the first RAM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background	DTC Type A
Control Module Processor	P0606	Indicates that the ECM has detected an ETC internal processor integrity fault	MHC processor detects throttle limiting fault Software tasks loops > schedule tasks loop Loss of SPI communication from the motor processor 1.5 msec < Average motor processor state of health toggle > 2.5 msec TPS or APPS minimum learned values fail compliment check TPS or APPS minimum learned values fail range check Motor processor integrity check error occurs Motor processor integrity check error of main processor occurs	Ignition in unlock/accessory, run or crank System voltage>5.23 V	187.5 ms in the MHC processor Error > 5 times of loop time; loop time are 12.5, 25,50,100 and 250 ms in the main processor 159 fails out of 400 counts non-consecutive or 15 counts consecutive; 39 counts consecutive during initialization. 475 ms at initialization 20 fails out of 200 counts non-consecutive or 175 ms consecutive in MHC processor 187.5ms continuous in the main processor	DTC Type A
Control Module Performance	P0607	Main & MHC state of health (SOH) discrete line is not toggling	Loss of discrete toggle for 500ms continuously	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	487.5 ms	DTC Special Type C (engine is shut down with P0606 also set)

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 Accelerator Pedal Position Performance	P060D	Verify that the indicated accelerator pedal position calculation is correct	Difference between Main processor indicated accelerator pedal position and MHC processor indicated accelerator pedal position > 2.5%	Ignitions in unlock/ accessory and run, not during TPS minimum learn active during intrusive portion of diagnostic execution System voltage > 5.23 V No PCM processor DTC Ignition in unlock, accessory, run or crank System voltage > 5.23 V No PCM processor DTC	39 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Control Module EEPROM Error	P062F	Indicates that there is an EEPROM error	EEPROM write will not complete	Ignition on.	1 test failure Tested once on controller power-up	DTC Type A
5 Volt Reference 1 Circuit	P0641	Detects a continuous or intermittent short on the #1 5 V sensor reference circuit	Vref1 < 4.75 or > 5.00 v	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No ECM processor DTCs	19/39 counts or 200 msec continuous; 12.5 msec/count in main /MHC processor	DTC Type A
Malfunction Indicator Lamp (MIL) Control Circuit	P0650	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage ≥ 11 volts, and ≤ 18 volts Remote start is not active	20 failures out of 25 samples 250ms loop continuous	DTC Type B No MIL
5 Volt Reference 2 Circuit	P0651	Detects a continuous or intermittent short on the #2 5 V sensor reference circuit	Vref2 < 4.75 or > 5.00 v	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No ECM processor DTCs	19/39counts or 200 msec continuous; 12.5 msec/count in main/MHC processor	DTC Type A
Intake Manifold Tuning Valve Solenoid Control Circuit Bank 1	P0660	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine speed > 425 rpm. Ignition voltage > 9 volts, and < 18 volts	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Control Module Power Relay Control Circuit	P0685	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage ≥ 11 volts, and ≤ 18 volts	8 failures out of 10 samples 250ms loop continuous	DTC Type B
Transmission Control Module (TCM) Requested MIL Illumination	P0700	Monitors the TCM MIL request line to determine when the TCM has detected a MIL illuminating fault.	Transmission Emissions-Related DTC set	Ignition in run or crank Time since power-up > 3 seconds	Continuous	DTC Type A No MIL
Park/Neutral Position Switch Circuit High Voltage	P0851	Check for P/N switch closed malfunction (in Park/Neutral when indicating Drive)	TPS > 10% Torque ≥ 75 Nm VSS ≥ 10 kph P/N switch is closed	Ignition voltage ≥9 and ≤ 18V Transmission Gear Selector Serial Data Message valid No Transmission Serial Data DTC(s) No Vehicle speed DTC(s) No Engine Torque DTC(s) No TP DTC(s) Engine Speed ≥ 400RPM	254 failures out of 255 samples Continuous Monitor 12.5 msec / sample	DTC Special Type C (defaults to D/R indication)

