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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Camshaft Actuator Solenoid Circuit	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 9 volts < Ignition Voltage < 18 volts	20 failures out of 25 samples 250ms loop continuous	DTC Type B (Applications with Cam Phaser Only)
Camshaft Actuator Solenoid Performance	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)] > 8	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position < 7.5 for 3.35 seconds 9 volts < 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	200 fail counts out of 1000 sample counts 100ms loop Continuous	DTC Type B (Applications with Cam Phaser Only)
CAM to Crank timing incorrect	P0016	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position	Cam signal falling edge out of more than -11 or +14 degrees from corresponding crank falling edge (Equates to ± 1 tooth)	<ul style="list-style-type: none"> 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
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)	<ul style="list-style-type: none"> Ignition switch is in crank or run 9 volts < Ignition Voltage < 18 volts RPM > 400 	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)	<ul style="list-style-type: none"> Ignition switch is in crank or run 9 volts < Ignition Voltage < 18 volts RPM > 400 	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B
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)	<ul style="list-style-type: none"> Ignition switch is in crank or run 9 volts < Ignition Voltage < 18 volts RPM > 400 	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	$2.8203 \Omega < \text{Calculated Heater resistance} < 9.5117 \Omega$	<ul style="list-style-type: none"> ECT - IAT < 8°C Engine Soak Time > 36000 Seconds -30 °C < ECT Temp < 45°C ECT 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

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Ho2s Heater Resistance Bank 1 Sensor 2	P0054	Detects an oxygen sensor heater having an incorrect or out of range resistance value	7 4414 Ω< Calculated Heater resistance <18 1309 Ω	<ul style="list-style-type: none"> • ECT – IAT < 8°C • Engine Soak Time > 36000 Seconds • -30 °C < ECT Temp < 45°C • ECT 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)	<ul style="list-style-type: none"> • Ignition switch is in crank or run • 9 volts < Ignition Voltage < 18 volts • RPM > 400 	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	2 8203 Ω< Calculated Heater resistance <9 5117 Ω	<ul style="list-style-type: none"> • ECT – IAT < 8°C • Engine Soak Time > 36000 Seconds • -30 °C < ECT Temp < 45°C • ECT 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 Sensor 2	P0060	Detects an oxygen sensor heater having an incorrect or out of range resistance value	7 4414 Ω< Calculated Heater resistance <18 1309 Ω	<ul style="list-style-type: none"> • ECT – IAT < 8°C • Engine Soak Time > 36000 Seconds • -30 °C < ECT Temp < 45°C • ECT 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	<ol style="list-style-type: none"> 1 Difference between measured MAP and estimated MAP > X kPa OR V5B OOR OR After Throt Blade MAP sensor TFTKO, then MAP leg failed 2 Difference between measured MAF and estimated MAF > Y grams/sec OR MAF sensor TFTKO OR Vbatt < 10 volts, then MAF leg failed 3 X, Y depend on throttle position, (see table "MAP and MAF Delta Criterion based on TPS % for P0068 code" attached) 	Engine running, engine speed > 800 rpm	Continuously fail MAP AND MAF legs for longer than 187 5 msec Continuous in the main processor	DTC Type A
Mass Air Flow System Performance (Rationality)	P0101	This DTC determines if the MAF sensor is stuck within the normal operating range	(Measured Flow – Modeled air Flow) Filtered > 12 AND (Measured Manifold Air Pressure – Manifold Model 2 pressure) Filtered > 15	Engine rpm =>450 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 > 70 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

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Mass Air Flow Sensor Circuit Low Frequency	P0102	Detects a continuous short to low or a open in either the signal circuit or the MAF sensor	MAF \leq 1867 Hz	Engine Running > 1 second Engine Speed \geq 300 RPM System Voltage \geq 8 volts The above must be present for a period of time greater than 1 0 second	50 test failures in 63 test samples 1 sample every Lo Res event	DTC Type B
Mass Air Flow Sensor Circuit High Frequency	P0103	Detects a continuous short to high in either the signal circuit or the MAF sensor	MAF \geq 14500 Hz	Engine Running > 1 second Engine Speed \geq 300 RPM System Voltage \geq 8 volts The above must be present for a period of time greater than 1 0 second	50 test failures in 63 test samples 1 sample every Lo Res event	DTC Type B
Map Sensor Range/ Performance (Rationality)	P0106	This DTC determines if the MAP sensor is stuck within the normal operation range	(Measured MAP - Manifold Model 1 pressure) filtered > 15 AND (Measured MAP - Manifold Model 2 pressure) filtered > 15	Engine rpm \Rightarrow 450 and \leq 8000 Time in All Cylinder mode \Rightarrow 2 seconds 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 > 70 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 LoRes loop	DTC Type B
Manifold Absolute Pressure Sensor Circuit Low	P0107	This DTC detects a continuous short to low or open in either the signal circuit or the MAP sensor	MAP voltage < 2% of Vref (0 05 volts)	TP sensor DTCs not active Engine Running \geq 400 RPM Throttle Position is \geq 0% when engine speed is \leq 800 RPM Or Throttle Position is \geq 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 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% of Vref (4 9 volts)	Cold Start Run Time - Table value in seconds based on Powerup ECT Temperature Run Test TP sensor DTCs not active Engine Running Throttle Position is \leq 1 % when engine speed is \leq 1200 RPM Or Throttle Position is \leq 20 % when engine speed is > 1200 RPM	320 test failures in 400 test samples 1 sample/12 5 ms	DTC Type B
Intake Air Temp Sensor Circuit Low (High Temp)	P0112	This DTC detects a continuous short to ground in the IAT signal circuit or the IAT sensor	Raw IAT < 45 ohms	VS sensor DTCs not active ECT sensor DTCs not active Engine run time > 10 seconds ECT Temperature < 150 C VSS > 0 KPH	50 test failures in 63 test samples 1 sample/100 msec	DTC Type B
Intake Air Temp Sensor Circuit High (Low Temp)	P0113	This DTC detects a continuous open or short to high in the IAT signal circuit or the IAT sensor	Raw IAT > 20,000ohms	MAF sensor DTCs not active ECT sensor DTCs not active VS sensor DTCs not active Engine run time > 10 seconds ECT > -40 MAF > 512 gm/s VSS < 512 KPH	50 test failures in 63 test samples 1 sample/100 msec	DTC Type B

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Engine Coolant Temp Sensor Rationality (High-Sided)	P0116	Detects ECT temp sensor stuck in mid range	<p>A failure will be reported if any of the following occur:</p> <p>ECT at powerup > IAT at powerup by an IAT based table lookup (See "P0116: Fail if powerup ECT exceeds IAT by these values 5 3L (LY5) ")value after a minimum 10 hour soak (fast fail)</p> <p>ECT at powerup > IAT at powerup by 10 C after a minimum 10 hour soak and a block heater has not been detected</p> <p>ECT at powerup > IAT at powerup by 10 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%</p>	<p>No VSS DTC's No IAT DTC's No ECT sensor shorted DTC's ECM/PCM Internal Engine Off Timer Performance DTC not active Non-volatile memory failure has not been detected on power-up Engine off time > 600 minutes (10 hours) Test run this trip = false Test aborted this trip = false</p> <p>Block heater detection: ECT at powerup > IAT at powerup by 20 C Powerup IAT > -7 C Vehicle driven a minimum of 400 seconds above 24 kph and IAT drops more than 4 C from powerup IAT</p>	<p>1 failure</p> <p>500 ms loop</p>	DTC Type B
Engine Coolant Temp Sensor Circuit Low (High Temp)	P0117	This DTC detects a continuous short to ground in the ECT signal circuit or the ECT sensor	Raw ECT < 45 ohms	Engine run time > 10 seconds Or IAT < 50 C	5 test failures in a 6 sample test 1 sec / sample	DTC Type B
Engine Coolant Temp Sensor Circuit High (Low Temp)	P0118	Circuit Continuity This DTC detects a continuous short to high or open in the ECT signal circuit or the ECT sensor	Raw ECT > 450,000ohms	Engine run time > 10 seconds Or IAT ≥ 0 C	5 test failures in a 6 sample test 1 sec / sample	DTC Type B
Throttle Position (Tp) Sensor 1 Circuit	P0120	Detects a continuous or intermittent short or open in TP sensor #1 circuit	0 325 Volts > TPS > 4 75 Volts	Ignition in unlock/accessory, run or crank System voltage>5 23 V No , 5 V reference DTCs	<p>79/159 counts; 55 counts continuous; 3 125 msec /count in the ECM main processor</p> <p>19/39 counts or 13 counts continuous; 12 5 msec/count in the MHC processor</p>	DTC Type A

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Throttle Position Sensor Circuit Performance (Rationality)	P0121	The DTC determines if a TPS sensor is stuck within the normal operating range	Filtered throttle error > 200 kPa/grams per second	Engine rpm \Rightarrow >450 and \leq 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 > 70 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
Throttle Position (Tp) Sensor 1 Circuit Lo	P0122	Detects a continuous or intermittent Out of Range lo TPS	TPS < 0.325 Volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No 5 V reference DTCs	79/159 counts; 55 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 Hi	P0123	Detects a continuous or intermittent Out of Range Hi TPS	TPS > 4.75 Volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No 5 V reference DTCs	79/159 counts; 55 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
Engine Coolant Temperature Below Stat Regulating Temperature	P0128	This DTC detects if the engine coolant temperature rises too slowly due to an ECT or cooling system fault	If actual accumulated airflow is > predicted accumulated airflow (See attached table "P0128: Maximum Accumulated Airflow for IAT and Start-up ECT conditions 5.3L (LY5) "_) before engine coolant reaches 75 C when IAT is > 10 C, and before engine coolant reaches 55 C when IAT is \leq 10 C but \geq -7 C	No MAF, MAP, TP Sensor, IAT, ECT shorted or open, VSS, ECT High Sided Rationality, or Fuel Compensation faults active ECT shorted or open faults not failing IAT \geq -7 C 90seconds \leq Engine runtime \leq 1370 seconds Fuel ethanol percent \leq 85% ECT at startrun \leq 70 C for IAT above 10 C; ECT at startrun \leq 50 C for IAT \leq 10 C but \geq -7 C Minimum Average Airflow \geq 10 gps Vehicle speed \geq 5 MPH for at least 1.50 miles Maximum airflow added to actual accumulated airflow limited to 75 gps Airflow added to actual accumulated airflow is considered 0 gps below an actual 20 gps	30 failures to set DTC <u>Frequency:</u> Once per ignition cycle 1 second loop	DTC Type B

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O2s Circuit Low Voltage Bank 1 Sensor 1	P0131	This DTC determines if the O2 sensor circuit is shorted to low	O2 sensor voltage < 80 millivolts	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Ethanol Percentage < 87% 0.992188 ≤ Equivalence ratio ≤ 1.013672 2.999878 % ≤ throttle position ≤ 70.00122 % Fuel state = closed loop with no fault pending All fuel injectors = ON Traction Control = not active <p>All of the above met for at least 2 seconds</p>	<p>90 test failures in a 96 sample test for 5 consecutive tests</p> <p><u>Frequency:</u> Continuous 100 ms loop</p>	DTC Type B
O2s Circuit High Voltage Bank 1 Sensor 1	P0132	This DTC determines if the O2 sensor or circuit is shorted to high	<p>O2 sensor voltage > 1050 millivolts to go fault pending</p> <p>O2 sensor voltage > 1050 millivolts to set DTC</p>	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Ethanol Percentage < 87% 0.992188 ≤ Equivalence Ratio ≤ 1.013672 2.999878 % ≤ throttle position ≤ 70.00122 % Fuel State = Closed loop <p>All of the above met for at least 2 seconds</p>	<p>90 test failures in a 96 sample test for 5 consecutive tests</p> <p><u>Frequency:</u> Continuous 100 ms loop</p>	DTC Type B

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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	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's • 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> • O2 Heater on for ≥ 0 seconds • B1S1 DTCs = Not Active • Learned heater resistance is valid • Misfire DTC = Not Active • ECT > 60 C • IAT > -40 C • Engine run time > 160 seconds • EVAP Canister purge duty cycle ≥ 0 % • 20 gps \leq MAF \leq 55 gps • 1200 \leq RPM \leq 3000 • Ethanol percentage < 86.99951 % • Baro > 69.80078 kPa • Throttle position ≥ 4.998779 % • Fuel Level > 10 % • 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 <p>All of the above met for at least 1 second</p>	<p>100 seconds</p> <p><u>Frequency:</u> Once per trip</p> <p><i>Green O2 Sensor Delay Criteria</i> This diagnostic will not be enabled until the following has been met: Total Accumulated Airflow $\geq 1,000,000$ grams</p> <p>Airflow accumulates anytime the engine is running and the current engine airflow is ≥ 20 gps The airflow can accumulate over several engine run cycles until the threshold is reached</p> <p>Note: This feature is only enabled when the vehicle is new and cannot be enabled in service</p>	DTC Type B

