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
Cam Phaser Solenoid Circuit Fault	P0013	Checks the cam phaser solenoid circuit for electrical integrity	Output state invalid		10/20 counts 100 msec/count Continuous check	DTC Type B
VCP System Performance (VCP = variable cam phaser)	P0014	Detects a VCP system error by comparing desired and actual VCP position through all operating ranges of VCP control	Actual position/desired position difference is greater than 3.75 degrees when VCP is commanded and stabilization of 3 secs is met	No cam phaser DTCs VCP is commanded VCP commanded position is stable within 0.9 degrees for 1 sec System voltage ≥ 11 V	135/150 counts 100 msec/count Continuous check when VCP is commanded	DTC Type B
Camshaft Position Sensor-B Bank-1 Correlation (Encoded Cam Sensor)	P0017	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position (Cam to crank Correlation Diagnostic)	Cam sensor pulse < 57.88 degrees or > 73.47 degrees before LoRes crank pulse	IF[CAM_TYPE = ENCODED_CAM AND CAM_TYPE ≠ CSI_CAM AND Engine_Running = TRUE AND Crank_Sync_Flag = Crank_In_Sync AND Cam_Phaser_Position = PARKED AND Fault_Pending[CMP_CKT_Perf] = FALSE AND Fault_Active [CMP_CKT] = FALSE AND Fault_Active [CKP_SnsrA_Ckt] = FALSE AND Fault_Active [CKP_SnsrA_Perf] = FALSE AND Fault_Active [CKP_SnsrB_Ckt] = FALSE AND Fault_Active [CKP_SnsrB_Perf] = FALSE AND Fault_Active [CKP_SnsrAB_Corr] = FALSE] THEN ENABLE DIAGNOSTIC ELSE DISABLE DIAGNOSTIC ENDIF	25 out of the last 35 cam rotations occur with 2 cam sensor pulses outside of malfunction criteria window Continuous check	DTC Type B
HO2S Heater Control Circuit Bank 1 Sensor 1	P0030	This DTC checks the Heater Output Driver circuit for electrical integrity	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11volts < Ignition Voltage < 18 volts • RPM > 425	10 failures out of 12 samples Frequency: 250ms loop Continuous	DTC Type B
HO2S Heater Control Circuit Bank 1 Sensor 2	P0036	This DTC checks the Heater Output Driver circuit for electrical integrity	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • RPM > 425	10 failures out of 12 samples Frequency: 250ms loop Continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
HO2S Heater Resistance Bank 1 Sensor 1	P0053	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	3.7 < Calculated Heater resistance < 8.9	• Coolant – IAT < 140ºC • Engine Soak Time > 36000 Seconds • -30 ºC < Coolant Temp < 45ºC • Coolant Fault = Not Active • Ignition Off Timer Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18	Once per valid cold start.	DTC Type B
HO2S Heater Resistance Bank 1 Sensor 2	P0054	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	3.6 < Calculated Heater resistance < 10.3	• Coolant – IAT < 140ºC • Engine Soak Time > 36000 Seconds • -30 ºC < Coolant Temp < 45ºC • Coolant Fault = Not Active • Ignition Off Timer Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18	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	1. Difference between measured MAP and estimated MAP < 20 kPa 2. Difference between measured MAF and estimated MAF < 25 grams/sec	Engine running No PCM processor, throttle actuation DTCs	187.5 msec Continuous in the main processor	DTC Type A
Mass Airflow (MAF) Sensor Performance	P0101	Determines if the MAF sensor is stuck within the normal operating range	1. Filtered airflow error > 15 grams/sec 2. Filtered manifold pressure 2 error > 20 kPa 3. Filtered throttle error < 350 kPa grams/sec	No MAF circuit, MAP circuit, EGR, ECT circuit, IAT circuit, crank sensor DTCs 375 RPM < Engine speed 70°C < ECT < 125°C -7°C < IAT < 125°C	Immediate Frequency: 12.5 msec loop Continuous check	DTC Type B
MAF Sensor Circuit Low Frequency	P0102	Detects a MAF sensor output that is out of the operating range low or continuous short to low or open in either the signal circuit or the MAF sensor.	MAF sensor signal < 900 Hz	Engine run time > 5 secs Engine speed > 300 RPM 11 V < System voltage Enable criteria stable time > 0.5 secs	30/40 counts 80 counts/sec Continuous check	DTC Type B