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
Park/Neutral Position Switch Circuit Low Voltage	P0852	Check for P/N switch open malfunction (in Drive when indicating P/N)	Gear selector in Park or Neutral AND P/N switch is open	Ignition voltage ≥ 9 and ≤ 18 V No Transmission Serial Data DTC(s) Transmission Gear Selector Serial Data Message received and valid Engine Speed ≤ 8192 RPM	254 failures out of 255 samples Continuous Monitor 12.5 msec/ sample	DTC Special Type C (defaults to D/R indication)
Traction Control Torque Request Circuit	P0856	Determines if torque request from the EBTCM (Electronic Brake Traction Control Module) is valid	Serial communication 2's complement not equal OR Serial communication rolling count value is not one greater than the previous	• No serial communication loss to TCM • Engine Running = TRUE • Power Mode = Run • Traction Control System present	2's complement errors ≥ 10 Rolling count errors ≥ 6 in 10 samples Frequency: 25 ms loop continuous	DTC Special Type C (defaults to ignore EBTCM torque requests)
Intake Air Flow System Performance	P1101	This DTC determines if there are multiple air induction problems affecting airflow and/or manifold pressure.	Filtered Throttle Error > 350 kPa/grams per second And Filtered Manifold2 Error > 20 kPa And Filtered Pressure1 Error > 20 kPa OR Filtered Airflow Error > 16 grams per second	Engine rpm =>400 and <= 8000 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active Crank sensor DTCs not active Engine Coolant DTCs not active Intake Air Temp. DTCs not active Engine Coolant > 69 deg C and < 125 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous Evaluated every 12.5 ms	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 Insufficient Switching Bank 1 Sensor 1	P1133	This DTC determines if the O2 sensor is no longer sufficiently switching.	Refer to "O2S Insufficient Switching Bank 1 Sensor 1 (P1133), O2S Insufficient Switching Bank 2 Sensor 1 (P1153) Pass/Fail Thresholds." In Lookup Tables section. OR Slope Time L/R switches < 3 OR Slope Time R/L switches < 3	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector and AIR Device controls = Not Active Specific Enable Criteria • O2 Heater on for ≥ 40 seconds • B1S1 green O2 sensor delay has expired • B1S1 DTCs = Not Active • B1S1 learned heater resistance is valid • Misfire DTC = Not Active • ECT > 65 °C • IAT > -40 °C • Engine run time > 60 seconds • EVAP Canister purge duty cycle ≥ 0 % • 17 grams per second ≤ MAF ≤ 37 grams per second • 1250 ≤ RPM ≤ 2550 • Ethanol percentage < 87.199 % • Baro > 69.801 kPa • Throttle position ≥ 3.5 % • Fuel Level > 9.9976 % • Fuel state = closed loop • No fuel level data faults • Transmission (automatic) not in Park, Reverse or Neutral • Transmission gear selection is not defaulted • Baro is not defaulted All of the above met for at least 2.5 seconds.	70 seconds 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 Insufficient Switching Bank 2 Sensor 1	P1153	This DTC determines if the O2 sensor is no longer sufficiently switching.	Refer to "O2S Insufficient Switching Bank 1 Sensor 1 (P1133), O2S Insufficient Switching Bank 2 Sensor 1 (P1153) Pass/Fail Thresholds." In Lookup Tables section. OR Slope Time L/R switches < 3 OR Slope Time R/L switches < 3	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • O2 Heater on for ≥ 40 seconds • B2S1 green O2 sensor delay has expired • B2S1 DTCs = Not Active • B2S1 learned heater resistance is valid • Misfire DTC = Not Active • ECT > 65 °C • IAT > -40 °C • Engine run time > 60 seconds • EVAP Canister purge duty cycle ≥ 0 % • 17 grams per second ≤ MAF ≤ 37 grams per second • 1250 ≤ RPM ≤ 2550 • Ethanol percentage < 87.199 % • Baro > 69.801 kPa • Throttle position ≥ 3.5 % • Fuel Level > 9.9976 % • Fuel state = closed loop • No fuel level data faults • Transmission (automatic) not in Park, Reverse or Neutral • Transmission gear selection is not defaulted • Baro is not defaulted All of the above met for at least 2.5 seconds.	70 seconds 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