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O2s Circuit Insufficient Activity Bank 1 Sensor 1	P0134	This DTC determines if the O2 sensor circuit is open	350 millivolts < O2 sensor < 550 millivolts	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 KfEOSD_U_SysVolt10Min volts < system voltage < KfEOSD_U_SysVolt18Max volts EGR, Idle, Fuel Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Engine run time > 300 seconds Ethanol percentage > 86.99951 % No B1S1 heater related DTCs 	<p>285 test failures in a 300 test samples</p> <p>Minimum of 0 occurrences of a delta TP sensor $\geq 4.998779\%$ during diagnostic test</p> <p><u>Frequency:</u> Continuous for pre catalyst sensors 100 ms loop rate</p>	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 > 3.125 amps	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Engine Run Time ≥ 300 seconds ECT ≥ 50 C 500 \leq Engine Rpm ≤ 3000 3 gps \leq Mass Airflow ≤ 40 gps O2 heater not in Device control B1S1 O2 heater resistance DTC not active <p>All of the above met for at least 2 seconds</p>	<p>8 test failures in 10 test samples</p> <p><u>Frequency:</u> 1 tests per trip 0.2 seconds delay between tests 1 second execution rate</p>	DTC Type B

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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 < 80 millivolts	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's • 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> • Ethanol Percentage < 87% • 992188 ≤ Equivalence ratio ≤ 1 013672 • 2 999878 % ≤ throttle position ≤ 70 00122 % • Fuel state = closed loop • All fuel injectors = ON • Traction Control = not active <p style="text-align: center;">All of the above met for at least 2 seconds</p>	<p>380 test failures in a 400 sample test for 5 consecutive tests</p> <p><u>Frequency:</u> Continuous 100 ms loop</p>	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	<p>O2 sensor voltage > 950 millivolts to go fault pending</p> <p>O2 sensor voltage > 950 millivolts to set DTC</p>	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's • 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> • Ethanol Percentage < 87% • 992188 ≤ Equivalence Ratio ≤ 1 013672 • 2 999878 % ≤ throttle position ≤ 70 00122 % • Fuel State = Closed loop <p style="text-align: center;">All of the above met for at least 2 seconds</p>	<p>380 test failures in a 400 sample test for 5 consecutive tests</p> <p><u>Frequency:</u> Continuous 100 ms loop</p>	DTC Type B

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O2s Circuit Insufficient Activity Bank 1 Sensor 2	P0140	This DTC determines if the O2 sensor circuit is open	<p>410 millivolts < O2 sensor < 490 millivolts for regular open test</p> <p>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)</p>	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's • 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> • Ethanol percentage > 86 99951 % • No B1S2 heater related DTCs • PCM State = run <p><u>Fast Pass:</u></p> <ul style="list-style-type: none"> • Engine run time ≤ 200 seconds <p>(Fast pass cannot report a fail; if Fastpass fails, the regular open test is run)</p> <p><u>Regular Open Test</u></p> <ul style="list-style-type: none"> • Engine run time > 300 seconds • Fuel state = closed loop 	<p>1450 test failures in a 1500 test samples</p> <p>Minimum of 6 occurrences of a delta TP sensor ≥ 4 998779 % during diagnostic test</p> <p>(sample counts – failure counts) < 550 within 200 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)</p> <p><u>Frequency:</u> Once/trip for post catalyst sensors 100 ms loop</p>	DTC Type B

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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 < 0.25 amps or > 1.625 amps	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Engine Run Time ≥ 300 seconds ECT ≥ 50 C 500 ≤ Engine Rpm ≤ 3000 3 gps ≤ Mass Airflow ≤ 40 gps O2 heater not in Device control B1S1 O2 heater resistance DTC not active <p>All of the above met for at least 2 seconds</p>	8 test failures in 10 test samples Frequency: 1 tests per trip 0.2 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 < 80 millivolts	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Ethanol Percentage < 87% 0.992188 ≤ Equivalence ratio ≤ 1.013672 2.999878 % ≤ throttle position ≤ 70.00122 % Fuel state = closed loop with no fault pending All fuel injectors = ON Traction Control = not active <p>All of the above met for at least 2 seconds</p>	90 test failures in a 96 sample test for 5 consecutive tests <u>Frequency:</u> Continuous 100 ms loop	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2s Circuit High Voltage Bank 2 Sensor 1	P0152	This DTC determines if the O2 sensor or circuit is shorted to high	<p>O2 sensor voltage > 1050 millivolts to go fault pending</p> <p>O2 sensor voltage > 1050 millivolts to set DTC</p>	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's • 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> • Ethanol Percentage < 87% • 0.992188 ≤ Equivalence Ratio ≤ 1.013672 • 2.999878 % ≤ throttle position ≤ 70.00122 % • Fuel State = Closed loop <p>All of the above met for at least 2 seconds</p>	<p>90 test failures in a 96 sample test for 5 consecutive tests</p> <p><u>Frequency:</u> Continuous 100 ms loop</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's • 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> • O2 Heater on for ≥ 0 seconds • B2S1 DTCs = Not Active • Learned heater resistance is valid • Misfire DTC = Not Active • ECT > 60 C • IAT > -40 C • Engine run time > 160 seconds • EVAP Canister purge duty cycle ≥ 0 % • 20 gps ≤ MAF ≤ 55 gps • 1200 ≤ RPM ≤ 3000 • Ethanol percentage < 86 99951 % • Baro > 69 80078 kPa • Throttle position ≥ 4 998779 % • Fuel Level > 10 % • 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 <p>All of the above met for at least 1 second</p>	<p>100 seconds</p> <p><u>Frequency:</u> Once per trip</p> <p><i>Green O2 Sensor Delay Criteria</i> This diagnostic will not be enabled until the following has been met: Total Accumulated Airflow >= 1,000,000 grams</p> <p>Airflow accumulates anytime the engine is running and the current engine airflow is >= 20 gps The airflow can accumulate over several engine run cycles until the threshold is reached</p> <p>Note: This feature is only enabled when the vehicle is new and cannot be enabled in service</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2s Circuit Insufficient Activity Bank 2 Sensor 1	P0154	This DTC determines if the O2 sensor circuit is open	350 millivolts < O2 sensor < 550 millivolts	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Engine run time > 300 seconds Ethanol percentage > 86 99951 % No B2S1 heater related DTCs 	<p>285 test failures in a 300 test samples</p> <p>Minimum of 0 occurrences of a delta TP sensor ≥ 4 998779 % during diagnostic test</p> <p><u>Frequency:</u> Continuous for pre catalyst sensors 100 ms loop rate</p>	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	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Engine Run Time ≥ 300 seconds ECT ≥ 50 C 500 \leq Engine Rpm ≤ 3000 3 gps \leq Mass Airflow ≤ 40 gps O2 heater not in Device control B2S1 O2 heater resistance DTC not active <p>All of the above met for at least 2 seconds</p>	<p>8 test failures in 10 test samples</p> <p><u>Frequency:</u> 1 tests per trip 0 2 seconds delay between tests 1 second execution rate</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 < 80 millivolts	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Ethanol Percentage < 87% 0.992188 ≤ Equivalence ratio ≤ 1.013672 2.999878 % ≤ throttle position ≤ 70.00122 % Fuel state = closed loop All fuel injectors = ON Traction Control = not active <p>All of the above met for at least 2 seconds</p>	<p>380 test failures in a 400 sample test for 5 consecutive tests</p> <p><u>Frequency:</u> Continuous 100 ms loop</p>	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	<p>O2 sensor voltage > 950 millivolts to go fault pending</p> <p>O2 sensor voltage > 950 millivolts to set DTC</p>	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> Ethanol Percentage < 87% 0.992188 ≤ Equivalence Ratio ≤ 1.013672 2.999878 % ≤ throttle position ≤ 70.00122 % Fuel State = Closed loop <p>All of the above met for at least 2 seconds</p>	<p>380 test failures in a 400 sample test for 5 consecutive tests</p> <p><u>Frequency:</u> Continuous 100 ms loop</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2s Circuit Insufficient Activity Bank 2 Sensor 2	P0160	This DTC determines if the O2 sensor is open	<p>410 millivolts < O2 sensor < 490 millivolts for regular open test</p> <p>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)</p>	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's • 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> • Ethanol percentage > 86.99951 % • No B1S2 heater related DTCs • PCM State = run <p><u>Fast Pass:</u> Engine run time ≤ 200 seconds</p> <p>(Fast pass cannot report a fail; if Fastpass fails, the regular open test is run)</p> <p><u>Regular Open Test</u></p> <ul style="list-style-type: none"> • Engine run time > 300 seconds <p>Fuel state = closed loop</p>	<p>1450 test failures in a 1500 test samples</p> <p>Minimum of 6 occurrences of a delta TP sensor ≥ 4.998779 % during diagnostic test</p> <p>(sample counts – failure counts) < 550 within 200 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)</p> <p><u>Frequency:</u></p> <p>Once/trip for post catalyst sensors 100 ms loop</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 < 0.25 amps or > 1.625 amps	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's • 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 Inj, and AIR Device controls = Not Active <p><u>Specific Enable Criteria</u></p> <ul style="list-style-type: none"> • Engine Run Time ≥ 300 seconds • ECT ≥ 50 C • 500 ≤ Engine Rpm ≤ 3000 • 3 gps ≤ Mass Airflow ≤ 40 gps • O2 heater not in Device control • B2S1 O2 heater resistance DTC not active <p>All of the above met for at least 2 seconds</p>	8 test failures in 10 test samples Frequency: 1 tests per trip 0.2 seconds delay between tests 1 second execution rate	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Lean Bank 1	P0171	<p>Determines if the fuel control system is in a lean condition, based on the EWMA of long-term fuel trim (LTM)</p> <p>(Note: EWMA stands for “Exponentially Weighted Moving Average”)</p>	The EWMA of long term fuel trim (LTM) samples ≥ 1245	<ul style="list-style-type: none"> • No Misfire , pre-cat O2 Sensor, or EVAP DTCs • No Fuel Injector or Composition (Ethanol) DTCs • No IAC, MAF, MAP, ECT, EGR, or A I R DTCs • No TP Sensor or TAC System DTCs • Engine speed > 375 rpm but < 7000 rpm • BARO > 70 kPa • ECT > -40°C but < 150 C • MAP > 10 kPa but < 255 kPa • IAT > -20 C but < 150 C • Mass Airflow > 1 0 g/s but < 510 g/s • Vehicle speed < 134 kph • Closed Loop Fueling • Long Term Fuel Trim Learning enabled • Not in Device Control • Catalyst Monitor Diagnostic Intrusive Test = Not Active • Post O2 Diagnostic Intrusive Test = Not Active • Evap diagnostic is at any stage except the “tank pull down” portion of the test • Fuel Level > 10 % (must be < 10% for at least 30 seconds to disable; default is to enable if fuel sender is faulty) <p>Notes: At least 30-45 seconds of LTM data (depending on the fuel trim cell) must accumulate on each trip with at least 20-35 seconds of data in the current fuel trim cell before a pass or fail decision can be made</p>	<p>The EWMA of long term fuel trim (LTM) samples ≥ 1245 for ≥ 100 ms</p> <p>Frequency: Continuous 100 ms loop</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Rich Bank 1	P0172	<p>Determines if the fuel control system is in a rich condition, based on the EWMA of long-term fuel trim (LTM)</p> <p>(Note: EWMA stands for "Exponentially Weighted Moving Average")</p>	<p>There exists both a Passive and, if needed, Intrusive rich test</p> <p>Passive: The EWMA of long term purge-off fuel trim (LTM) samples ≤ 0.755</p> <p>Intrusive: If a passive decision cannot be made, and the EWMA of long term purge-on fuel trim (LTM) samples ≤ 0.76, purge is ramped off to determine if excess purge is the cause. Therefore, the following must also occur to report a failure:</p> <p>The EWMA of LTM samples with purge off ≤ 0.755 for at least 60 seconds during each of 3 intrusive segments</p> <p>Intrusive Notes:</p> <ol style="list-style-type: none"> 1 Segments can last up to 30 seconds, and are separated by the smaller of a 20 second purge-on time or enough time to purge 16 grams of vapor 2 A maximum of 5 completed segments or 20 intrusive attempts are allowed for each intrusive test 3 After an intrusive test report is completed, another intrusive test cannot occur for 300 seconds to allow sufficient time to purge excess vapors from the canister. During this period, fuel trim will pass if the EWMA of LTM samples ≥ 0.76 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 	<ul style="list-style-type: none"> • No Misfire, No pre-cat O2 Sensor or EVAP DTCs • No Fuel Injector or Composition (Ethanol) DTC's • No IAC, MAF, MAP, ECT, EGR, or A I R DTCs • No TP Sensor or TAC System DTCs • Engine speed > 375 rpm but < 7000 rpm • BARO > 70 kPa • ECT > -40°C but < 150 C • MAP > 10 kPa but < 255 kPa • IAT > -20 C but < 150 C • Mass Airflow > 10 g/s but < 510 g/s • Vehicle speed < 134 kph • Closed Loop and Long Term Fuel Trim Learning enabled • Not in Device Control • Catalyst Monitor Diagnostic Intrusive Test = Not Active • Post O2 Diagnostic Intrusive Test = Not Active • Evap diagnostic is at any stage except the "tank pull down" portion of the test • Fuel Level > 10 % (for at least 30 seconds to disable; default is to enable if fuel sender is faulty) <p>General Notes:</p> <ol style="list-style-type: none"> 1 At least 30-45 seconds of LTM data (depending on the fuel trim cell) must accumulate on each trip with at least 20-35 seconds of data in the current fuel trim cell before a pass or fail decision can be made 2 In addition to the above, the Intrusive Test requires at least 58 more seconds of LTM data before a pass or fail decision can be made 	<p>Passive: The EWMA of long term purge-off fuel trim (LTM) samples ≤ 0.755 for ≥ 100ms</p> <p>Intrusive: If rich fail counter is ≥ 3 before pass counter ≥ 3, diagnostic fails</p> <p><u>Frequency:</u> Continuous 100 ms loop</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Rich Bank 1 (Cont)				Intrusive Enable Criteria: <ul style="list-style-type: none"> • Insufficient purge off data prior to purge-on operation to make a passive decision • The EWMA of long term purge-on fuel trim (LTM) samples ≤ 0.76 • RPM > 375 • Mass Airflow > 1.0 g/s but < 510 g/s • MAP > 18 kPa but < 255 kPa Temporary Intrusive Test Inhibit Criteria: If intrusive test segment exceeds 30 consecutive seconds (In this case, purge valve is opened for the smaller of 20 seconds or enough time to purge 16 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 ≥ 1.245	<ul style="list-style-type: none"> • No Misfire , pre-cat O2 Sensor, or EVAP DTCs • No Fuel Injector or Composition (Ethanol) DTCs • No IAC, MAF, MAP, ECT, EGR, or A I R DTCs • No TP Sensor or TAC System DTCs • Engine speed > 375 rpm but < 7000 rpm • BARO > 70 kPa • ECT > -40°C but < 150 C • MAP > 10 kPa but < 255 kPa • IAT > -20 C but < 150 C • Mass Airflow > 1.0 g/s but < 510 g/s • Vehicle speed < 134 kph • Closed Loop Fueling • Long Term Fuel Trim Learning enabled • Not in Device Control • Catalyst Monitor Diagnostic Intrusive Test = Not Active • Post O2 Diagnostic Intrusive Test = Not Active • Evap diagnostic is at any stage except the “tank pull down” portion of the test • Fuel Level > 10 % (must be < 10% for at least 30 seconds to disable; default is to enable if fuel sender is faulty) Notes: At least 30-45 seconds of LTM data (depending on the fuel trim cell) must accumulate on each trip with at least 20-35 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 ≥ 1.245 for ≥ 100 ms Frequency: Continuous 100 ms loop	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Rich Bank 2	P0175	<p>Determines if the fuel control system is in a rich condition, based on the EWMA of long-term fuel trim (LTM)</p> <p>(Note: EWMA stands for "Exponentially Weighted Moving Average")</p>	<p>There exists both a Passive and, if needed, Intrusive rich test</p> <p>Passive: The EWMA of long term purge-off fuel trim (LTM) samples ≤ 0.755</p> <p>Intrusive: If a passive decision cannot be made, and the EWMA of long term purge-on fuel trim (LTM) samples ≤ 0.76, purge is ramped off to determine if excess purge is the cause. Therefore, the following must also occur to report a failure:</p> <p>The EWMA of LTM samples with purge off ≤ 0.755 for at least 60 seconds during each of 3 intrusive segments</p> <p>Intrusive Notes:</p> <p>4 Segments can last up to 30 seconds, and are separated by the smaller of a 20 second purge-on time or enough time to purge 16 grams of vapor</p> <p>5 A maximum of 5 completed segments or 20 intrusive attempts are allowed for each intrusive test</p> <p>6 After an intrusive test report is completed, another intrusive test cannot occur for 300 seconds to allow sufficient time to purge excess vapors from the canister. During this period, fuel trim will pass if the EWMA of LTM samples ≥ 0.76 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</p>	<ul style="list-style-type: none"> • No Misfire, No pre-cat O2 Sensor or EVAP DTCs • No Fuel Injector or Composition (Ethanol) DTC's • No IAC, MAF, MAP, ECT, EGR, or A I R DTCs • No TP Sensor or TAC System DTCs • Engine speed > 375 rpm but < 7000 rpm • BARO > 70 kPa • ECT > -40°C but < 150 C • MAP > 10 kPa but < 255 kPa • IAT > -20 C but < 150 C • Mass Airflow > 1.0 g/s but < 510 g/s • Vehicle speed < 134 kph • Closed Loop and Long Term Fuel Trim Learning enabled • Not in Device Control • Catalyst Monitor Diagnostic Intrusive Test = Not Active • Post O2 Diagnostic Intrusive Test = Not Active • Evap diagnostic is at any stage except the "tank pull down" portion of the test • Fuel Level > 10 % for at least 30 seconds to disable; default is to enable if fuel sender is faulty <p>General Notes:</p> <p>3 At least 30-45 seconds of LTM data (depending on the fuel trim cell) must accumulate on each trip with at least 20-35 seconds of data in the current fuel trim cell before a pass or fail decision can be made</p> <p>4 In addition to the above, the Intrusive Test requires at least 58 more seconds of LTM data before a pass or fail decision can be made</p>	<p>Passive: The EWMA of long term purge-off fuel trim (LTM) samples ≤ 0.755 for ≥ 100ms</p> <p>Intrusive: If rich fail counter is ≥ 3 before pass counter ≥ 3, diagnostic fails</p> <p><u>Frequency:</u> Continuous 100 ms loop</p>	DTC Type B