MAF Sensor Circuit High Frequency	P0103	Detects a MAF sensor output that is out of the operating range high.	MAF sensor signal >14500 Hz	Engine run time > 5 secs Engine speed > 300 RPM 11 V < System voltage Enable criteria stable time > 0.5 secs	30/40 counts 80 counts/sec Continuous check	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Manifold Absolute Pressure (MAP) Sensor 1 Performance	P0106	Determines if the MAP sensor is stuck within the normal operating range.	1. Filtered manifold pressure 1 error > 20 kPa 2. Filtered manifold pressure 2 error > 20 kPa 3. Filtered throttle error < 350 kPa grams/sec	No MAF circuit, MAP circuit, EGR, ECT circuit, IAT circuit, crank sensor DTCs 375 RPM < Engine speed 70°C < ECT < 125°C -7°C < IAT < 125°C	Immediate Frequency: 12.5 msec loop Continuous check	DTC Type B
MAP Circuit Low Input	P0107	Detects a continuous short to low or open in either the signal circuit or the MAP sensor.	MAP < 1.0% of 5 V reference	No TPS, 5 V reference DTCs Controller State = RUN [(TPS ≥ 0% & Engine speed ≤ 1100 RPM) or (TPS ≥ 10% & Engine speed > 1100 RPM)]	320/400 counts 20 counts/sec Continuous check	DTC Type B
MAP Circuit High Input	P0108	Detects a continuous short to high or open in either the signal circuit or the MAP sensor.	MAP > 98.0% of 5 V reference	No TPS, 5 V reference DTCs Controller State = RUN Engine run time > table value based on start-up coolant temperature [(TPS < 29% & Engine speed ≤ 1100 RPM) or (TPS < 70% & Engine speed > 1100 RPM)]	320/400 counts 20 counts/sec Continuous check	DTC Type B
IAT Sensor Circuit Low Voltage	P0112	This DTC determines if the IAT sensor is out of range or shorted low by checking for an IAT sensor resistance below a threshold	IAT resistance < 45 Ω	No ECT, VSS DTCs ECT < 110°C VSS ≥ 40.2 KPH Engine run time > 10 sec	50/100 counts 4 counts/sec Continuous check	DTC Type B
IAT Sensor Circuit High Voltage	P0113	Determines if the IAT sensor is out of range or shorted high by checking for an IAT sensor resistance above a threshold	IAT resistance > 163,000 Ω	No ECT, VSS, MAF DTCs set ECT ≥ 50°C VSS < 1.6 KPH MAF < 12 grams/sec Engine run time > 10 sec	50/100 counts 4 counts/sec Continuous check	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
ECT Sensor Performance	P0116	This DTC detects if the engine coolant sensor is biased high while in range	A failure will be reported if any of the following occur: ECT at power up > IAT at power up by KtECTD_T_HSC_FastFailTempDiff _after a minimum 8 hour soak (fast fail). ECT at power up > IAT at power up by 15.75°C after a minimum 8 hour soak and a block heater has not been detected. ECT at power up > IAT at power up by 15.75°C after a minimum 8 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 2.5%.	A failure will be reported if any of the following occur: ECT at power up > IAT at power up by KtECTD_T_HSC_FastFailTempDiff _after a minimum 8 hour soak (fast fail). ECT at power up > IAT at power up by 15.75°C after a minimum 8 hour soak and a block heater has not been detected. ECT at power up > IAT at power up by 15.75°C after a minimum 8 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 2.5%.	Frequency: 100 ms loop Continuous	DTC Type B
ECT Sensor Circuit Low Voltage	P0117	Determines if the ECT sensor is shorted low by checking for an ECT sensor resistance below a threshold	ECT resistance < 25 Ω	No IAT DTCs IAT ≤ 70 °C Or Engine run time ≥ 10 sec	50/100 counts 1 count/sec Continuous check	DTC Type B
ECT Sensor Circuit High Voltage	P0118	Determines if the ECT sensor is shorted high by checking for an ECT sensor resistance above a threshold	ECT resistance > 1800000 Ω	No IAT DTCs IAT ≥ -7 °C Or Engine run time ≥ 60 sec	50/100 counts 1 count/sec Continuous check	DTC Type B
Throttle Position (TP) Sensor 1 Circuit	P0120	Detects a continuous or intermittent short or open in TP sensor #1 circuit	0.275 V > TPS > 4.725 V	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	20/40 counts; 10 counts continuous; 12.5 msec /count in the motor processor	DTC Type A
Throttle Position (TP) Sensor 1 Performance	P0121	Determines if the TP sensor is stuck within the normal operating range	1. Filtered throttle error > 350 kPa grams/sec 2. Filtered manifold pressure 2 error < 20 kPa	No MAF circuit, MAP circuit, EGR, ECT circuit, IAT circuit, crank sensor DTCs 375 RPM < Engine speed 70°C < ECT < 125°C -7°C < IAT < 125°C	Immediate Frequency: 12.5 msec loop Continuous	DTC Type B
Throttle Position (TP) Sensor 1 Circuit OOR Low	P0122	Detects a continuous or intermittent short or open in TP sensor #1 circuit	0.275V > Raw TPS sensor signal	Ignition in unlock/accessory, run or crank Ignition Voltage > 5.23 V No Vref Fault	20/40 Counts 10 Counts Continuous 12.5 ms /Ct in the MCP	DTC Type A MIL