Air Fuel Imbalance Bank 1	P1174	Determines if the air-fuel delivery system is imbalanced by monitoring the pre-catalyst O2 sensor voltage characteristics	The Bank 1 AFIM Filtered Length Ratio (EWMA) variable exceeds a value of 0.173. Notes: 1. The AFIM Filtered Length Ratio is determined by calculating the difference between the measured O2 voltage length (accumulated O2 voltage over a 2.5 second period) and an emissions-correlated threshold value, divided by the threshold value, and finally multiplied by a Quality Factor (the latter ranges between 0 and 1, based on robustness to false diagnosis in the current operating region). The resulting ratio is then filtered utilizing an Exponentially Weighted Moving Average (EWMA). 2. The first report is delayed for 25 seconds to allow time for the AFIM Filtered Length Ratio variable to saturate. This minimizes the possibility of reporting a pass before a potential failure could be detected.	• No Misfire, Fuel Injector, A.I.R., or EVAP DTC's • No ECT, MAF, MAP, or pre-cat O2 Sensor DTC's • No Fuel Composition (Ethanol) DTC's • Device Control = Not Active • Intrusive Diagnostics = Not Active • Engine OverSpeed Protection = Not Active • Reduced Power Mode (ETC DTC) = Not Active • PTO = Not Active • Traction Control = Not Active • Fuel Control in A/F Closed Loop or Learn-Enabled • System Voltage < 10 V or > 18 V for > 4 seconds • Engine Run Time ≥ 25 seconds • ECT > -40 °C • Engine speed ≥ 1100 rpm but ≤ 6000 rpm • Mass Airflow ≥ 13 g/s but ≤ 510 g/s • PerCent Ethanol ≤ 85 % • Delta O2 voltage during previous 12.5ms ≥ 20/-20 Quality Factor ≠ 0 in the current operating region	EWMA variable is updated after every 2.5 seconds of valid data. Frequency: Continuous Monitoring of O2 voltage signal in 12.5ms 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
Air Fuel Imbalance Bank 2	P1175	Determines if the air-fuel delivery system is imbalanced by monitoring the pre-catalyst O2 sensor voltage characteristics	The Bank 2 AFIM Filtered Length Ratio (EWMA) variable exceeds a value of 0.140. Notes: 1. The AFIM Filtered Length Ratio is determined by calculating the difference between the measured O2 voltage length (accumulated O2 voltage over a 2.5 second period) and an emissions-correlated threshold value, divided by the threshold value, and finally multiplied by a Quality Factor (the latter ranges between 0 and 1, based on robustness to false diagnosis in the current operating region). The resulting ratio is then filtered utilizing an Exponentially Weighted Moving Average (EWMA). 2. The first report is delayed for 25 seconds to allow time for the AFIM Filtered Length Ratio variable to saturate. This minimizes the possibility of reporting a pass before a potential failure could be detected.	• No Misfire, Fuel Injector, A.I.R., or EVAP DTC's • No ECT, MAF, MAP, or pre-cat O2 Sensor DTC's • No Fuel Composition (Ethanol) DTC's • Device Control = Not Active • Intrusive Diagnostics = Not Active • Engine OverSpeed Protection = Not Active • Reduced Power Mode (ETC DTC) = Not Active • PTO = Not Active • Traction Control = Not Active • Fuel Control in A/F Closed Loop or Learn-Enabled • System Voltage < 10 V or > 18 V for > 4 seconds • Engine Run Time ≥ 25 seconds • ECT > -40 °C • Engine speed ≥ 1100 rpm but ≤ 6000 rpm • Mass Airflow ≥ 13 g/s but ≤ 510 g/s • PerCent Ethanol ≤ 85 % • Delta O2 voltage during previous 12.5ms ≥ 20/-20 Quality Factor ≠ 0 in the current operating region	EWMA variable is updated after every 2.5 seconds of valid data. Frequency: Continuous Monitoring of O2 voltage signal in 12.5ms loop	DTC Type B