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Fuel System Too Rich Bank 2 (Cont)				Intrusive Enable Criteria: <ul style="list-style-type: none"> • Insufficient purge off data prior to purge-on operation to make a passive decision • The EWMA of long term purge-on fuel trim (LTM) samples ≤ 0.76 • RPM > 375 • Mass Airflow > 1.0 g/s but < 510 g/s • MAP > 18 kPa but < 255 kPa Temporary Intrusive Test Inhibit Criteria: If intrusive test segment exceeds 30 consecutive seconds (In this case, purge valve is opened for the smaller of 20 seconds or enough time to purge 16 grams vapor)		
Injector Control Circuit (Cylinders 1-8) (Odm)	P0201 – P0208	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 and 18 volts > Ignition voltage > 9 volts for more than 1 second	8 failures out of 10 samples 250ms loop continuous	DTC Type B
Throttle Position (Tp) Sensor 2 Circuit	P0220	Detects a continuous or intermittent short or open in TP sensor #2 circuit	0.25 Volts > TPS > 4.59 Volts	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No 5 V reference DTCs	79/159 counts; 55 counts continuous; 3.125 msec/count in the motor processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Throttle Position (Tp) Sensor 2 Lo	P0222	Detects a continuous or intermittent short or open in TP sensor #2 circuit	TPS < 0.25 Volts	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No 5 V reference DTCs	79/159 counts ; 55 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 Hi	P0223	Detects a continuous or intermittent short or open in TP sensor #2 circuit	TPS > 4.59 Volts	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No 5 V reference DTCs	79/159 counts ; 55 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
Fuel Pump Control Circuit (Odm)	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	RunCrankIgnInRange (9 volts < Ignition < 18 volts) Engine speed > 0 RPM	8 failures in a 10 sample test 250 msec / sample	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 Cylinder 7 Misfire Detected Cylinder 8 Misfire Detected	P0300 P0301 P0302 P0303 P0304 P0305 P0306 P0307 P0308	These DTC's will determine if a random or a cylinder specific misfire is occurring by monitoring crankshaft velocity	Deceleration index Vs Engine speed Vs Load Emission Failure Threshold = 1 125% Catalyst Damage Threshold = 5% to 10 625% depending on engine speed and engine load (table attached)	<ul style="list-style-type: none"> • Engine run time > 2 crankshaft revolutions • DTCs not active for VSS, CKP, TP, MAP, ECT, CMP, IAT and MAF sensors • No engine protection faults • No Electronic Throttle Control Faults • P0315 (Crankshaft Position System Variation Not Learned) not active or engine speed < 1000 RPM • Fuel cutoff not active • Power management is not active • Brake torque management not active • Fuel level > 10% (disablement ends 500 after a low fuel level condition ceases, and fuel disable does not occur with a fuel sensor DTC) • -7 C < ECT < 130°C • If ECT at startup < -7 C, then disable until ECT > 21 C • 375 RPM < Engine speed < 5600 RPM • 9 volts < System voltage < 18 volts • + Throttle position delta < 75% per 25 ms • - Throttle position delta < 75% per 25 ms • Power Take Off is disabled • Abnormal engine speed is not present • ABS rough road not detected • ABS/TCS is not active • Positive and zero torque (except the CARB approved 3000 rpm to redline triangle) Positive and zero torque is detected when both is true: 1) engine load > zero torque cal (cal a function of engine speed and temperature), and 2) TPS > 1 or VSS < 30 mph • Detectable engine speed and engine load region • CAM sensor is in sync with CKP sensor • Misfire Diag is not requesting to disable TCC when transmission is in hot mode • Crankshaft Ring Filter inactive (after a low level misfire, another misfire may not be detectable until crankshaft ringing ceases) • Not an automatic transmission shift with a Throttle position >94 999% • Displacement On Demand transition is not in progress 	Emission Exceedence = (5) failed 200 revolution blocks of 16 Failure reported with (1) Exceedence in 1st (16) 200 revolution block, or (4) Exceedences thereafter 1st Catalyst Exceedence = Number of 200 revolution blocks as data supports for catalyst damage 2nd and subsequent Catalyst Exceedences = (1) 200 revolution block with catalyst damage Failure reported with (3) Exceedences in FTP, or (1) Exceedence outside FTP <u>Frequency:</u> Continuous	DTC Type B (MIL Flashes with Catalyst Damaging Misfire)
Crankshaft Position System Variation Not Learned	P0315	Monitor for valid crankshaft error compensation factors	Sum of Compensation Factors are $\geq 4 001$ or $\leq 3 999$	OBD Manufacturer Enable Counter = 0	0 50 seconds <u>Frequency:</u> Continuous 100 ms loop	DTC Type A