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Throttle Position (TP) Sensor 1 Circuit OOR High	P0123	Detects a continuous or intermittent short or open in TP sensor #1 circuit	Raw TPS sensor signal > 4.725 V	Ignition in unlock/accessory, run or crank Ignition Voltage > 5.23 V No Vref Fault	20/40 Counts 10 Counts Continuous 12.5 ms /Ct in the MCP	DTC Type A MIL
Engine Coolant Temperature (ECT) Below Thermostat Regulating Temperature	P0128	Detects if the engine coolant temperature rises too slowly due to an ECT sensor or cooling system fault	Actual accumulated airflow > predicted accumulated airflow and engine coolant temperature <77°C Airflow is accumulated every sec if 10 grams/sec < MAF < 40 grams/sec	No MAF, IAT, VSS, ECT circuit DTCs Start up ECT < 72 °C Minimum average airflow > 5 grams/sec VSS > 8 KPH for .5 kilometer 30 secs < Engine run time < 1800 secs IAT $\geq$ -7 °C	30 secs 1 sec loop Frequency: Once per ignition cycle	DTC Type B
O2S Circuit Low Voltage Bank 1 Sensor 1	P0131	This DTC determines if the O2 sensor circuit is shorted to low.	O2 sensor voltage < 50 millivolts	Common Enable Criteria • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • 0.99 $\leq$ Equivalence ratio $\leq$ 1.01 • 15 % $\leq$ throttle position $\leq$ 50 % • Fuel state = closed loop with no fault pending • All fuel injectors = ON • Traction Control = not active All of the above met for at least 2 seconds	950 test failures in a 1000 sample test for 1 consecutive tests Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit High Voltage Bank 1 Sensor 1	P0132	This DTC determines if the O2 sensor or circuit is shorted to high.	O2 sensor voltage > 1000 millivolts to go fault pending O2 sensor voltage > 1000 millivolts to set DTC	<u>Common Enable Criteria</u> • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active <u>Specific Enable Criteria</u> • $0.99 \leq$ Equivalence Ratio ≤ 1.01 • $15\% \leq$ throttle position $\leq 50\%$ • Fuel State = Closed loop All of the above met for at least 2 seconds	140 test failures in a 150 sample test for 1 consecutive tests <u>Frequency:</u> Continuous <u>100 ms loop</u>	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit 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) Pass/Fail Threholds."** In Lookup Tables section.	Common Enable Criteria • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • O2 Heater on for $\geq$ 0 seconds • B1S1 DTCs = Not Active • Learned heater resistance is valid • Misfire DTC = Not Active • ECT > 70 °C • IAT > - 40 °C • Engine run time > 200 seconds • EVAP Canister purge duty cycle $\geq$ 0 % • 15 gps $\leq$ MAF $\leq$ 50 gps • 1000 $\leq$ RPM $\leq$ 3500 • Ethanol percentage < 85 % • Baro > 69.8 kPa • Throttle position $\geq$ 5.0 % • 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 2 second.	120 seconds Frequency: Once per trip	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit Insufficient Activity Bank 1 Sensor 1	P0134	This DTC determines if the O2 sensor circuit is open.	400 mV< O2 sensor voltage < 500 mV	Common Enable Criteria • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 200 seconds • Ethanol percentage > 85 % • No B1S1 heater related DTCs	Common Enable Criteria • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 200 seconds • Ethanol percentage > 85 % • No B1S1 heater related DTCs	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Heater Performance Bank 1 Sensor 1	P0135	Determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	O2 sensor heater current is < 0.73 amps or > 2.70 amps	**Common Enable Criteria** • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active **Specific Enable Criteria** • Engine Run Time ≥ 230 seconds • ECT ≥ 70° C • 1000 ≤ Engine Rpm ≤ 2500 • 15 gps ≤ Mass Airflow ≤ 30 gps • O2 heater not in Device control • B1S1 O2 heater resistance DTC not active All of the above met for at least 1 seconds	45 test failures in 50 test samples Frequency: 1 tests per trip 20 second delay between tests 1 second execution rate	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit Low Voltage Bank 1 Sensor 2	P0137	This DTC determines if the O2 sensor circuit is shorted to low by checking for a lean condition during steady throttle.	O2 sensor voltage < 50 millivolts	Common Enable Criteria • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • $0.99 \leq$ Equivalence ratio ≤ 1.01 • $15\% \leq$ throttle position $\leq 50\%$ • Fuel state = closed loop • All fuel injectors = ON • Traction Control = not active All of the above met for at least 2 seconds	950 test failures in a 1000 sample test for 1 consecutive tests Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit High Voltage Bank 1 Sensor 2	P0138	This DTC determines if the O2 sensor or circuit is shorted to high	O2 sensor voltage > 1000 millivolts to go fault pending O2 sensor voltage > 1000 millivolts to set DTC	Common Enable Criteria • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • $0.99 \leq$ Equivalence Ratio ≤ 1.01 • $15\ \% \leq$ throttle position $\leq\ 50\ \%$ • Fuel State = Closed loop All of the above met for at least 2 seconds	950 test failures in a 1000 sample test for 1 consecutive tests Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit Insufficient Activity Bank 1 Sensor 2	P0140	This DTC determines if the O2 sensor circuit is open.	425 millivolts < O2 sensor < 475 millivolts for regular open test 300 millivolts < O2 sensor < 600 millivolts to fail the fast pass open test (must fail the regular open test in order to fail the DTC; regular open test is run if fast pass is not run or if fast pass fails)	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • Ethanol percentage > 85 % • No B1S2 heater related DTCs • PCM State = run Fast Pass: • Engine run time $\leq$ 100 seconds (Fast pass cannot report a fail; if Fastpass fails, the regular open test is run) Regular Open Test • Engine run time > 200 seconds • Fuel state = closed loop	45 test failures in 50 test samples Frequency: 1 tests per trip 20 second delay between tests 1 second execution rate	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S 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 < 0.60 amps or > 2.30 amps	Common Enable Criteria • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time $\geq$ 230 seconds • ECT $\geq$ 70° C • 1000 $\leq$ Engine Rpm $\leq$ 2500 • 15 gps $\leq$ Mass Airflow $\leq$ 30 gps • O2 heater not in Device control • B1S1 O2 heater resistance DTC not active All of the above met for at least 1 seconds	45 test failures in 50 test samples Frequency: 1 tests per trip 20 second delay between tests 1 second execution rate	DTC Type B