Engine Coolant Over Temperature - Protection Mode Active	P1258	Monitor for engine protection mode active.	Coolant temperature >= 129°C for more than 5 seconds.	No coolant sensor DTCs.	Set immediately upon engine protection mode active.	DTC Type A
Cold Start Emissions Reduction System Fault	P1400	Model based test computes power from exhaust flow and thermal energy resulting from elevated idle speed and retarded spark advance. Detects if the cold start emission reduction system has failed resulting in the delivered power being out of range.	(Average desired accumulated exhaust energy - Average estimated accumulated exhaust energy) < -2 kJ/s OR (Average desired accumulated exhaust energy - Average estimated accumulated exhaust energy) > 2.9 kJ/s	• Cold start emission reduction strategy is active. • Vehicle speed < 2 kph. • Throttle position < 0.1%. • 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, ETC, VS sensor, 5 volt reference, Intake Flow Rationality, ECM Memory	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	Detect a throttle positioning error. Determine if the actuator has been miswired.	|Throttle error| >= 2% for more than 500 ms after > 4 sec stability OR |Throttle error| > 10%	• Ignition in run or crank • RPM>0 or (RPM=0 and not in battery saver mode and system voltage > 11.0 volts) • No airflow actuation or throttle actuation DTCs • Engine running = true or system voltage > 6.5 V • Minimum TPS learn active state = false	487.5 ms in the MHC processor	DTC Type A
Ignition 1 Switch Circuit 2	P1682	Detect a continuous or intermittent OOC in the Run/Crank Ignition Voltage & ETC Run/Crank Ignition Voltage	|Run/Crank – ETC Run/Crank| > 3 V	• Ignition in unlock/accessory, run or crank • System voltage >5.23 V • Powertrain Relay Commanded on.	15 counts, 12.5msec loop time, in main processor	DTC Type B
Intake Manifold Tuning Valve Stuck Open	P2070	This DTC check for valve stuck open in normal operation range	160 Hz ≥ Valve frequency outside normal range ≤ 140 Hz OR Valve learn period ≥ 2sec and Engine running OR Number of learn attempts ≤100	Intake Manifold Tuning sensor present No power up reset > 5 times 11 volts ≥ Ignition volt ≤ 18 volts Engine Run Time > 5 seconds Intake Manifold Tuning Valve self test completed and passed No IMTV DTC fault No Engine coolant DTC fault No IAT DTC fault No TP DTC fault No Engine Overtemperature DTC fault Engine running Engine Coolant – Table value in degrees C based on minimum induction air temperature current key-on Engine Load present 1350 ≤Engine Speed ≤ 4200	400 failures out of 500 samples 12.5 ms Continuous	DTC Type B
Intake Manifold Tuning Valve Stuck Closed	P2071	This DTC check for valve stuck closed in normal operation range	Commanded valve position not = actual valve position	Intake Manifold Tuning sensor present No power up reset > 5 times 11 volts ≥ Ignition volt ≤ 18 volts Engine Run Time > 5 seconds Intake Manifold Tuning Valve self test completed and passed No IMTV DTC fault No Engine coolant DTC fault No IAT DTC fault No TP DTC fault No Engine Overtemperature DTC fault Engine running Engine Coolant – Table value in degrees C based on minimum induction air temperature current key-on Engine Load present 1350 ≤Engine Speed ≤ 4200	400 failures out of 500 samples 12.5 ms Continuous	DTC Type B
Intake Manifold Tuning Valve Position Sensor Circuit Low	P2077	This DTC detects a continuous short to low or open in either the signal circuit or the sensor.	95% ≤ valve position	9 volts ≥ Ignition volt ≤ 18 volts	400 failures out of 500 samples 12.5 ms 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