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Knock Sensor Module Performance	P0324	This diagnostic will detect a failed internal ECM component associated with knock control	Any Cylinder's Avg Gain Signal > 4.5 if RPM>1500 OR All Cylinder's Actual Signals < 0.2 if RPM>1500	APC >200	50 out of 63 100ms sample rate Continuous	DTC Type B
Knock Sensor Circuit	P0325	This diagnostic checks for an open to the knock sensor	Gated Low Pass Filter Voltage > 4V or < 1.24 V	ECT>-40 and Engine Run Time > 0 PTO not active Temporarily disabled ('Indeterminate' state reported) for samples in which P0327 or P0328 report 'Failed' state	50 out of 63 100ms sample rate Continuous	DTC Type B
Knock Sensor Performance Bank 1	P0326	This diagnostic checks for an overactive knock sensor caused by noisy engine components (e.g. lifters)	Fast Retard ≥ 12	Engine Speed ≥ 500 MAP ≥ 55 No throttle fault No PTO active Fast spark retard active	50 out of 63 100ms sample rate Continuous	DTC Type B
Knock Sensor 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	ECT> -40 and Engine Run Time > 0 PTO not active	50 out of 63 100ms sample rate Continuous	DTC Type B
Knock Sensor 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	ECT> -40 and Engine Run Time > 0 PTO not active	50 out of 63 100ms sample rate Continuous	DTC Type B
Knock Sensor Circuit Bank 2	P0330	This diagnostic checks for an open to the knock sensor	Gated Low Pass Filter Voltage > 4V or < 1.24 V	ECT> -40 and Engine Run Time > 0 PTO not active Temporarily disabled ('Indeterminate' state reported) for samples in which P0332 or P0333 report 'Failed' state	50 out of 63 100ms sample rate Continuous	DTC Type B
Knock Sensor 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	ECT> -40 and Engine Run Time > 0 PTO not active	50 out of 63 100ms sample rate Continuous	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Knock Sensor 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	ECT> -40 and Engine Run Time > 0 PTO not active	50 out of 63 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 3 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 While starter is engaged 2 Continuous – 75 ms 3 Continuous - 2 test failures out of 10 samples	DTC Type B
Crankshaft Position (Ckp) Sensor A Performance	P0336	This diagnostic determines whether a performance fault exists with crank position sensor signal	1 Unable to achieve crank sync 2 Twenty five crank resyncs occur within 25 seconds 3 55 > number of crank pulses received in one engine revolution >61	1 Engine cranking and either CMP pulses being received or MAF >3 grams per second 2 Engine speed > 450 RPM Engine is spinning and no 5V reference or cam position sensor DTCs set	1 While starter engaged – 1 5s 2 Continuous – 1 test failures 3 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 24 MEDRES events 2 No Cam pulses received for 100 engine cycles 3 No Cam pulses received while starter is engaged 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 One time while starter is engaged 2 Continuous – 8 test failures out of 10 samples 3 Continuous – three seconds while starter is engaged 4 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 2 > number of cam pulses received in 24 MEDRES events > 8 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 One time while starter is engaged 2 Continuous – 8 test failures out of 10 samples	DTC Type B
Ignition Control (Cylinders 1-8)	P0351 – P0358	This DTC checks the circuit for electrical integrity during operation Monitors EST for each cylinder	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match	Ignition voltage > 6V	50 out of 63 100ms sample rate Continuous	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Catalyst System Low Efficiency Bank 1	P0420	Oxygen Storage	<p>Normalized Ratio OSC Value ≤ 0.35 (EWMA filtered)</p> <p>Normalized Ratio OSC Value Calculation Information and Definitions =</p> <p>1 Raw OSC Calculation = (post cat O2 Resp time - pre cat O2 Resp time)</p> <p>2 BestFailing OSC value from a calibration table (based on temp and exhaust gas flow)</p> <p>3 WorstPassing OSC value (based on temp and exhaust gas flow)</p> <p>Normalized Ratio Calculation = $(1-2) / (3-2)$</p> <p>A Normalized Ratio of 1 essentially represents a good part and a ratio of 0 essentially represents a very bad part</p>	<p><u>General Enable</u></p> <ul style="list-style-type: none"> 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 <p><u>Valid Idle Period Criteria</u></p> <ul style="list-style-type: none"> Throttle Position < 2% Vehicle Speed ≤ 3 2kph Engine speed ≥ 1000 RPM for a minimum of 10 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 <p><u>Catalyst Idle Conditions Met Criteria</u></p> <p>General Enable met and the Valid Idle Period Criteria met</p> <ul style="list-style-type: none"> Green Converter Delay = Not Active Induction Air > -20 C Induction Air < 85 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 ≥ 45 C ECT ≤ 128 C Barometric Pressure > 70 KPA Idle Time is ≤ 60 seconds \Rightarrow Idle time is incremented if the vehicle speed \leq vehicle speed cal and the throttle position \leq TPS cal as identified in the Valid Idle Period Criteria section Short Term Fuel Trim < 1 10 Short Term Fuel Trim > 0 90 Predicted catalyst temp ≥ 450 C for at least 30 seconds with a closed throttle time ≤ 180 seconds 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 	<p>1 test attempted per valid idle period</p> <p>Minimum of 1 test per trip</p> <p>Maximum of 6 tests per trip</p> <p><u>Frequency:</u></p> <ul style="list-style-type: none"> Fueling Related : 12 5 ms OSC Measurements: 100 ms Temp Prediction: 1000ms <p>Rapid Step Response (RSR) feature will initiate multiple tests:</p> <ul style="list-style-type: none"> If the difference between current EWMA value and the current OSC Normalized Ratio value is ≥ 0.45 The current OSC Normalized Ratio value is ≤ 0.5 <p>Maximum of 6 tests per trip</p> <p>Maximum of 18 tests to detect failure when RSR is enabled</p>	DTC Type A

Comment [G1]:

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Catalyst System Low Efficiency Bank 1 (cont)				<p><u>Idle Stable Criteria :: Must hold true from after Catalyst Idle Conditions Met to the end of test</u></p> <ul style="list-style-type: none"> • MAF >= 4.5 grams per second • MAF <= 20 grams per second • CCP DC Multiplier <= 1 • Predicted catalyst temperature <= 800 degC <p><u>Engine Fueling Criteria at Beginning of Idle Period</u> 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</p> <ul style="list-style-type: none"> • Number of pre-O2 switches >= 1 • Short Term Fuel Trim Avg >= 0.96 • Short Term Fuel Trim Avg <= 1.04 	<p><u>Green Converter Delay Criteria</u> This is part of the check for the Catalyst Idle Conditions Met Criteria section</p> <ul style="list-style-type: none"> • The diagnostic will not be enabled until the following has been met: Predicted catalyst temperature >= 535 C for 3600 seconds non-continuously <p>Note: this feature is only enabled when the vehicle is new and cannot be enabled in service</p>	

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Catalyst System Low Efficiency Bank 2	P0430	Oxygen Storage	<p>Normalized Ratio OSC Value ≤ 0.35 (EWMA filtered)</p> <p>Normalized Ratio OSC Value Calculation Information and Definitions =</p> <p>1 Raw OSC Calculation = (post cat O2 Resp time - pre cat O2 Resp time)</p> <p>2 BestFailing OSC value from a calibration table (based on temp and exhaust gas flow)</p> <p>3 WorstPassing OSC value (based on temp and exhaust gas flow)</p> <p>Normalized Ratio Calculation = $(1-2) / (3-2)$</p> <p>A Normalized Ratio of 1 essentially represents a good part and a ratio of 0 essentially represents a very bad part</p>	<p><u>General Enable</u></p> <ul style="list-style-type: none"> 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 <p><u>Valid Idle Period Criteria</u></p> <ul style="list-style-type: none"> Throttle Position < 2% Vehicle Speed ≤ 3 2kph Engine speed ≥ 1000 RPM for a minimum of 10 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 <p><u>Catalyst Idle Conditions Met Criteria</u></p> <p>General Enable met and the Valid Idle Period Criteria met</p> <ul style="list-style-type: none"> Green Converter Delay = Not Active Induction Air > -20 C Induction Air < 85 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 ≥ 45 C ECT ≤ 128 C Barometric Pressure > 70 KPA Idle Time is ≤ 60 seconds \Rightarrow Idle time is incremented if the vehicle speed \leq vehicle speed cal and the throttle position \leq TPS cal as identified in the Valid Idle Period Criteria section Short Term Fuel Trim < 1 10 Short Term Fuel Trim > 0 90 Predicted catalyst temp ≥ 450 C for at least 30 seconds with a closed throttle time ≤ 180 seconds 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 	<p>1 test attempted per valid idle period</p> <p>Minimum of 1 test per trip</p> <p>Maximum of 6 tests per trip</p> <p><u>Frequency:</u></p> <ul style="list-style-type: none"> Fueling Related : 12 5 ms OSC Measurements: 100 ms Temp Prediction: 1000ms <p>Rapid Step Response (RSR) feature will initiate multiple tests:</p> <ul style="list-style-type: none"> If the difference between current EWMA value and the current OSC Normalized Ratio value is ≥ 0.45 The current OSC Normalized Ratio value is ≤ 0.5 <p>Maximum of 6 tests per trip</p> <p>Maximum of 18 tests to detect failure when RSR is enabled</p>	DTC Type A

Comment [G2]:

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Catalyst System Low Efficiency Bank 2 (Cont)				<p><u>Idle Stable Criteria :: Must hold true from after Catalyst Idle Conditions Met to the end of test</u></p> <ul style="list-style-type: none"> • MAF >= 4.5 grams per second • MAF <=20 grams per second • CCP DC Multiplier <= 1 • Predicted catalyst temperature <= 800 degC <p><u>Engine Fueling Criteria at Beginning of Idle Period</u> 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</p> <ul style="list-style-type: none"> • Number of pre-O2 switches >= 1 • Short Term Fuel Trim Avg >= 0.96 • Short Term Fuel Trim Avg <= 1.04 	<p><u>Green Converter Delay Criteria</u> This is part of the check for the Catalyst Idle Conditions Met Criteria section</p> <ul style="list-style-type: none"> • The diagnostic will not be enabled until the following has been met: Predicted catalyst temperature >= 535 C for 3600 seconds non-continuously • Note: this feature is only enabled when the vehicle is new and cannot be enabled in service 	

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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.	<p><u>SMALL LEAK TEST FAIL:</u> Engine Off Natural Vacuum (EONV) while the engine is off. The total pressure change achieved during the test is normalized against a target value that is based upon fuel level and ambient temperature (values range from 2.2 to 2.2 inches of water). The normalized value is entered into EWMA (with 0= perfect pass and 1=perfect fail). Once EWMA exceeds the fail threshold, the DTC light is illuminated. The DTC light can be turned off if the EWMA falls below the re-pass threshold for 3 consecutive trips.</p> <p>Fail threshold = 0.71 Re-Pass threshold = 0.35</p>	<p><u>TEST ENABLE:</u> No MAP DTC's No Thermostat Rationality DTC's VS Sensor DTC's not active No Fuel Tank Pressure Sensor circuit DTC's No EVAP Canister Purge Solenoid circuit DTC's No EVAP Canister Vent Solenoid circuit DTC's No Fuel Level DTC's ECT Sensor DTC's not active IAT Sensor DTC's not active EVAP CCP stuck open DTC not active EVAP large leak DTC not active Ignition off timer DTC not active Canister Vent restriction DTC is not active Fuel Level >15.0% but < 85.0% Drive time >= 600 seconds Drive length >= 5 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</p> <p>Estimate of Ambient Air Temperature Valid Conditions 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 4 minutes and 3 kilometers)</p>	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 9 under normal conditions Run length is 2 to 6 trips after code clear or non-volatile reset
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 (9 volts < Ignition < 18 volts)	20 failures in a 25 sample test 250 msec / sample	DTC Type B

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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 > 12 00 "H2O for 5 seconds BEFORE Purge Volume > 10 liters OR Vented Vacuum < -2.5 in H2O or Vented Vacuum > 5 in H2O for 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 DTC's No TP Sensor DTC's No VSS DTC's No IAT DTC's No ECT DTC's No Fuel Tank Pressure Sensor circuit DTC's No Evap Canister Purge solenoid circuit DTC's No EVAP Canister Vent Solenoid circuit DTC's No Thermostat Rationality DTC's 15 % < Fuel Level < 85 % 11 00 V < System Voltage < 18 00 V 4 C < IAT < 30 C ECT < 35 C BARO > 74 00 kPa (8000 ft)	Once per Cold Start Time is dependent on driving conditions Max before test abort is 1000 seconds	DTC Type B
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 (9 volts < Ignition < 18 volts)	20 failures in a 25 sample test 250 msec / sample	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

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Fuel Tank Pressure (Ftp) Sensor Circuit Low Voltage	P0452	This DTC will detect a fuel tank pressure sensor signal that is too low out of range	Fuel tank pressure sensor signal < 0.1 volts produces a failing sample Otherwise, the sample is considered passing	<ul style="list-style-type: none"> 0.10 second delay after sensor power up for sensor warm-up ECM State <> crank 	<u>Frequency:</u> Continuous 100ms loop If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC	DTC Type B
Fuel Tank Pressure (Ftp) Sensor Circuit High Voltage	P0453	This DTC will detect a fuel tank pressure sensor signal that is too high out of range	Fuel tank pressure sensor signal > 4.9 volts produces a failing sample Otherwise, the sample is considered passing	<ul style="list-style-type: none"> 0.10 second delay after sensor power up for sensor warm-up ECM state <> crank 	<u>Frequency:</u> Continuous 100ms loop If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC	DTC Type B
Fuel Tank Pressure (Ftp) Sensor Circuit Intermittent	P0454	This DTC will detect intermittent tank vacuum sensor signals that would have caused the engine-off natural vacuum small leak test to abort due to an apparent re-fueling event	If an abrupt change in tank vacuum is detected the engine-off natural vacuum test is aborted due to an apparent refueling event. Subsequent to the abort, a refueling rationality test is executed to confirm that a refueling event occurred. If a refueling is confirmed, then the test sample is considered passing. Otherwise, the sample is considered failing indicating an intermittent signal problem. The abrupt change is defined as a change > 0.45 and < 1.0 "H2O vacuum in the span of 1.0 seconds A refueling event is confirmed if the fuel level has a persistent change of 10.0% for 30 seconds	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