Fuel System Too Lean Bank 1	P0171	Determines if the fuel control system is in a lean condition.	The EWMA of long term fuel trim (LTM) samples $\geq$ 1.215 for at least 2 secs (Note: EWMA stands for "Exponentially Weighted Moving Average") Notes: At least 10 secs of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 36 secs of data in the current fuel trim cell must accumulate on each trip before the LTM for that cell is considered usable in the EWMA calculation.	No misfire, O2 sensor, Evap, injector, fuel temperature, fuel composition, IAC, MAF, MAP, ECT, EGR, AIR, TPS, TAC system DTCs 400 RPM < Engine speed <6000 RPM Baro > 70 kPa -20°C < ECT < 125 °C 11 kPa < MAP <104 kPa -20°C < IAT < 145°C 1.0 grams/sec < MAF < 511 grams/sec VSS < 300 KPH Closed loop fueling Long term fuel trim learning enabled Not in device control EGR flow diagnostic intrusive test = Not Active Catalyst monitor 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 secs to disable; default is to enable if fuel sender is broken)	2 out 3 test failures Continuous check 100 msec loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Rich Bank 1	P0172	Determines if the fuel control system is in a rich condition.	The EWMA of long term fuel trim (LTM) samples < 0.8299 Once the above occurs, purge is ramped off to determine if excess purge is the cause. Therefore, the following must also occur to report a failure: The EWMA of LTM samples with purge off < 0.8200 for at least 7 secs during each of 2 intrusive segments. General Notes: 1. At least 10 secs of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 36 secs of data in the current fuel trim cell must accumulate on each trip before the LTM for that cell is considered usable in the EWMA calculation. Intrusive Notes: Segments can last up to 35 secs, and are separated by the smaller of a 30 sec purge-on time or enough time to purge 18 grams of vapor. A maximum of 3completed segments are allowed for each intrusive test, and up to 30 intrusive attempts allowed per trip. After an intrusive test report is completed, another intrusive test cannot occur for 300 secs to allow sufficient time to purge excess vapors from the canister. During this period, fuel trim will pass if the EWMA of LTM samples > 0.8200 for at least 60 secs, indicating that the canister has been purged. Performing intrusive tests too frequently may also affect Evap and FTP emissions, and the execution nostics.	No misfire, O2 sensor, Evap, injector, fuel temperature, fuel composition, IAC, MAF, MAP, ECT, EGR, AIR, TPS, TAC system DTCs 400 RPM < Engine speed < 6000 RPM Baro > 70 kPa -20°C < ECT < 125°C 11 kPa > MAP < 104 kPa -20 °C < IAT < 145°C 1 gram/sec < MAF < 511 grams/sec VSS < 300 KPH Closed loop fueling Long term fuel trim learning enabled Not in device control EGR flow diagnostic intrusive test = Not Active Catalyst monitor 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 secs to disable; default is to enable if fuel sender is broken) Intrusive Enable Criteria The EWMA LTM samples < 0.8299 Engine speed > 400 RPM 2 grams/sec < MAF < 511 grams/sec 11 kPa < MAP <104 kPa Temporary Intrusive Test Inhibit Criteria If intrusive test segment exceeds 35 consecutive secs (in this case, purge valve is opened for the smaller of 30 secs or enough time to purge 18 grams vapor before attempting additional intrusive segments)	If rich fail counter is ≥ 2 before pass counter ≥ 2, diagnostic fails Continuous check 100 msec loop	DTC Type B
Fuel Injector 1 Control Circuit	P0201	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel Injector 2 Control Circuit	P0202	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B
Fuel Injector 3 Control Circuit	P0203	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B
Fuel Injector 4 Control Circuit	P0204	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B
Fuel Injector 5 Control Circuit	P0205	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B
Fuel Injector 6 Control Circuit	P0206	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B
Throttle Position (TP) Sensor 2 Circuit	P0220	Detects a continuous or intermittent short or open in TP sensor #2 circuit	0.275 V > TPS > 4.725 V	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No PCM processor, 5 V reference DTCs	15/35 counts; 10 counts continuous; 12.5 msec /count in the motor processor	DTC Type A
Throttle Position (TP) Sensor 2 Circuit OOR Low	P0222	Detects a continuous or intermittent short or open in TP sensor #2 circuit	0.275V > Raw TPS sensor signal	Ignition in Unlock/accessory, run, crank Ignition Voltage > 5.23 V No 5VR DTCs	15/35 Counts 10 Counts Continuous 12.5 ms / Ct in the MCP	DTC Type A MIL
Throttle Position (TP) Sensor 2 Circuit OOR High	P0223	Detects a continuous or intermittent short or open in TP sensor #2 circuit	Raw TPS sensor signal > 4.725 V	Ignition in Unlock/accessory, run, crank Ignition Voltage > 5.23 V No 5VR DTCs	15/35 Counts 10 Counts Continuous 12.5 ms / Ct in the MCP	DTC Type A MIL
Fuel Pump Relay Circuit Fault	P0230	Checks the fuel pump relay circuit for electrical integrity	Output state invalid	The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.	10/12 counts 10 counts/sec Continuous check	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Random Misfire Detected Cylinder 1 Misfire Cylinder 2 Misfire Cylinder 3 Misfire Cylinder 4 Misfire Cylinder 5 Misfire Cylinder 6 Misfire	P0300 P0301 P0302 P0303 P0304 P0305 P0306	Determine if a random misfire or a cylinder specific misfire is occurring by monitoring crankshaft velocity	Deceleration index Vs Engine speed Vs Load and Camshaft Position Emission Failure Threshold = 1% misfire Catalyst Damage Threshold = 5%	Engine run time > 1 engine cycle No VSS, crank, TPS, MAP, ECT, MAF, ETC, PCM, cam, fuel sensing, throttle actuator, IAT DTCs Crankshaft position system variation must be learned or engine speed < 1000 RPM. Fuel cutoff not active Power management is not active Brake torque management not active Drag Control not active: N/A Fuel level > 2.5%. Disablement ends 88 engine cycles after a low fuel level condition ceases, and fuel disable does not occur with a fuel sensor DTC -7 °C < ECT < 125°C If ECT at startup < -7°C disable until ECT > 21°C 445 RPM < Engine speed < 6200 RPM 9 V < System voltage < 18 V + TP delta < 95% per 100 msec - TP delta < 95% per 100 msec Abnormal engine speed is not present Excess engine acceleration is not present No rough road TCS is not active Positive and zero torque. Detectable engine speed and engine load region EGR intrusive test not active: N/A AIR intrusive test not active: N/A Cam sensor is in sync with crank sensor. Misfire diagnostic is not requesting to disable TCC when transmission is in hot mode Crankshaft ring filter inactive (after a low level misfire, another misfire may not be detectable until crankshaft ringing ceases)	Emission Exceedence = 5 failed 200 revolution blocks of 16. Failure reported with 1 exceedence in first 16*200 revolution block, or 4 exceedences thereafter 1st Catalyst Exceedence = Number of 200 revolution blocks as data supports for catalyst damage. 2nd and subsequent Catalyst Exceedences = 1 200 revolution block with catalyst damage. Failure reported with 3 exceedences in FTP, or 1 exceedence outside FTP. Frequency: Continuous	DTC Type B
Crankshaft Position System Variation Not Learned	P0315	Determine if the crankshaft position system variation has not been learned	Sum of compensation factors between 98173 and 98435	PCM state = Run Manufacturers enable counter must be 0	0.5 sec 100msec loop Continuous check	DTC Type A
Knock Sensor Circuit	P0325	Checks for knock sensor rationality	Knock sensor average voltage > 4.99 V or < 0.01 V	1800 RPM < Engine speed < 6400 RPM Air per Cylinder (load) > 65 grams	60/80 counts 10 counts/sec Continuous check	DTC Type B
Knock Sensor Circuit Excessive Spark Retard	P0326	Checks for knock sensor performance	Knock total retard $\geq$ a value that is a function of MAP and RPM	Knock detection = Enabled Engine speed > 1800 RPM MAP > 55 kPa	40/80 counts 10 counts/sec Continuous check	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Knock Sensor (KS) Circuit Low Frequency Bank 1	P0327	Checks for knock sensor range	Knock sensor max cylinder voltage – min cylinder voltage $\leq$ 0.0586 V	Engine speed > 1800 RPM Air per Cylinder (load) > 65 grams	78/80 counts 10 counts/sec Continuous check	DTC Type B
Knock Sensor (KS) Circuit Low Frequency Bank 2	P0332	Checks for knock sensor range	Knock sensor max cylinder voltage – min cylinder voltage < 0.0586 V	Engine speed > 1800 RPM Air per Cylinder (load) > 65 mg	60/80 counts 10 counts/sec Continuous check	DTC Type B