Intake Manifold Tuning Valve Position Sensor Circuit High	P2078	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the sensor	Valve position ≤ 5%	9 volts ≥ Ignition volt ≤ 18 volts	400 failures out of 500 samples 12.5 ms Continuous	DTC Type B
Control Module Throttle Actuator Position Performance	P2101	Detect a throttle positioning error	Difference between measured throttle position and modeled throttle position > 10%	• Ignition in run or crank • RPM>0 or (RPM=0 and not in battery saver mode) • No airflow actuation or throttle actuation DTCs • Engine running • System voltage > 11 V	15 fails out of 15 samples 12.5 msec in the main processor	DTC Type A
Throttle Closed Position Performance	P2119	Throttle unable to return to default after de-energizing	When throttle is de-energizing, throttle is out of default range	Ignition in unlock/accessory, run or crank System voltage>5.23 V Throttle de-energized	500 ms	DTC Special Type C (engine is shut down if throttle actuation fault also occurs)
Accelerator Pedal Position (APP) Sensor 1 Circuit	P2120	Detect a continuous or intermittent short or open in the APP sensor #1	0.325 V < Raw APP 1 < 4.75V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39counts or 13counts continuous; 12.5 msec/count in the main processor 19/39counts or 13counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 1 Circuit Low Voltage	P2122	Detect a continuous or intermittent short or open in the APP sensor #1	Raw APP 1 < 0.325V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the main processor 19/39counts or 13counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 1 Circuit High Voltage	P2123	Detect a continuous or intermittent short or open in the APP sensor #1	Raw APP 1 > 4.75V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the main processor 19/39 counts or 13counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 2 Circuit	P2125	Detect a continuous or intermittent short or open in the APP sensor #2	0.325 V < Raw APP 1 < 4.75v	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39counts or 13counts continuous; 12.5 msec/count in the main processor 19/39 counts or 13counts continuous; 12.5 msec/count in the motor processor	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 2 Circuit Low Voltage	P2127	Detect a continuous or intermittent short or open in the APP sensor #2	Raw APP 2 < 0.325V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39 counts or 13 counts continuous; 12.5 msec/count in the main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 2 Circuit High Voltage	P2128	Detect a continuous or intermittent short or open in the APP sensor #2	Raw APP 2 > 4.75V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39 counts or 13 counts continuous; 12.5 msec/count in the main processor 19/39counts or 13 counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Throttle Position (TP) Sensor 1-2 Correlation	P2135	Detects a continuous or intermittent correlation fault between TP sensors #1 and #2	Difference between displaced throttle sensor #1 and #2 > 7% offset at min. throttle position with an increasing to 10% at max. throttle position Difference between raw min. TPS1 and raw min. TPS2 > 0.125 volts	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	79/159 counts or 52 counts continuous; 3.125 msec/count in the main processor 19/39 counts or 15 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 1-2 Correlation	P2138	Detect an invalid minimum mechanical position correlation between APP sensor #1 and #2 Detect a short between APP sensors #1 and #2 circuits.	Difference between displaced pedal position sensor #1 and #2 > 10% Difference between min. learned pedal position sensor #1 and #2 >5%	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the main processor 19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the motor processor 2 counts 156.25 msec w/ immediate test on an error, performed in the main processor	DTC Type A