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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	<p>Purge volume > 14 liters BEFORE Tank vacuum < 11 "H₂O</p> <p>2 liters of fuel must be consumed after setting the DTC active the first time to set the DTC active the second time</p> <p><u>Weak Vacuum Follow-up Test</u> (fuel cap replacement test) Weak Vacuum Test failed Passes if tank vacuum > 11 " H₂O</p> <p>Note: Weak Vacuum Follow-up Test can only report a pass</p>	<p><u>General Test Enable</u></p> <ul style="list-style-type: none"> • No MAP DTC's • No TP Sensor DTC's • No VSS DTC's • No IAT DTC's • No ECT DTC's • No Fuel Tank Pressure circuit Sensor DTC's • No Evap Canister Purge solenoid circuit DTC's • No EVAP Canister Vent Solenoid circuit DTC's • No Thermostat Rationality DTC's • 15 % < Fuel Level < 85 % • 11 00 V < System Voltage < 18 00 V • 4 C < IAT < 30 C • ECT < 35 C • BARO > 74 00 kPa (8000 ft) <p style="text-align: center;">Cold Start Test</p> <ul style="list-style-type: none"> • IAT < 30 C • Cold temperature Δ(ECT-IAT): < 8 C if ECT > IAT • Cold Test Timer < 1000 seconds 	<p>Once per cold start</p> <p>Time is dependent on driving conditions</p> <p>Max before test abort is 1000 seconds</p> <p><u>Weak Vacuum Follow-up Test</u> With large leak detected, the follow-up test is limited to 1300 seconds Once the MIL is on, the follow-up test runs indefinitely</p>	DTC Type B
Fuel Level No Change, Stuck In Range Primary Tank	P0461	This DTC will detect a fuel sender stuck in range	IF Delta Fuel Volume change less than 10 liters over an accumulated 241 4 Kilometers	No VSS DTC's set Engine Running	Continuous	DTC Type B
Fuel Level Stuck Low Primary Tank	P0462	This DTC will detect a fuel sender stuck out of range low	Fuel level Sender % of 5V range < 10 %	runs continuously	240 failures out of 300 samples 1 sample = 100 ms Continuous	DTC Type B
Fuel Level Stuck High Primary Tank	P0463	This DTC will detect a fuel sender stuck out of range high	Fuel level Sender % of 5V range > 70%	runs continuously	240 failures out of 300 samples 1 sample = 100 ms Continuous	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel 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	<p>If a change in fuel level is detected the engine-off natural vacuum test is aborted due to an apparent refueling event Subsequent to the abort, a refueling rationality test is executed to confirm that a refueling event occurred If a refueling is confirmed, then the test sample is considered passing Otherwise, the sample is considered failing indicating an intermittent signal problem</p> <p>The refuel event is defined as a change of 10% fuel level during the engine-off test</p> <p>A refueling event is confirmed if the fuel level has a persistent change of 10 % for 30 seconds</p>	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	<p>This test is executed during an engine-off natural vacuum small leak test The test can only execute up to once per engine-off period</p> <p>The length of the test is determined by the refueling rationality test, which can take up to 600 seconds to complete</p> <p>The test will report a failure if 2 out of 3 samples are failures</p>	DTC Type A
Primary Cooling Fan Relay Control Circuit Malf (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 (9 volts < Ignition < 18 volts) Engine speed greater than 400 rpm	20 failures in a 25 sample test 250 msec / sample	DTC Type B (Not used on systems with Mechanical Fan)
Secondary Cooling Fan Relay Control Circuit Malf (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 (9 volts < Ignition < 18 volts) Engine speed greater than 400 rpm	20 failures in a 25 sample test 250 msec / sample	DTC Type B (Not used on systems with Mechanical Fan)
Cooling Fan System Performance	P0483	Detects a large error between the commanded fan RPM and the actual fan RPM	The raw residual (measured fan speed – commanded) is weighted based on ECT temperature, intake air temperature, and input shaft speed This weighted residual is then EWMA filtered to produce a weighted filtered residual A failure is detected if the weighted filtered residual is outside the window of -600 RPM to +300 RPM	No EV Cooling Fan Sensor Circuit DTC present Engine is running System voltage > 10 volts IAT > -7 C EV Fan is commanded on The weighting factors are EWMA filtered This total filtered weighting > 0.6	Continuous when the EV fan is being commanded on Length of time will be based on driving and environmental conditions	DTC Type B (EV Fan applications Only)
Cooling Fan Overspeed	P0493	Indicates the cooling fan is in an overspeed condition	Cooling fan speed sensor is > 6500 RPM)	Engine speed is > 1400 RPM	2 / 2 counts 1 count/ 100msec Continuous	DTC Type A (EV Fan applications Only)

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Cooling Fan Speed High	P0495	Detects the cooling fan is spinning too fast when it is not commanded on	Cooling Fan RPM is > fan drag speed This is a lookup table of input shaft speed (RPM) vs Fan RPM	Engine is running System voltage is > 10 volts IAT > -7 C EV Cooling Fan is not commanded on Fluid clutch is pumped out (< 0 011 cc)	800 / 1000 counts 1 count/ 100msec Continuous	DTC Type B (EV Fan applications Only)
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 > 10 "H2O for 5 00 sec BEFORE Test time > 60 seconds (cold start)	<u>General Test Enable</u> <ul style="list-style-type: none"> • No MAP DTC's • No TP Sensor DTC's • No VSS DTC's • No IAT DTC's • No ECT DTC's • No Fuel Tank Pressure Sensor circuit DTC's • No EVAP canister purge solenoid circuit DTC's • No EVAP Canister Vent Solenoid circuit DTC's • No Thermostat Rationality DTC's • 15 % < Fuel Level < 85 % • 11 00 V < System Voltage < 18 00 V • 4 C < IAT < 30 C • ECT < 35 C • BARO > 74 00 kPa (8000 ft) <p style="text-align: center;">Cold Start Test</p> <ul style="list-style-type: none"> • IAT < 30 C • Cold temperature Δ(ECT-IAT): < 8 C if ECT > IAT • Cold Test Timer < 1000 seconds 	Once per cold start Cold start: max time is 1000 seconds	DTC Type B
Vehicle Speed Sensor Circuit Low Voltage	P0502	Lack of activity in the VSS circuit	Transmission output speed ≤ (200/Final Drive Ratio) RPM	No TPS or VSS intermittent DTCs Engine Running 9 V < System Voltage < 18 V Engine Torque Inaccurate not True TPS ≥ 8 % Transmission Fluid Temperature ≥ -40°C 1500 RPM < Engine speed < 6500 RPM VSS < 200 KPH 50 Nm < Engine torque < 8192 Nm	Fail Time = 4 5 sec Continuous	DTC Type B (Manual Applications Only)
Vehicle Speed Sensor Circuit Intermittent	P0503	Intermittent fault in the VSS circuit	Transmission output speed must drop by (1200/Final Drive Ratio) RPM in 0 025 secs	Engine running 9 V < System Voltage < 18 V 1500 RPM < Engine speed < 6500 RPM VSS < 200KPH Engine Speed change < 500 RPM in 2 0 sec Output Speed ≥ (1000/Final Drive Ratio) for ≥ 2 0 sec Input Speed ≤ 500 for ≥ 2 0 sec Positive Output Speed Change ≤ (500/Final Drive Ratio) for ≥ 2 0 sec	Fail time = 3 25 sec Continuous	DTC Type B (Manual Applications Only)

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE																				
Idle System - Low Engine Speed	P0506	This DTC will determine if a low idle exists	RPM < Desired RPM by an amount determined in a look up table based on engine coolant <table border="0"> <tr><td>ECT</td><td>value</td></tr> <tr><td>56</td><td>-100</td></tr> <tr><td>68</td><td>-100</td></tr> <tr><td>80</td><td>-100</td></tr> <tr><td>92</td><td>-100</td></tr> <tr><td>104</td><td>-100</td></tr> <tr><td>116</td><td>-100</td></tr> <tr><td>128</td><td>-100</td></tr> <tr><td>140</td><td>-3200</td></tr> <tr><td>152</td><td>-3200</td></tr> </table>	ECT	value	56	-100	68	-100	80	-100	92	-100	104	-100	116	-100	128	-100	140	-3200	152	-3200	No MAF, MAP, IAT, ECT, TP, Injector, Fuel System, Misfire, ETC, VSS or Purge DTC's TCM Communication Fault not active Engine Run > 60 sec ECT > 60 C BARO > 65 kPa IGN voltage > 9 volts but < 18 volts IAT > -10 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 > 2 seconds to enable diagnostic test	Time for each test: Within pass criteria continuously for 12 seconds Outside of fail criteria continuously for 8 seconds 3 tests to fail; must leave enable criteria between each test Frequency: Continuous after enable 100ms loop	DTC Type B
ECT	value																									
56	-100																									
68	-100																									
80	-100																									
92	-100																									
104	-100																									
116	-100																									
128	-100																									
140	-3200																									
152	-3200																									
Idle System - High Engine Speed	P0507	This DTC will determine if a high idle exists	RPM > Desired RPM by an amount determined in a look up table based on engine coolant <table border="0"> <tr><td>ECT</td><td>value</td></tr> <tr><td>56</td><td>200</td></tr> <tr><td>68</td><td>200</td></tr> <tr><td>80</td><td>200</td></tr> <tr><td>92</td><td>200</td></tr> <tr><td>104</td><td>200</td></tr> <tr><td>116</td><td>200</td></tr> <tr><td>128</td><td>200</td></tr> <tr><td>140</td><td>3200</td></tr> <tr><td>152</td><td>3200</td></tr> </table>	ECT	value	56	200	68	200	80	200	92	200	104	200	116	200	128	200	140	3200	152	3200	No MAF, MAP, IAT, ECT, TP, Injector, Fuel System, Misfire, ETC, VSS or Purge DTC's TCM Communication Fault not active Engine Run > 60 sec ECT > 60 C BARO > 65 kPa IGN voltage > 9 volts but < 18 volts IAT > -10 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 > 2 seconds to enable diagnostic test	Time for each test: Within pass criteria continuously for 12 seconds Outside of fail criteria continuously for 12 seconds 3 tests to fail; must leave enable criteria between each test Frequency: Continuous after enable 100ms loop	DTC Type B
ECT	value																									
56	200																									
68	200																									
80	200																									
92	200																									
104	200																									
116	200																									
128	200																									
140	3200																									
152	3200																									
Engine Oil Pressure Sensor Performance	P0521	This diagnostic determines if the oil pressure sensor is stuck out of range	The filtered difference between actual engine oil pressure and predicted engine oil pressure (a function of engine speed and engine oil temperature) is either greater than 47 kPa or less than -50 kPa	Oil temp less than 140C Engine speed between 1000 and 3500 Engine run flag true	Sample rate of 100ms loop	DTC Type B (DoD Applications Only)																				
Engine Oil Pressure Circuit Low	P0522	This diagnostic determines if the oil pressure sensor circuit has low voltage	Voltage <2% engine oil pressure will set DTC	Run crank true	50 fail counts out of 63 samples Sample rate of 50ms	DTC Type B (DoD Applications Only)																				