Crankshaft Position Sensor-A Circuit	P0335	Crank Sensor Event Test
		Incorrect number of crank sensor pulses in a given number of cam sensor pulses
		
		Crank Time Without Match Test
		Excessive time without crank sensor match
			Crank Sensor Event Test
			90 > number of crank pulses > 110
			
			Crank Time Without Match Test
			See 'TIME LENGTH AND FREQUENCY' column
				Crank Sensor Event Test
				IF [(Engine Running = TRUE OR
				    Engine Cranking = TRUE) AND
				    (Primary_Cam_Sync_Flag = CAM_SIDE OR
				    Primary_Cam_Sync_Flag =
				    CAM_CYLINDER) AND
				    PRIMARY_CAM_TYPE $\neq$ CSI_CAM) AND
				    Fault Active [Primary Cam-Ckt] = FALSE
				AND
				    Fault Active [Primary Cam-Perf] = FALSE]
				THEN
				    Enable diagnostic
				ELSE
				    Disable diagnostic
				ENDIF
				
				Crank Time Without Match Test
				IF [(Engine Running = TRUE OR
				    Engine Cranking = TRUE) AND
				    (Engine Speed Defaulted < 2000 RPM)
				    AND
				    {(Cranking Motor Is Engaged = TRUE AND
				THEN
				    Enable diagnostic
				ELSE
				    Disable diagnostic
				ENDIF
					Crank Sensor Event Test
					• One test = 10 cam sensor pulses
					• Fail report = 8/10 tests exceed malfunction criteria
					
					Crank Time Without Match Test
					• During engine crank = match has not occurred within the last 4 secs
					• During engine run = match has not occurred within the last 2 secs
						DTC Type B

Crankshaft Position Sensor-A Performance	P0336	Detects an excessive number of crank sensor resyncs	See 'TIME LENGTH AND FREQUENCY' column	IF [Engine Running = TRUE AND Engine Speed > 450 RPM]
				THEN
				    Enable diagnostic
				ELSE
				    Disable diagnostic
				ENDIF
					20 crank resyncs occur within 25 secs	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Ignition Coil 1 Control Circuit	P0351	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	20 failures for 100 cylinder events	DTC Type B
Ignition Coil 2 Control Circuit	P0352	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	20 failures for 100 cylinder events	DTC Type B
Ignition Coil 3 Control Circuit	P0353	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	20 failures for 100 cylinder events	DTC Type B
Ignition Coil 4 Control Circuit	P0354	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	20 failures for 100 cylinder events	DTC Type B
Ignition Coil 5 Control Circuit	P0355	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	20 failures for 100 cylinder events	DTC Type B
Ignition Coil 6 Control Circuit	P0356	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	20 failures for 100 cylinder events	DTC Type B
Camshaft Position Sensor-B Bank-1 Circuit	P0365	Detects cam sensor circuit malfunctions by monitoring for the absence of cam sensor pulses	See 'TIME LENGTH AND FREQUENCY' column	IF[$\quad$ MAF ≥ 0 AND [(Engine_Cranking = TRUE AND Cam_Sync_Flag $\neq$ CAM_CYLINDER) OR Engine_Running = TRUE]] THEN $\quad$ Enable diagnostic ELSE $\quad$ Disable diagnostic ENDIF	5 cam pulses do not occur within 3 secs	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE

Camshaft Position Sensor-B Bank-1 Performance	P0366	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	After Engine Start (slow event based)
			525 > cam sensor pulses > 625
			
			Near Engine Start (fast event based)
			5 > cam pulses > 15
				After Engine Start (slow event based)
				IF[{ (CAM_TYPE ≠ CSI AND) } AND
				  CKP_MedRes_Active = TRUE AND
				  Crank_Sync_Flag = Crank_In_Sync AND
				  Fault_Active[CMP_Ckt] = FALSE AND
				  Fault_Active[CKP_SnsrA_Ckt] = FALSE
				
				AND
				  Fault_Active[CKP_SnsrA_Perf] = FALSE
				AND
				  Fault_Active[CKP_SnsrB_Ckt] = FALSE
				AND
				  Fault_Active[CKP_SnsrB_Perf] = FALSE
				AND
				  Fault_Active[CKP_SnsrAB_Corr] = FALSE
				THEN
				  Enable diagnostic
				ELSE
				  Disable diagnostic
				ENDIF
				
				Near Engine Start (fast event based)
				IF[MedRes_CKP_Counter ≤ 10 AND
				  CKP_MedRes_Active = TRUE AND
				  Crank_Sync_Flag = Crank_In_Sync AND
				  CAM_TYPE ≠ CSI_CAM AND
				  Fault_Active[CMP-Ckt] = FALSE]
				THEN
				  ENABLE DIAGNOSTIC
				ELSE
				  DISABLE DIAGNOSTIC
				ENDIF
				
				Footnote: the crank MedRes counter increments when the diagnostic is enabled and counts the number of crank MedRes software interrupts. ECM throughput prohibits interrupting on every crank sensor pulse. Typical crank MedRes software interrupts occur twice per cylinder, but varies in each engine.
					After Engine Start One Test = 1200 MedRes software interrupts
					