Minimum Throttle Position Not Learned	P2176	TP minimum learning not completed	TPS > 0.935V	Minimum TPS learn active state Stable throttle position reading for 40 msec Ignition in run or crank No TPS circuit DTCs	1.8secs	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
Torque Management Request Input Signal A	P2544	Determines if torque request from the TCM is valid	1. Serial Communication 2's complement not equal 2. Serial Communication rolling count value is not + 1 from previous message 3. 2's complement not equal of torque requested value or torque requested type when stored in ECM 4. TCM Requested Torque > 8191.75 nM	No Serial communication loss to TCM Engine is Running Ignition is in Run or Crank	1. # of Protect Errors ≥16 fails 2. # of Alive Rolling Errors ≥ 6 fails in 10 samples 3. # of RAM errors ≥ 3 fails 4. # of range errors ≥ 3 fails in 10 samples If any the above exist for > 2 sec seconds, increment fail counter. Else fail counter is reset. If the fail counter is ≥ 2 count, fault is active Pass diagnostic if none of the above conditions are present for ≥ 2 seconds Frequency: 12.5ms loop continuous	DTC Type B
ECM/PCM Internal Engine Off Timer Performance	P2610	This DTC determines if the engine off timer does not initialize or count accurately and properly	Initial value test: Ignition off timer < 1 sec OR Ignition off timer > 15 sec Clock rate test: • Time since last ignition off timer increment ≥ 1.375 seconds • Current ignition off time < old ignition off time • Time between ignition off timer increments < 0.8 • Time between ignition off timer increments > 1.2 • Current ignition off time minus old ignition off time ≠ 1.0	ECM is powered down DTC sets on next key cycle if failure detected -40°C ≤ IAT ≤ 125°C	Initial value test: 3 consecutive fails Clock rate test: 8 fails out of 10 samples Up to 1.375 seconds/sample Once every key down	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 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 > 550 millivolts or < 350 millivolts to set closed loop fuel O2 Ready flag. Once set to "Ready," the O2 sensor voltage cannot be > 350 millivolts and < 550 millivolts for > 10 seconds or the O2 Ready flag will be reset to "Not Ready."	• No TP Sensor, MAF, MAP, IAT, ECT, EVAP, Secondary Air, Injector DTCs • No B1S1 or B2S1 O2 DTCs • Engine Run Time ≥ 100 seconds • ECT ≥ 65° C • Engine Metal Overtemp = Not Active • Traction Control = Not Active • No default throttle action • Not in Catalyst Protection Mode • 10 volts ≤ Ignition Voltage ≤ 18 volts • 500 ≤ Engine Speed ≤ 3000 • 5 grams per second ≤ Mass Airflow ≤ 30 grams per second • Not in Decel Fuel Cutoff Mode • Not in Power Enrichment • Predicted O2 temp ≥ 0 °C All of the above met for 5 seconds.	240 test failures in a 300 test sample Frequency: Continuous 100ms loop	DTC Type B
O2 Sensor Circuit Range/Performance Bank 1 Sensor 2	P2A01	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 increases or reduces delivered fuel to achieve the required rich or lean threshold.	Post catalyst O2 sensor cannot achieve voltage ≥ 715 millivolts and voltage ≤ 175 millivolts	Common Enable Criteria • No O2 circuit, heater, response or heater driver DTCs active • No TP Sensor, ETC, MAF, ECT, MAP, IAT, EVAP, Secondary Air, Fuel Injector DTCs • Engine Runtime ≥ 300 seconds • Green converter delay = not active Specific Enable Criteria: • No Fuel Trim or Misfire DTCs active • 625 rpm ≤ Engine Speed ≤ 1650 rpm • 3.5 grams per second ≤ Airflow ≤ 15 grams per second • 40 kph ≤ Vehicle Speed ≤ 132 kph • In Purge On or Purge Off Decel Cell All of the above met for at least 2 seconds, and then: • 0.954 ≤ Short term fuel trim ≤ 1.046 • Fuel state = closed loop • O2 sensor circuit range/performance diagnostic has exclusive control of purge If all of the above are met for 4 seconds, the intrusive portion of the test will be performed. Once the test is intrusive, it cannot be aborted except by a power enrichment event.	