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Engine Oil Pressure Circuit High	P0523	This diagnostic determines if the oil pressure sensor circuit has high voltage	Voltage > 87.5% engine oil pressure will set DTC	Run crank true	50 counts out of 63 samples will fail Sample rate of 50ms	DTC Type B (DoD Applications Only)
Cooling Fan Speed Sensor Circuit	P0526	Detects a continuous open or short condition with the cooling fan sensor input circuit(s)	Fan speed < 4 RPM	Engine is running System voltage is > 10 volts	900 / 1200 counts 1 count/ 100msec Continuous	DTC Type B (EV Fan Applications Only)
Brake Booster Pressure Sensor Performance	P0556	This DTC determines if the Brake Booster Vacuum sensor is stuck or skewed within the normal operating range by comparing the engine vacuum to the brake booster vacuum when the engine is producing a large amount of vacuum	The engine vacuum value is compared to the brake booster vacuum sensor value when the throttle has been below a calibrated value for a calibrated period of time When the throttle once again exceeds the calibrated value, the min and max vacuum sensor values are normalized and subtracted from a EWMA value of 1 A properly operating vacuum sensor would have a normalized result of 1 or greater. If the normalized result is greater than 1 it is considered 1. The EWMA value would be 0 in a passing system. EWMA fail threshold > 0.69 EWMA re-pass threshold < 0.59	No TPS or MAP faults	6.25ms loop	DTC Type B (Applications with Brake Booster Sensors Only)
Brake Booster Pressure Sensor Circuit Low	P0557	This DTC detects a continuous short to low or open in either the signal circuit or the Brake Booster Vacuum sensor	Voltage < 2% will turn on DTC	No TPS or MAP faults	Fail 320 out of 400 samples to fail 6.25ms loop	DTC Type B (Applications with Brake Booster Sensors Only)
Brake Booster Pressure Sensor Circuit High	P0558	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the Brake Booster Vacuum sensor	Voltage > 98% will turn on DTC	No TPS or MAP faults	Fail 320 out of 400 samples to fail 6.25ms loop	DTC Type B (Applications with Brake Booster Sensors Only)

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Control Module Read Only Memory (Rom)	P0601	This DTC will be stored if any software or calibration checksum is incorrect	Calculated Checksum does not match stored checksum	Ignition in Run or Crank	1 failure if it occurs during the first ROM test of the ignition cycle, otherwise 5 failures <u>Frequency:</u> Runs continuously in the background	DTC Type A
Control Module Not Programmed	P0602	Indicates that the ECM needs to be programmed	This DTC is set via calibration	Ignition in Run or Crank	Runs once at 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 in Run or Crank	1 failure <u>Frequency:</u> Once at power-up	DTC Type A
Control Module Random Access Memory (Ram)	P0604	Indicates that ECM 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 <u>Frequency:</u> Runs continuously in the background	DTC Type A

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Processor Performance Check - Learn Corruption Fault Main & Motor Processor 1 Processor Performance Check - Throttle limiting Fault 2 Processor Performance Check - ETC software is not executed in proper order 3 Processor Performance Check 4 Processor Performance Check - SPI failed 5 Processor Performance Check - motor processor state of health (Main) 6 Processor Performance Check - Learn Corruption Fault (Main&motor processor) 7 Processor Performance Check - Learn Corruption Fault MAIN & motor processor 8 Processor Performance Check - motor processor state of health (Main) Processor Performance Check - MAIN state of health (motor processor)	P0606	Indicates that the ECM has detected an ETC internal processor integrity fault	1 MHC processor detects throttle limiting fault 2 Software tasks loops > schedule tasks loop 3 Loss of SPI communication from the motor processor 4 1 5 msec < Average motor processor state of health toggle > 2 5 msec 5 TPS or APPS minimum learned values fail compliment check 6 TPS or APPS minimum learned values fail range check 7 Motor processor integrity check error occurs 8 Motor processor integrity check error of main processor occurs	Ignition in unlock/accessory, run or crank System voltage>5 23 V	1 187 5 ms in the MHC processor 2 Error > 5 times of loop time; loop time are 12 5, 25,50,100 and 250 ms in the main processor 3 159/400 counts or 15 counts continuous; 39 counts continuous @ initialization, 4 counts/ 10 counts at initialization, 50 msec/count in the main processor, 487 5ms in MHC processor 5 187 5ms continuous/100 ms intermittent in the main processor 6 187 5ms continuous/100 msec intermittent in the main processor	DTC Type A

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Control Module Accelerator Pedal Position (App) System Performance	P060D	Verify that the indicated accelerator pedal position calculation is correct	1 PPS sensor switch fault 2 Difference between Main processor indicated accelerator pedal position and MHC processor indicated accelerator pedal position > 2.5%	1 Ignitions in unlock/ accessory and run, System voltage > 5.23 V 2 Ignition in unlock, accessory, run or crank System voltage > 5.23 V No Comm Fault w/ Main	39 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Control Module Eeprom Error	P062F	Indicates that the NVM Error flag has not been cleared	Last EEPROM write did not complete	Ignition on	1 test failure 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 < 4.43 or > 4.66 Volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V	19/39 counts or 187.5 msec continuous; 12.5 msec/count in main /MHC processor	DTC Type A
Malfunction Indicator Lamp Control Circuit Malf (Odm)	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	RunCrankIgnInRange (9 volts < Ignition < 18 volts) Remote Vehicle Start is not active	20 failures in a 25 sample test 250 msec / sample	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 < 4.43 or > 4.66 Volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V	19/39 counts or 187.5 msec continuous; 12.5 msec/count in main/MHC processor	DTC Type A
Powertrain Relay Control (Odm)	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	RunCrankIgnInRange (9 volts < Ignition < 18 volts)	8 failures in a 10 sample test 250 msec / sample	DTC Type B
Powertrain Relay Feedback Circuit Low	P0689	This DTC is a check to determine if the Powertrain relay is functioning properly	PT Relay feedback voltage is ≤ 5 volts	Powertrain relay commanded "ON" No Powertrain Relay Control output driver fault	5 failures in a 6 sample test 1 second / sample	DTC Type B
Powertrain Relay Feedback Circuit High	P0690	This DTC is a check to determine if the Powertrain relay is functioning properly	PT Relay feedback voltage is ≥ 16 volts Stuck Test: PT Relay feedback voltage is > 2 volts when commanded 'OFF'	Powertrain relay commanded "ON" No Powertrain Relay Control output driver fault	5 failures in a 6 sample test 1 second / sample Stuck Test: 100 msec / sample Continuous failures ≥ 2 seconds	DTC Type B
Fuel System Control Module (FSCM) Requested MIL Illumination	P069E	Monitor FSCM MIL Request to determine when the TCM has detected a MIL illuminating fault	Fuel System Control Module Emissions-Related DTC set requesting MIL illumination	Time since power-up > 3 seconds Time Since Code Clear > 2 seconds Diagnostic System not Disabled for Service Run Crank Active Controller Type = ECM	Continuous 100ms Sample Rate	DTC Type A No MIL (FSCM Equipped vehicles only)
Transmission Control Module (Tcm) Requested Mil Illumination	P0700	Monitor TCM MIL Request to determine when the TCM has detected a MIL illuminating fault	Transmission Emissions-Related DTC set requesting MIL illumination	Time since power-up > 3 seconds Time Since Code Clear > 2 seconds Diagnostic System not Disabled for Service Run Crank Active Controller Type = ECM	Continuous 100ms Sample Rate	DTC Type A No MIL

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Skip Shift Solenoid Control Circuit	P0803	Control circuit voltage is monitored during operation It should be low during operation and near B+ when "off"	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match	Engine is running 9 volts < ignition < 18 volts	20 / 25 counts 1 count/ 250msec	DTC Type B (Manual Transmission Only)
Clutch Pedal Switch B Circuit	P0833	Clutch switch state is monitored during vehicle operation	The ECM detects that a clutch switch state transition has not occurred when the vehicle speed has gone from 0 KPH above a threshold value and back to 0 KPH (Top of Travel)	No VSS codes present VSS > 38kph	9 test failures in a 10 test sample size 100ms Continuous	DTC Type B Manual Transmission Vehicles Only
Traction Control Torque Request Circuit	P0856	Determines if torque request from the EBTCM is valid	For PPEI3 1 Serial Communication 2's complement not equal for message \$1C9 (PPEI3) 2 Serial Communication rolling count value shall be + 1 from previous \$1C9 message (PPEI3) or for PPEI2 1 Serial Communication 2's complement not equal for message \$140 (PPEI2) 2 Serial Communication rolling count value shall be + 1 from previous \$140 message (PPEI2) or for Class2 w/ PWM 4%<=PWM or 95%>= PWM set a fail coun	Torque Reduction Signal Diagnostic Enabled For GMLAN PPEI2 or PPEI3 (KeTCSD_b_GMLAN_DiagEnable == TRUE) No Serial communication loss to TCM (U0108) Engine Running == TRUE Power Mode = Run Traction Control System == Present for GMLAN \$380 (PPEI2) or \$4E9 (PPEI3) message or for Class2 w/ PWM Systems: KbTCSD_NoFreqDiagEnbl == TRUE Traction/Drag Control System == Present for PWM \$2B3C (Class2) message	1 # of Protect Errors >= 10 2 # of Alive Rolling Errors >= 10 in 10 SampleSize # of Samples performed in the 25ms loop or for Class2 w/ PWM Systems: Fail Counts => 10 in 10 # of samples performed in the 50ms loop	Special DTC Type C

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Inlet Airflow System Performance	P1101	This DTC determines if there are multiple air induction problems affecting airflow and/or manifold pressure	Filtered Throttle Error > 200 kPa/grams per second And Filtered Manifold2 Error > 15 kPa And Filtered Pressure1 Error > 15 kPa OR Filtered Airflow Error > 12 grams per second	Engine rpm =>450 and <= 8000 MAP sensor high/low DTCs not active EGR circuit/performance 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 > 70 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

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O2s Insufficient Switching Bank 1 Sensor 1	P1133	This DTC determines if the O2 sensor is no longer sufficiently switching	Half cycle L/R switches < 60 OR Half cycle R/L switches < 60 OR Slope Time L/R switches < 10R Slope Time R/L switches < 1	<u>Common Enable Criteria</u> <ul style="list-style-type: none"> • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's • 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 Inj, and AIR Device controls = Not Active <u>Specific Enable Criteria</u> <ul style="list-style-type: none"> • O2 Heater on for ≥ 0 seconds • B1S1 DTCs = Not Active • Learned heater resistance is valid • Misfire DTC = Not Active • ECT > 60 C • IAT > -40 C • Engine run time > 160 seconds • EVAP Canister purge duty cycle ≥ 0 % • 20 gps ≤ MAF ≤ 55 gps • 1200 ≤ RPM ≤ 3000 • Ethanol percentage < 86 99951 % • Baro > 69 80078 kPa • Throttle position ≥ 4 998779 % • Fuel Level > 10 % • 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 1 second	100 seconds <u>Frequency:</u> Once per trip	DTC Type B

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O2s Insufficient Switching Bank 2 Sensor 1	P1153	This DTC determines if the O2 sensor is no longer sufficiently switching	Half cycle L/R switches < 60 OR Half cycle R/L switches < 60 OR Slope Time L/R switches < 10R Slope Time R/L switches < 1	<u>Common Enable Criteria</u> <ul style="list-style-type: none"> No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTC's 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 Inj, and AIR Device controls = Not Active <u>Specific Enable Criteria</u> <ul style="list-style-type: none"> O2 Heater on for ≥ 0 seconds B2S1 DTCs = Not Active Learned heater resistance is valid Misfire DTC = Not Active ECT > 60 C IAT > -40 C Engine run time > 160 seconds EVAP Canister purge duty cycle ≥ 0 % 20 gps \leq MAF \leq 55 gps 1200 \leq RPM \leq 3000 Ethanol percentage < 86.99951 % Baro > 69.80078 Throttle position ≥ 4.998779 % Fuel Level > 10 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 <p>All of the above met for at least 1 second</p>	100 seconds <u>Frequency:</u> Once per trip	DTC Type B
Engine Coolant Over Temperature - Protection Mode Active	P1258	Monitor for engine protection mode active	ECT temperature ≥ 129.4 C for more than 10 seconds	No ECT sensor DTCs	Set immediately upon engine protection mode active	DTC Type A