					8 failed tests out of the last 10tests
					
					Near Engine Start One Test = 12 MedRes software interrupts
					
					Fail Report = 1 failed test
						DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Secondary AIR Incorrect Airflow	P0411	Detects an insufficient flow condition This test is run during Phase 1 (SAI pump commanded On, Valve commanded Open)	Predicted System Pressure versus Actual System Pressure Error > 6kPa	No active MAF DTCs No active MAP DTCs No active SAI Pressure Sensor Performance DTCs No active SAI Pressure Sensor Circuit DTCs No active SAI pump relay DTCs No active SAI valve relay DTCs No active IAT DTCs No active ECT DTCs No active Misfire DTCs No active Catalyst Monitor DTCs No active P0606 DTC No active 5 Volt DTCs No active EST DTCs No active Fuel Injector DTCs BARO > 70 kPa Engine Airflow < 33 g/s 9V < System Voltage < 18V Stability Time > 5 seconds SAI System commanded On	Conditional test weight > 7 seconds Frequency: Once per trip when SAI pump commanded On	DTC Type B
Secondary AIR Solenoid Control Circuit	P0412	This DTC checks the SAI solenoid circuit for electrical integrity	Output state invalid	Ignition Voltage in Range	100/120 counts Frequency: 4 counts/second Continuous check	DTC Type B
Secondary AIR Pump Control Circuit	P0418	This DTC checks the SAI pump relay circuit for electrical integrity	Output state invalid	Ignition Voltage in Range	20/25 counts Frequency: 4 counts/second Continuous check	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Catalyst Low Efficiency - Bank 1	P0420	Oxygen Storage	OSC Time Difference $\geq$ 0.25 sec OSC Time Difference = OSC Worst Pass Thresh - OSC Compensation Factor * (Post Cat O2 Resp Time - Pre Cat O2 Resp Time) OSC Worst Pass Thresh = 5.0 sec	Trip Enable Criteria • No ECT, VSS, Fuel Trim, TPS, IAT, MAP, O2 Sensor, MAF, Cam Sensor, Purge System, Idle System, Crank Sensor, or Misfire DTCs • IAT > - 20.5 °C Valid Idle Period Criteria • Engine Speed $\geq$ 1250 rpm and TPS $\geq$ 3% for a minimum of 17 sec since end of last idle period • Engine Run time $\geq$ 100 sec • Vehicle Speed $\leq$ 5 mphTest Enable Conditions • Closed loop fuel control • Tests Attempted this idle period < 1 • Transmission in a drive Gear (Automatic only) • No other intrusive diagnostics running • 450 °C $\leq$ Predicted Catalyst Temperature $\leq$ 700 °C • Barometric Pressure $\geq$ 68 kPa • -20.5 °C < IAT< 80 °C • 50 $\leq$ ECT $\leq$ 125 °C • System Voltage > 9 V • 0 < Idle Time $\leq$ 60 sec $\Rightarrow$ Idle Time is incremented if: Vehicle Speed < 5 mph & Throttle Position (without IAC) $\leq$ 3 % • 2 $\leq$ Airflow $\leq$ 15 grams per second • Delta Throttle Position (with IAC) $\leq$ 50 % • 0.88 $\leq$ Short Term Integrator Multiplier $\leq$ 1.12 • Short Term Integrator Multiplier Change $\leq$ 0.12 • 0.94$\leq$ Average Short Term Integrator Multiplier $\leq$1.06 • HO2S (bank1 sensor1) RtoL + LtoR transitions (450mv transition pt.) $\geq$ 4 • Max Desired Engine Idle RPM $\leq$ 1075 • CCP DC Multiplier $\leq$ 1 • Green Converter Delay = Not ActiveRapid Step Response Enable Criteria • OSC Time Difference Step $\geq$ 0.83 sec. • OSC Time Difference $\geq$ 0 sec.	1 test attempted per valid idle periodMinimum of 1 test per trip. Rapid Step Response mode: Maximum of 6 tests per trip. Maximum of 18 tests to detect failure when Rapid Step Response is enabled. Frequency: Execution Rate 12.5 ms Green Converter Delay Criteria • Predicted catalyst temperature $\geq$ 500 °C for 3600 sec (non-continuous). The diagnostic will not be enabled until the next ignition cycle after this criterion has been met. Enable criteria must be met on the next ignition cycle for the test to run. Note: This feature is only enabled when the vehicle is new and cannot be enabled in service.	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Evap Emission System Leak Detection (Small Leak)	P0442	This DTC will detect a small leak ($\geq$ 0.020") in the Evap system between the fuel fill cap and the purge solenoid. The DTC will also be set if the fuel tank vacuum sensor is out of range when it tries to re-zero prior to test phase-1 or test phase-2 of the EONV test. The DTC will also be set if the refueling rationality test during EONV is failed.	Small Leak Test Fail Engine Off Natural Vacuum (EONV) The total pressure change achieved during the test is normalized against a target value = 1.5" 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. Fail threshold = 0.550 Re-Pass threshold = 0.35 Vacuum sensor out of range < 1.2 V or > 1.8 V: vacuum sensor out of range is reported as a perfect fail to the EWMA	Test Enable No VSS, ECT, IAT, Evap vacuum, CCP stuck open, Evap large leak. ignition off timer DTCs 15% < Fuel level < 85% No fuel filling during EONV • Increase of fuel level of 10% • Increase of tank pressure of 1 inch of H_2O per second • Maximum tank pressure of 3 inches of H_2O while engine is running and vent is open Valid Cold Start 4°C < ECT < 30°C 4°C < IAT < 30°C ECT-IAT< 8°C Baro > 74.0 kPa Estimated ambient temperature at end of drive > 2°C but < 32°C Drive time $\geq$ 10 minutes Drive length $\geq$ 5 km Coolant $\geq$ 70°C No fuel filling (fuel level increment $\geq$ 10%)	Once per cold start, during hot soak up to 2500 sec Time since last complete test $\geq$ 17 hours if EWMA is passing, or $\geq$ 10 hours if EWMA is failing No more than 2 attempts per day	DTC Type A EWMA
Canister Purge Circuit Fault	P0443	This DTC checks the canister purge solenoid circuit for electrical integrity	Output state invalid		100/120 counts 10 counts/sec Continuous check	DTC Type B
Evap Emission Control System - Vent Control Malfunction	P0446	This DTC will determine if a restriction is present in the vent solenoid, vent filter, vent hose or canister.	Excess Vacuum Test Vent solenoid commanded open Fuel Tank Vacuum $\geq$ 10 inches of H_2O for 2 seconds as monitored during initial purge ramp Cold Start Key-Up Test Vented Vacuum $\leq$ -2.5 inches of H_2O or Vented Vacuum $\geq$ 5.0 inches of H_20 for 3 secs after cold-start key-up	Test Enable No MAP, voltage, TPS, VSS, ECT, O2 sensor, IAT DTCs 15% < Fuel level < 85% 11 V < System voltage < 18 V Cold Start Test 4°C < ECT < 30°C 4°C < IAT < 30°C ECT-IAT< 8°C Baro > 74.0 kPa	Test must complete within 1000 secs from when vehicle is started Excess Vacuum Test – Stage II 180 secs Once per cold start	DTC Type B