Accumulated Mass Air Flow > 400 grams without achieving B1S2 sensor voltage < 175 mV during lean portion of test OR Accumulated Mass Air Flow > 600 grams without achieving B1S2 sensor voltage > 715 mV during rich portion of test Frequency: 8 tests per trip max, once per trip on pass	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 Range/Performance Bank 2 Sensor 1	P2A03	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 > 550 millivolts or < 350 millivolts to set closed loop fuel O2 Ready flag. Once set to "Ready," the O2 sensor voltage cannot be > 350 millivolts and < 550 millivolts for > 10 seconds or the O2 Ready flag will be reset to "Not Ready."	• No TP Sensor, MAF, MAP, IAT, ECT, EVAP, Secondary Air, Injector DTCs • No B1S1 or B2S1 O2 DTCs • Engine Run Time ≥ 100 seconds • ECT ≥ 65° C • Engine Metal Overtemp = Not Active • Traction Control = Not Active • No default throttle action • Not in Catalyst Protection Mode • 10 volts ≤ Ignition Voltage ≤ 18 volts • 500 ≤ Engine Speed ≤ 3000 • 5 grams per second ≤ Mass Airflow ≤ 30 grams per second • Not in Decel Fuel Cutoff Mode • Not in Power Enrichment • Predicted O2 temp ≥ 0 °C All of the above met for 5 seconds.	240 test failures in a 300 test sample Frequency: Continuous 100ms loop	DTC Type B
O2 Sensor Circuit Range/Performance Bank 2 Sensor 2	P2A04	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 test increases or reduces delivered fuel to achieve the required rich or lean threshold.	Post catalyst O2 sensor cannot achieve voltage ≥ 715 millivolts and voltage ≤ 175 millivolts	Common Enable Criteria • No O2 circuit, heater, response or heater driver DTCs active • No TP Sensor, ETC, MAF, ECT, MAP, IAT, EVAP, Secondary Air, Fuel Injector DTCs • Engine Runtime ≥ 300 seconds • Green converter delay = not active Specific Enable Criteria: • No Fuel Trim or Misfire DTCs active • 625 rpm ≤ Engine Speed ≤ 1650 rpm • 3.5 grams per second ≤ Airflow ≤ 15 grams per second • 40 kph ≤ Vehicle Speed ≤ 132 kph • In Purge On or Purge Off Decel Cell All of the above met for at least 2 seconds, and then: • 0.954 ≤ Short term fuel trim ≤ 1.046 • Fuel state = closed loop • O2 sensor circuit range/performance diagnostic has exclusive control of purge If all of the above are met for 4 seconds, the intrusive portion of the test will be performed. Once the test is intrusive, it cannot be aborted except by a power enrichment event.	Accumulated Mass Air Flow > 400 grams without achieving B1S2 sensor voltage < 175 mV during lean portion of test OR Accumulated Mass Air Flow > 600 grams without achieving B1S2 sensor voltage >715 mV during rich portion of test Frequency: 8 tests per trip max, once per trip on pass	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
Control Module Communication Bus Off	U0073	Detects that a CAN serial data bus shorted condition has occurred to force the CAN device driver to enter a bus-off state.	CAN device driver has reported that it has entered a bus-off state.	Ignition in the RUN or ACCESSORY position	5 fails out of 5 samples Frequency: Continuous 1 second loop	DTC Type B
Lost Communication with TCM	U0101	Detects that CAN serial data communication has been lost with the TCM.	Lost communication with the TCM	Ignition in the RUN or ACCESSORY position	12 fails out of 12 samples Frequency: Continuous 1 second loop	DTC Type B