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Abs Rough Road Malfunction	P1380	This diagnostic detects if the ABS controller is indicating a fault. When this occurs, misfire will continue to run.	ABS controller sends a message to PCM indicating that a failure has occurred in the ABS module.	VS ≥ 5mph RPM ≤ 7000 Engine Load ≤ 60%	450 failures out of 500 samples 100 msec loop continuous	DTC Special Type C (DTC can only set when a P0300 Light Request is True)
Abs System Rough Road Detection Communication Fault	P1381	This diagnostic detects if the rough road information is no longer being received from the ABS module. When this occurs, misfire will continue to run.	Serial data messages are lost.	VS ≥ 5mph RPM ≤ 7000 Engine Load ≤ 60%	450 failures out of 500 samples 100 msec loop continuous	DTC Special Type C (DTC can only set when a P0300 Light Request is True)
Cold Start Emissions Reduction System Fault	P1400	Model based test computes exhaust thermal energy from elevated idle speed and retarded spark advance. Detects if the cold start emission reduction system has failed resulting in the delivered thermal energy being out of range.	(Average desired accumulated exhaust energy - Average estimated accumulated exhaust energy) < -8.25 kJ/s OR (Average desired accumulated exhaust energy - Average estimated accumulated exhaust energy) > -0.20 kJ/s	<ul style="list-style-type: none"> Cold start emission reduction strategy is active Vehicle speed < 2 kph Throttle position < 2% 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 14 seconds of accumulated qualified data	DTC Type A
Cooling Fan Speed Output Circuit	P1482	Control circuit voltage is monitored during operation. It should be low during operation and near B+ when "off".	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine speed greater than 400 rpm Ignition voltage > 9 volts and < 18 volts	20 / 25 counts 1 count/ 250msec	DTC Type B (Corvette Only)
Throttle Actuator Control (TAC) Module - Throttle Actuator Position Performance	P1516	<ol style="list-style-type: none"> Detect a throttle positioning error Determine if the actuator has been miswired 	<ol style="list-style-type: none"> throttle error ≥ 2% after > 0.4875 sec stability with no change in error sign, OR throttle error > 9.1 % TPS1 < 1.91 Volts 	Ignition in run or crank [(RPM>0 and system voltage > 5.5 Volts) OR (RPM=0 and not in battery saver mode and System voltage > 11 Volts)] No comm. Fault w/ Main TPS min learn not active	187.5ms in the MHC processor	DTC Type A
Ignition Correlation	P1682	Detect a continuous or intermittent Out Of Correlation in the Run/Crank Ignition Voltage & ETC Run/Crank Ignition Voltage.	Run/Crank - ETC Run/Crank > 3 Volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V & Powertrain Relay Commanded on	15/15 counts, 12.5msec loop time, in main processor	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel Level No Change, Stuck In Range Secondary Tank	P2066	This DTC will detect a fuel sender stuck in range	IF Delta Fuel Volume change less than 3 liters over an accumulated 322 kilometers OR If Primary is FULL and Secondary is EMPTY for > 322 kilometers	Fuel level greater than 32 liters No VSS DTC's set Engine Running	Continuous	DTC Type B (For use on vehicles with dual fuel tanks)
Fuel Level Stuck Low Secondary Tank	P2067	This DTC will detect a fuel sender stuck out of range low	Fuel level Sender % of 5V range < 10 %	runs continuously	240 failures out of 300 samples 1 sample = 100 ms Continuous	DTC Type B (For use on vehicles with dual fuel tanks)
Fuel Level Stuck High Secondary Tank	P2068	This DTC will detect a fuel sender stuck out of range high	Fuel level Sender % of 5V range > 70%	runs continuously	240 failures out of 300 samples 1 sample = 100 ms Continuous	DTC Type B (For use on vehicles with dual fuel tanks)
Control Module Throttle Actuator Position Performance	P2101	1 Detect a throttle positioning error 2 Detect excessive motor driver current (PWM)	1 Difference between measured throttle position and modeled throttle position > 9.1 % 2 Motor driver PWM output > Thresh Thresh based on system voltage	1 Ignition in run or crank [(RPM>0 and system voltage > 5.5 Volts) OR (RPM=0 and not in battery saver mode and System voltage > 11 Volts)] Throttle not at default position 2 NA	1 15/15 counts continuous 2 Check runs every 12.5 msec in the main processor	DTC Type A
Accelerator Pedal Position (App) Sensor 1	P2120	1 Detect a continuous or intermittent short or open in the APP sensor #1 on Main processor 2 Detect a continuous or intermittent short or open in the APP sensor #1 on MHC processor	1 APP1 < 0.325 OR APP1 > 4.75 Volts 2 APP1 < 0.325 OR APP1 > 4.75 Volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No 5 Volt reference DTCs	1 19/39counts or 13counts continuous; 12.5 msec/count in the main processor 2 19/39counts or 13counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Accelerator Pedal Position (App) Sensor 1 Lo	P2122	Detect a continuous or intermittent short or open in the APP sensor #1 on Main processor	APP 1 < 0.325 Volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No 5 Volt reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the Main processor	DTC Type A
Accelerator Pedal Position (App) Sensor 1 Hi	P2123	Detect a continuous or intermittent short or open in the APP sensor #1 on Main processor	APP 1 > 4.75 Volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No 5 Volt reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the Main processor	DTC Type A

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Accelerator Pedal Position (App) Sensor 2	P2125	<ol style="list-style-type: none"> 1 Detect a continuous or intermittent short or open in the APP sensor #1 on Main processor 2 Detect a continuous or intermittent short or open in the APP sensor #1 on MHC processor 	<ol style="list-style-type: none"> 1 APP2 < 0.325 OR APP2 > 4.75 Volts 2 APP2 < 0.325 OR APP2 > 4.75 Volts 	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	<ol style="list-style-type: none"> 1 19/39counts or 13counts continuous; 12.5 msec/count in the main processor 2 19/39counts or 13counts continuous; 12.5 msec/count in the MHC processor 	DTC Type A
Accelerator Pedal Position (App) Sensor 2 Lo	P2127	Detect a continuous or intermittent short or open in the APP sensor #2 on Main processor	APP 2 < 0.325 Volts	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the Main processor	DTC Type A
Accelerator Pedal Position (App) Sensor 2 Hi	P2128	Detect a continuous or intermittent short or open in the APP sensor #2 on Main processor	APP 2 > 4.75 Volts	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the Main processor	DTC Type A
Throttle Position (Tp) Sensor 1-2 Correlation	P2135	<ol style="list-style-type: none"> 1 Detects a continuous or intermittent correlation fault between TP sensors #1 and #2 on Main processor 2 Detects a continuous or intermittent correlation fault between TP sensors #1 and #2 on MHC processor 	<ol style="list-style-type: none"> 1 Difference between TPS1 displaced and TPS2 displaced > 7.1% offset at min throttle position with an increasing to 10% at max throttle position 2 Difference between TPS1 displaced and TPS2 displaced > 7.1% offset at min throttle position with an increasing to 10% at max throttle position 	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	<ol style="list-style-type: none"> 1 79/159 counts or 63 counts continuous; 3.125 msec/count in the main processor 2 19/39 counts or 15 counts continuous; 12.5 msec/count in the MHCprocessor 	DTC Type A

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Accelerator Pedal Position (App) Sensor 1-2 Correlation	P2138	Detect an invalid minimum mechanical position correlation between APP sensor #1 and #2	<p>1 Difference between (raw min learned PPS#1 voltage-raw min PPS#1 voltage) and (raw PPS#2 voltage - raw min learned PPS#2 voltage) > 10% offset at min throttle position with an increasing to 10% (0.5v)at max throttle position for Main processor</p> <p>OR</p> <p>2 Difference between (raw min learned PPS#1 voltage-raw min PPS#1 voltage) and (raw PPS#2 voltage - raw min learned PPS#2 voltage) > 10% offset at min throttle position with an increasing to 10% (0.5v)at max throttle position for MHC processor</p>	<p>1 Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTC's</p> <p>2 Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTC's</p>	<p>1 19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the main processor</p> <p>2 19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the MHC processor</p>	DTC Type A
Minimum Throttle Position Not Learned	P2176	TP minimum learning not completed	<p>1 TPS > 0.98 Volts during TPS min learn on the Main processor</p> <p>OR</p> <p>2 TPS > 0.98 Volts during TPS min learn on the MHC processor</p>	<p>Minimum TPS learn active state Stable throttle position reading for 40 msec Ignition in run or crank</p> <p>No TPS circuit DTCs</p>	1.8secs	DTC Type A
Transmission Control Torque Request Circuit	P2544	Determines if torque request from the TCM is valid	<p>1 Serial Communication 2's complement not equal for message \$199 (PTEI3)</p> <p>2 Serial Communication rolling count value shall be + 1 from previous \$199 message (PTEI3)</p> <p>3 2's complement not equal of torque requested value or torque requested type when stored in ECM</p> <p>4 If TCM Requested Torque in message \$199 (PTEI3) > 400</p>	<p>No Serial communication loss to TCM (U0101) Engine Running == TRUE Power Mode = Run Crank Active</p>	<p>1 # of Protect Errors >= 16</p> <p>2 # of Alive Rolling Errors >= 6 in 10 samples</p> <p>3 # of RAM errors >= 3</p> <p>4 # of range errors >= 3 in 10 samples</p> <p>If any the above exist for > 2 seconds then increment fail counter else fail counter is reset</p> <p>If the fail counter is => 2 fault is active</p> <p>Pass diagnostic if none of the above conditions are present for => 2 seconds</p> <p>12.5ms loop</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
ECM/PCM Internal Engine Off Timer Performance	P2610	This DTC determines if the engine off timer does not initialize or count properly Clock rate test: Checks the accuracy of the 1 second timer by comparing it with the 12.5 msec timer	Initial value test: Initial ignition off timer value < 1 sec OR Initial ignition off timer value > 10 sec Clock rate test: <ul style="list-style-type: none"> • Time between ignition off timer increments < 0.8 • Time between ignition off timer increments > 1.2 • Time since last ignition off timer increment > 1.375 seconds • Current ignition off time < old ignition off time • Current ignition off timer minus old ignition off timer ≠ 1.0 	ECM is powered down DTC sets on next key cycle if failure detected -40 C ≤ IAT ≤ 125 C	Initial value test: 50 failures 1.375 sec / sample Clock rate test: 8 failures in a 10 sample test 1 second / sample test runs once each key-off	DTC Type B
Fuel Pump 2 Relay Control Circuit	P2632	This DTC monitors the secondary transfer pump output driver for faults	Either an open circuit, ground short, or power short is detected for 100 out of 120 samples	Run / crank ignition voltage must be in a range from 9 to 18 Volts, and engine RPM must be ≥ 400	100 faults out of 120 samples Invoked every 250 msec	DTC Type B (For use on vehicles with dual fuel tanks)
Fuel Pump 2 Flow Insufficient	P2636	This DTC detects if there is insufficient fuel flow from the secondary to the primary tank	Both primary tank fuel level delta < 3 L and secondary tank fuel level delta < 3 L for 200 sec or more	Engine must be running Vehicle speed must be zero Transfer pump is activated A slosh delay of 20 sec has passed	Continuous	DTC Type B (For use on vehicles with dual fuel tanks)
Four Wheel Drive Lo Switch Circuit	P2771	Detects a continuous Open (stuck off) or Ground (stuck on) in the Four Wheel Drive Low Switch Circuit	<p style="text-align: center;"><u>FAIL CASE 1</u> 4WD Low Switch is Open 2.39 < MTCR < 2.90 Count = 2</p> <p style="text-align: center;"><u>FAIL CASE 2</u> 4WD Low Switch is Grounded 0.80 < MTCR < 1.75 Count = 1</p> <p style="text-align: center;">MTCR = NI / (NO * commanded gear Ratio)</p>	No EPSR, TPS, VSS DTCs Transmission not in Park, Neutral, or Reverse 1000 ≤ Engine Speed ≤ 4500 RPM for 30 sec 9.0 ≤ System Voltage ≤ 18.0 10% ≤ Throttle Position Sensor ≤ 99% 20° C ≤ Transmission Fluid Temperature ≤ 130° C Vehicle Speed ≥ 11.2 km/hr	<p><u>4WD Low Switch Stuck OFF</u> Fail Time = 1.1 sec 2nd Occurrence Continuous</p> <p><u>4WD Low Switch Stuck ON</u> Fail Time = 7.0 sec 1st Occurrence Continuous</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 is an intrusive test which increases or reduces delivered fuel to achieve the required rich or lean threshold.	Post catalyst O2 sensor cannot achieve voltage \geq 730 millivolts and voltage \leq 200 millivolts	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> • Engine Runtime \geq 300 seconds • No O2 circuit, response, heater current, or heater resistance DTC's active • No TP Sensor, ETC, MAF, ECT, MAP, IAT, EVAP, Secondary Air, Fuel Injector DTC's • 10 volts < system voltage < 18 volts • Learned heater resistance is valid • ICAT MAT Burnoff delay is not active <p><u>Specific Enable Criteria:</u></p> <ul style="list-style-type: none"> • No Fuel Trim or Misfire DTC's active • 500 rpm \leq Engine Speed \leq 5000 rpm • 3 gps \leq Airflow \leq 50 gps • 24 kph \leq Vehicle Speed \leq 132 kph • 0.959991 \leq Short term fuel trim \leq 1.0400085 • Fuel state = closed loop • EVAP diagnostic not in control of purge • Ethanol Estimate is not in progress • Fuel Level > 10 % • Post Cell Enabled • Power Take Off is not active • EGR diagnostic is not intrusive <p>All of the above met for at least 1 seconds, and then:</p> <p>Purge Duty Cycle = 0 % For 5 seconds</p>	<p>Up to 550 grams of accumulated air flow for the Lean Test and 550 grams of accumulated air flow for the Rich Test</p> <p><u>Frequency:</u> Once per trip</p> <p><i>Green O2 Sensor Delay Criteria</i> This diagnostic will not be enabled until the following has been met: Total Accumulated Airflow \geq 0 grams</p> <p>Airflow accumulates anytime the engine is running and the current engine airflow is \geq 20 gps. The airflow can accumulate over several engine run cycles until the threshold is reached.</p> <p>Note: This feature is only enabled when the vehicle is new and cannot be enabled in service.</p>	DTC Type B