Fuel Tank Vent Circuit Fault	P0449	This DTC checks the fuel tank vent solenoid circuit for electrical integrity	Output state invalid		100/120 counts 10 counts/sec Continuous check	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel Tank Pressure (FTP) Sensor Circuit 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 an 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 = 0.72998 Re-Pass threshold = 0.400024	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 that can take up to 600 seconds to complete.	DTC Type A EWMA
Evap Fuel Tank Pressure Sensor Circuit Low Voltage	P0452	This DTC will detect a Fuel tank pressure sensor that is to low out of range	Fuel tank pressure sensor signal < 0.1 volts produces a failing sample. Otherwise, the sample is considered passing. If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC.	• 0.10 second delay after sensor power up for sensor warm-up • ECM State ≠ crank	Frequency: Continuous 100ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Evap Fuel Tank Pressure Sensor Circuit High Voltage	P0453	This DTC will detect a Fuel tank pressure sensor that is to high out of range	Fuel tank pressure sensor signal > 4.9 volts produces a failing sample. Otherwise, the sample is considered passing. If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC.	• 0.10 second delay after sensor power up for sensor warm-up • ECM state ≠ crank	Frequency: Continuous 100ms loop	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 < 1249 Pa vacuum in the span of 1.0 seconds. A refueling event is confirmed if the fuel level has a persistent change of 20.0 % for 30 seconds. The test will report a failure if 2 out of 3 samples are failures.	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	This test is executed during an engine-off natural vacuum small leak test. The test can only execute up to once per engine-off period. The length of the test is determined by the refueling rationality test that can take up to 600 seconds to complete.	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Evap Emission Control System – Malfunction	P0455	This DTC will detect a weak vacuum condition (large leak or purge restriction) in the Evap system	Weak Vacuum Test- Stage I (Cold) Tank vacuum < 8 inches of H_2O after the displaced purge volume has reached 15 liters. 2 liters of fuel must be consumed after setting the DTC active the first time to set the DTC active the second time Weak Vacuum Test- Stage II (Warm) Stage I test failed previous trip and this trip Passes if Tank vacuum > 8 inches of H_2O for 5 secs Note: Stage II can only report a pass	Test Enable No MAP, voltage, TPS, VSS, ECT, O2 sensor, IAT DTCs 15% < Fuel level < 85% 11 V < System voltage < 18 V Power-up Vacuum Test Fail = False Cold Start Test 4°C < ECT < 30°C 4°C < IAT < 30°C ECT-IAT< 8°C Baro > 74.0 kPa	Weak Vacuum Test- Stage I: Test must complete within 1000 secs after the vehicle is started Weak Vacuum Test- Stage II: Fault present for a time $\geq$ 600 secs; this is the maximum test time length. Once per cold start	DTC Type B
Fuel Level Sensor Circuit Performance	P0461	Fuel sender rationality check	Fuel level delta < 5 liters within 240 km		Continuous check	DTC Type B
Fuel Level Sensor Circuit Low Input	P0462	Detects a fuel sender failed to a low voltage level	Fuel level Sender % of 5V range < 6.25 %	Runs continuously	60 failures out of 100 samples 1 sample = 100 ms Continuous	DTC Type B
Fuel Level Sensor Circuit High Input	P0463	Detects a fuel sender failed to a high voltage level	Fuel level Sender % of 5V range > 70%	Runs continuously	60 failures out of 100 samples 1 sample = 100 ms Continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel Level Sensor 1 Circuit Intermittent	P0464	This DTC will detect intermittent fuel level sensor signals that would have caused the engine-off natural vacuum small leak test to abort due to an apparent re-fueling event.	If a change in fuel level is detected the engine-off natural vacuum test is aborted due to an apparent refueling event. Subsequent to the abort, a refueling rationality test is executed to confirm that a refueling event occurred. If a refueling is confirmed, then the test sample is considered passing. Otherwise, the sample is considered failing indicating an intermittent signal problem. The refuel event is defined as a change of 20.0 % fuel level during the engine-off test. A refueling event is confirmed if the fuel level has a persistent change of 20.0 % for 30 seconds. The test will report a failure if 2 out of 3 samples are failures.	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	This test is executed during an engine-off natural vacuum small leak test. The test can only execute up to once per engine-off period. The length of the test is determined by the refueling rationality test that can take up to 600 seconds to complete.	DTC Type A
Engine Cooling Fan Relay 1 Control Circuit	P0480	This DTC checks the Engine cooling fan relay 1 circuit for electrical integrity	Output state invalid	RunCrankIgnInRange (9 volts < Ignition < 18 volts) Engine Speed > 400	20 failures in a 25 sample test 250 msec / sample	DTC Type B Not used on systems with Mechanical Fan)
EV Cooling Fan System Performance Error	P0483	Detects an unacceptable 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 -700 RPM to +300 RPM.	No IAT DTC's present. No ECT DTC's present. No IOT DTC present 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 For use on vehicles with EV fan
EV Cooling Fan Overspeed Problem	P0493	Indicates that the EV Cooling fan is in an overspeed condition	EV Cooling Fan Speed is > 6500 5 RPM.	Engine is running Engine Speed > 1400 rpm	2 / 2 counts 100 ms / count Continuous	DTC Type A For use on vehicles with EV fan