O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153) Pass/Fail Thresholds.

Rich to Lean Time \ Lean to Rich Time	0	0.02441	0.03613	0.04785	0.05957	0.07227	0.08398	0.0957	0.1084	0.12012	0.13184	0.14355	0.15625	0.16797	0.17969	0.19238
0	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.03613	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.04785	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.05957	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL
0.07227	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL
0.08398	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL
0.0957	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.1084	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL
0.12012	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
0.13184	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
0.14355	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
0.15625	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
0.16797	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
0.17969	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
0.19238	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.2041	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
1	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL

Lean to Rich Average Time (seconds)

Rich to Lean Average Time (seconds)

	0.000	0.024	0.036	0.048	0.060	0.072	0.084	0.096	0.108	0.120	0.132	0.144	0.156	0.168	0.180	0.192	1.000
0.000	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail
0.036	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail
0.048	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail	Fail	Fail
0.060	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail	Fail
0.072	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail
0.084	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail
0.096	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail
0.108	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.120	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.132	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.144	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.156	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.168	Fail	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.180	Fail	Fail	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.192	Fail	Fail	Fail	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.204	Fail	Fail	Fail	Fail	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
1.000	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail

P0300: Misfire Zero Torque Threshold

Engine Speed (RPM) Torque (%)

500	20.09888
600	18.20984
700	16.22925
800	15.30151
900	14.80103
1000	14.44092
1100	14.34021
1200	14.08081
1300	14.00146
1400	14.11133
1600	14.01978
1800	14.23035
2000	14.09912
2200	14.20898
2400	14.20898
2600	14.53857
2800	14.40125
3000	14.55078
3500	16.14685
4000	17.74292
4500	19.33899
5000	20.93506
5500	22.52808
6000	24.12415
6500	25.72021
7000	27.31628

TABLE - IFRD weight factors	RPM																
	0	250	750	1250	1750	2250	2750	3250	3750	4250	4750	5250	5750	6250	6750	7250	9000
MAF residual weight (RPM)	0	1	0.955	0.946	0.875	0.8	0.757	0.787	0.707	0.673	0.68	0.677	0.599	0.436	0.249	1	1
MAP1 residual weight	0	0.5	0.8	0.971	0.997	0.98	0.938	0.958	0.941	0.946	0.94	0.798	0.812	0.921	0.931	1	1
MAP2 residual weight	0	0.96	0.964	1	1	1	1	1	0.997	1	1	0.998	1	1	0.897	1	1
TPS residual weight	0	0.5	0.8	1	1	0.919	0.849	0.839	0.814	0.862	0.876	0.794	0.828	0.757	0.64	1	1
	MAF g/s																
	0	50	70	73	76	79	82	85	89	95	100	110	150	170	180	200	350
MAF residual weight (MAF)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

P0116																	
Induction Air Temperature at Powerup Powertrain (VeEITI_T_InductAirCvrtdPwrUp)	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
The minimum temperature difference required to allow a gross failure of the ECT to bypass the engine block heater algorithm and promptly fail the diagnostic (KtECTD_T_HSC_FastFailTempDiff)	79.5	79.5	79.5	60	60	39.75	39.75	25	25	25	15	15	15	25	30	30	30

P0128											
For IAT > 10C, Threshold = 71C											
Coolant Temp at Begin Run Transition (SfECTI_T_EngCoolBRn)	-40	-28	-16	-4	8	20	32	44	56	68	80
Calculated minimum total air threshold as a function of Coolant Temp (KaECTD_m_EngTotAirGramsStartRun)	13230	13230	13230	13230	13230	11674	10118	8562	7005	5449	3893

P0128											
For –7C < IAT < 10C, Threshold = 55C											
Coolant Temp at Begin Run Transition (SfECTI_T_EngCoolBRn)	-40	-28	-16	-4	8	20	32	44	56	68	80
Calculated minimum total air threshold as a function of Coolant Temp (KaECTD_m_EngTotAirGramsStartRun)	13700	13700	13700	12344	10988	9632	8276	6920	5564	5564	5564

O2S Insufficient Switching Bank 1 Sensor 1 (P1133), O2S Insufficient Switching Bank 2 Sensor 1 (P1153) Pass/Fail Thresholds.

Average Airflow (g/s)	# of HC Switches
0.00	49
6.25	49
12.50	49
18.75	50
25.00	52
31.25	52
37.50	54

P2070 Coolant Threshold

Coolant	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
Time	410	300	120	20	10	5	5	1	1	1	1	1	1	1	1	1	1