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 is an intrusive test which increases or reduces delivered fuel to achieve the required rich or lean threshold.	Post catalyst O2 sensor cannot achieve voltage \geq 730 millivolts and voltage \leq 200 millivolts	<p><u>Common Enable Criteria</u></p> <ul style="list-style-type: none"> Engine Runtime \geq 300 seconds No O2 circuit, response, heater current, or heater resistance DTC's active No TP Sensor, ETC, MAF, ECT, MAP, IAT, EVAP, Secondary Air, Fuel Injector DTC's 10 volts < system voltage < 18 volts Learned heater resistance is valid ICAT MAT Burnoff delay is not active <p><u>Stage 2 Specific Enable Criteria:</u></p> <ul style="list-style-type: none"> No Fuel Trim or Misfire DTC's active 500 rpm \leq Engine Speed \leq 5000 rpm 3 gps \leq Airflow \leq 50 gps 24 kph \leq Vehicle Speed \leq 132 kph 0 959991 \leq Short term fuel trim \leq 1 0400085 Fuel state = closed loop EVAP diagnostic not in control of purge Ethanol Estimate is not in progress Fuel Level > 10 % Post Cell Enabled Power Take Off is not active EGR diagnostic is not intrusive <p>All of the above met for at least 1 seconds, and then:</p> <p>Purge Duty Cycle = 0 % For 5 seconds</p>	<p>550 grams of accumulated air flow for the Lean Test and 550 grams of accumulated air flow for the Rich Test</p> <p><u>Frequency:</u> Once per trip</p> <p><i>Green O2 Sensor Delay Criteria</i> This diagnostic will not be enabled until the following has been met: Total Accumulated Airflow \geq 0 grams</p> <p>Airflow accumulates anytime the engine is running and the current engine airflow is \geq 20 gps. The airflow can accumulate over several engine run cycles until the threshold is reached.</p> <p>Note: This feature is only enabled when the vehicle is new and cannot be enabled in service.</p>	DTC Type B
Deactivation System Performance	P3400	Detects a "failed to deactivate" condition	Manifold model 2 Lag – Manifold model 2 Lag in DoD > 10 and Manifold model 2 Lag < -10 while in DoD	<p>Engine rpm \Rightarrow 450 and \leq 8000</p> <p>Time in DoD mode \Rightarrow 2 seconds</p> <p>Time in All Cylinder mode \Rightarrow 2 seconds</p> <p>MAP sensor high/low DTC's not active</p> <p>MAF sensor high/low DTC's not active</p> <p>Crank sensor DTC's not active</p> <p>Engine Coolant DTC's not active</p> <p>Intake Air Temp DTC's not active</p> <p>Engine Coolant > 70 deg C and < 125 deg C</p> <p>Intake Air Temp > -7 deg C and < 125 deg C</p> <p>Total residual weigh factors (filtered) \Rightarrow 0</p>	100 Failures out of 200 samples where a sample is a 100 ms loop while in DoD mode	DTC Type B (DoD Applications Only)
Cylinder 1 Deactivation Solenoid Control Circuit	P3401	Detects shorted or open circuit for the DoD solenoid	20 fail counts out of 25 Sample Counts will fail the diagnostic	<p>Run Crank in Range</p> <p>Engine speed \geq to deac limit</p>	250ms loop time	DTC Type B (DoD Applications Only)

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SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Cylinder 4 Deactivation Solenoid Control Circuit	P3425	Detects shorted or open circuit for the DoD solenoid	20 fail counts out of 25 Sample Counts will fail the diagnostic	Run Crank in Range Engine speed >= to deac limit	250ms loop time	DTC Type B (DoD Applications Only)
Cylinder 6 Deactivation Solenoid Control Circuit	P3441	Detects shorted or open circuit for the DoD solenoid	20 fail counts out of 25 Sample Counts will fail the diagnostic	Run Crank in Range Engine speed >= to deac limit	250ms loop time	DTC Type B (DoD Applications Only)
Cylinder 7 Deactivation Solenoid Control Circuit	P3449	Detects shorted or open circuit for the DoD solenoid	20 fail counts out of 25 Sample Counts will fail the diagnostic	Run Crank in Range Engine speed >= to deac limit	250ms loop time	DTC Type B (DoD Applications Only)
Control Module Communication Bus Off (Automatic Transmission)	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 for 5 failures out of 5 samples		5 sec <u>Frequency:</u> Continuous 1000 ms loop	DTC Type B
Lost Communication With TCM (Automatic Transmission)	U0101	Detects that CAN serial data communication has been lost with the TCM	Lost communication with the TCM while the ignition switch is in the RUN power mode for 12 failures out of 12 samples		12 sec <u>Frequency:</u> Continuous 1000 ms loop	DTC Type B
Lost Communication With Fuel Pump Control Module	U0109	Detects that CAN serial data communication has been lost with the fuel pump control module	Lost communication with the fuel pump control module while the ignition switch is in the RUN power mode for 12 failures out of 12 samples		12 sec <u>Frequency:</u> Continuous 1000 ms loop	DTC Type B (FSCM Equipped vehicles only)

2007MY 5.3L (LY5) GMT921 AUTO TRUCK ENGINE DIAGNOSTIC PARAMETERS

OBD II Group: 07OBDG14

Certification Standard: NW-- Bin 4

Test Group: 7GMXT05.3380

MAP and MAF Delta Criterion based on TPS % for P0068 code

Throtte position %	5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	100.00
Max MAP delta	20.59	21.80	23.12	24.32	19.91	17.88	100.00	100.00	100.00
Max MAF delta	13.97	18.28	22.09	32.31	40.02	44.85	255.00	255.00	255.00

IFRD Residual Weighting Factors (P0101, P0106, P0121)

	Engine Speed																
	0	250	750	1250	1750	2250	2750	3250	3750	4250	4750	5250	5750	6250	6750	7250	9000
TPS residual weight factors	1.000	1.000	1.000	0.564	0.830	0.745	0.601	0.406	0.436	0.533	0.381	0.363	0.509	1.000	1.000	1.000	1.000
MAP2 Residual wt factors	1.000	0.550	0.573	0.373	0.595	0.495	0.415	0.462	0.445	0.587	0.524	0.460	0.359	0.416	1.000	1.000	1.000
MAP1 Residual wt factors	1.000	0.550	0.600	0.431	0.589	0.774	0.803	0.670	0.607	0.650	0.857	0.876	0.683	0.910	1.000	1.000	1.000
MAF Residual wt factors	1.000	1.000	1.000	1.000	0.491	0.559	0.390	0.353	0.187	0.305	0.276	0.220	0.176	0.193	1.000	1.000	1.000
MAF Residual wt factors based on MAF estimate	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

P0116: Fail if powerup ECT exceeds IAT by these values. 5.3L (LY5)

Difference ↓ / IAT →	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
Temperature Difference	65	55	45	35	25	25	25	25	25	25	15	15	15	15	15	15	15

2007MY 5.3L (LY5) GMT921 AUTO TRUCK ENGINE DIAGNOSTIC PARAMETERS

OBD II Group: 070BDG14

Certification Standard: NW-- Bin 4

Test Group: 7GMXT05.3380

P0128: Maximum Accumulated Airflow for IAT and Start-up ECT conditions. 5.3L (LY5)

IAT ↓ / Start-up ECT →	-40	-28	-16	-4	8	20	32	44	56	68	80
IAT > 10°C	17626	17626	17626	17626	17626	15882	14137	12392	10648	8903	7159
10°C ≤ IAT ≥ -7°C	16976	16976	16976	15517	14060	12600	11142	9684	8225	8225	8225

**TABLE - O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153)
Lean-Rich Ave**

Seconds	0.000	0.070	0.080	0.090	0.100	0.110	0.120	0.130	0.140	0.150	0.160	0.170	0.180	0.190	0.200	0.210	64.0	
Rich-Lean Ave	PASS	FAIL	FAIL	FAIL														
0.000	PASS	PASS	FAIL															
0.250	PASS	PASS	PASS															
0.0480.260	FAIL	FAIL	PASS	PASS	FAIL													
0.0600.270	FAIL	FAIL	FAIL	PASS	PASS	FAIL												
0.0720.280	FAIL	FAIL	FAIL	FAIL	PASS	PASS	FAIL											
0.0840.290	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	FAIL										
0.0960.300	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	FAIL									
0.1080.310	FAIL	PASS	PASS	FAIL														
0.1200.320	FAIL	PASS	PASS	FAIL														
0.1320.330	FAIL	PASS	PASS	FAIL														
0.1440.340	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL									
0.1560.350	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	FAIL										
0.1680.360	FAIL	PASS	PASS	PASS	PASS	PASS	FAIL											
0.1800.370	FAIL	PASS	PASS	PASS	PASS	FAIL												
0.1920.380	FAIL	PASS	PASS	PASS	FAIL													
0.2040.390	FAIL	FAIL	FAIL															
2.00064.0	FAIL	FAIL	FAIL															

2007MY 5.3L (LY5) GMT921 AUTO TRUCK ENGINE DIAGNOSTIC PARAMETERS

OBD II Group: 07OBDG14

Certification Standard: NW-- Bin 4

Test Group: 7GMXT05.3380

P0300: Catalyst Damaging Misfire Percentages as a Function of Engine Speed and Load Table: 5.3L (LY5)

Eng. Load ↓ / Eng. RPM →	0 RPM	1000 RPM	2000 RPM	3000 RPM	4000 RPM	5000 RPM	6000 RPM	7000 RPM	8000 RPM
0 Load_In_Percent	10.625	10.625	10.625	7.125	6.25	5	5	5	5
10 Load_In_Percent	10.625	10.625	8.3125	6.25	5.5	5	5	5	5
20 Load_In_Percent	10.625	10.625	8.3125	6.25	5	5	5	5	5
30 Load_In_Percent	10.625	10.625	8.3125	5.5	5	5	5	5	5
40 Load_In_Percent	10.625	10.625	8.3125	5	5	5	5	5	5
50 Load_In_Percent	10	8.3125	6.25	5	5	5	5	5	5
60 Load_In_Percent	8.3	8.3125	5	5	5	5	5	5	5
70 Load_In_Percent	7.125	6.25	5	5	5	5	5	5	5
80 Load_In_Percent	6.25	5.5	5	5	5	5	5	5	5
90 Load_In_Percent	5.5	5	5	5	5	5	5	5	5
100 Load_In_Percent	5	5	5	5	5	5	5	5	5

2007MY 5.3L (LY5) GMT921 AUTO TRUCK ENGINE DIAGNOSTIC PARAMETERS

OBD II Group: 07OBDG14

Certification Standard: NW-- Bin 4

Test Group: 7GMXT05.3380

P0495: EV-Fan Drag Speed Table: 5.3L (LH6)

Drag Speed (RPM) ↓ / Input Shaft Speed (RPM) →	<u>400</u>	<u>800</u>	1200	1600	<u>2000</u>	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400	6800
	508	1000	1100	1200	1345	1350	1560	1730	1780	1800	1800	1800	1800	1800	1800	1800	1800

P0521 Engine Oil Pressure Rationality Weighting Factors									
Speed									
0.00	500.00	900.00	1000.00	1500.00	1750.00	2000.00	3500.00	4000.00	
0.00	0.00	0.00	0.45	0.45	0.45	0.46	0.44	0.00	
Load									
0.00	5.00	10.00	20.00	30.00	50.00	100.00	200.00	399.25	
1.00	1.00	0.50	0.30	0.00	0.00	0.00	0.00	0.00	
Temp									
-40.00	40.00	60.00	80.00	90.00	100.00	120.00	130.00	140.00	
0.58	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.00	
Pressure									
0.00	170.00	250.00	275.00	360.00	375.00	400.00	500.00	600.00	
0.00	0.00	0.10	1.00	1.00	1.00	1.00	0.86	0.00	