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
EV Cooling Fan Speed Too High	P0495	Detects that the EV Cooling Fan is spinning too fast when it has not been commanded on.	Cooling Fan RPM is > fan drag speed. This is a lookup table of input shaft speed (RPM) vs Fan RPM.	No IAT DTC's present. No ECT DTC's present. No IOT DTC present. No EV Cooling Fan Sensor Circuit DTC present. Engine is running. System voltage is >= 10 volts IAT >= -7°C. EV Fan is not commanded on. Input shaft speed > 1500 RPM. Fluid clutch is pumped out (< 0.011 cc) or input shaft speed > 1500 RPM for 150 seconds (cumulative).	800 / 1000 counts 1 count/ 100msec Continuous	DTC Type B For use on vehicles with EV fan
Evap. Emission Control System - Continuous Open Purge Flow	P0496	Determines if the purge solenoid is leaking to engine manifold vacuum.	Purge Valve Leak Test Purge valve closed Fuel Tank Vacuum 2491 Pa for 5 secs before purge time > 60 sec s (Fuel Tank Vacuum level dependent on fuel level)	Test Enable No MAP, voltage, TPS, VSS, ECT, O2 sensor, IAT DTCs 15% < Fuel level < 85% 11 V < System voltage < 18 V Power-up Vacuum Test Fail = False Cold Start Test 4°C < ECT < 30°C 4°C < IAT < 30°C ECT-IAT< 8°C Baro > 74.0 kPa	Once per trip Max engine run time is 65 secs	DTC Type B
VSS Circuit No Activity (Manual transmission)	P0502	Detects the lack of activity on the VSS circuit	Transmission output speed ≤ 100 RPM	No trans input speed, TP, or VSS intermittent DTCs TP ≥ 12 % 10 V < System voltage < 18 V 1000 RPM < Engine speed < 6800 RPM for 8 seconds 40 Nm < Engine torque < 300 Nm	3 seconds Continuous check	DTC Type B
VSS Circuit Intermittent (Manual Transmission)	P0503	Detects an intermittent fault on the VSS circuit	Transmission output speed must drop by 1500 RPM in 0.5 secs	No trans input speed or shift solenoid A circuit DTCs Engine running 450 RPM < Engine speed < 6800 RPM for 8 seconds 10 V < System voltage < 18 V Time since the last gear change > 6 secs Time since transfer case gear change > 3 secs Transmission not in P/N Engine speed change < 500 RPM in 2 seconds	25 msec loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Idle System Low	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 ECT value 56 -75 68 -75 80 -75 92 -75 104 -75 116 -75 128 -75 140 -75 152 -75	No MAF, MAP, IAT, ECT, TP, Injector, Fuel System, Misfire, ETC, VSS or Purge DTC's TCM Communication Fault not active Engine Run > 100 sec. ECT > -7 C BARO > 72 kPa IGN. voltage > 11 volts but < 18 volts IAT > -7 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 3 seconds Outside of fail criteria continuously for 5 seconds 3 tests to fail; must leave enable criteria between each test Frequency: Continuous after enable 100ms loop	DTC Type B
Idle System High	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 ECT value 56 150 68 150 80 150 92 150 104 150 116 150 128 150 140 150 152 150	No MAF, MAP, IAT, ECT, TP, Injector, Fuel System, Misfire, ETC, VSS or Purge DTC's TCM Communication Fault not active Engine Run > 100 sec. ECT > -7 C BARO > 72 kPa IGN. voltage > 11 volts but < 18 volts IAT > -7 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 3 seconds Outside of fail criteria continuously for 15 seconds 1 test to fail; must leave enable criteria between each test Frequency: Continuous after enable 100ms loop	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
EV Cooling Fan Sensor Circuit	P0526	Detects a continuous open or short condition with the EV Cooling Fan Sensor input circuit(s).	No EV Fan Sensor Circuit input activity is detected (fan speed signal < =4 Hz)	Engine is running System voltage is >= 10 1 volts	900 /1200 counts 100 ms / count Continuous	DTC Type B For use on vehicles with EV fan
PCM Memory – Read Only Memory (ROM) Main and motor processor	P0601	Checks for proper function of the PCM memory	Computed EPROM checksum not equal to expected	Ignition in unlock/accessory, run or crank Ignition voltage > 5.23 V	1 failure during the first execution; 5 failures thereafter Background loop Continuous check	DTC Type A
PCM not Programmed	P0602	Checks for proper programmed state of the PCM	Calibration parameter not equal to expected value		1 failure Frequency 250 msec Continuous check	DTC Type A
PCM 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		1 failure Once at power-up	DTC Type A
PCM Memory – Random Access Memory (RAM) Main and motor processor	P0604	Checks for proper function of the PCM memory	Bad RAM location found	Ignition in unlock/accessory, run or crank Ignition voltage > 5.23 V	100 failures if found during first test in ignition cycle 2 failures if found during subsequent tests in the ignition cycle Continuous check	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
PCM Processor 1. Processor Performance Check - Throttle limiting Fault (motor processor) 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) 9. Processor Performance Check - MAIN state of health (motor processor)	P0606	Indicates that the ECM has detected an ETC internal processor integrity fault	1. Motor processor desired throttle limiting occurring 2. ETC software is not executed in proper order 3. Software tasks loops > schedule tasks loop 4. Loss of SPI communication from the motor processor 5. 1.5 msec < Average motor processor state of health toggle > 2.5 msec 6. TPS or APPS minimum learned values fail compliment check 7. TPS or APPS minimum learned values fail range check 8. Motor processor integrity check error occurs 9. Motor processor integrity check error of main processor occurs	Ignition in unlock/accessory, run or crank System voltage >5.23 V	1. 99 counts continuous, 2 msec/count in the motor processor 2. 1 count continuous; 12.5 msec/count in the main processor 3. Error > 3 counts; 100 msec/count in the main processor 4. 160/400 counts or 15 counts continuous; 39 counts continuous @ initialization; 12.5 msec/count in the main processor 5. 3 counts continuous; 50 msec/count in the main processor 6. 100 msec in the main processor 7. 10 msec in the main processor 8. 4 counts continuous, 50 msec /count in the main processor 9. 2 count continuous, 12.5 msec/count in the main motor processor	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Control Module Accelerator Pedal Position (APP) System Performance	P060D	1. Verify the PCMs ability to detect a short between the APPS 1 & 2 circuits 2. Verify that the indicated accelerator pedal position calculation is correct.	1. APPS #2 voltage > 2.05V 2. (main APPS – motor APPS) > 0V	Ignitions in unlock/ accessory and run, not during TPS minimum learn active during intrusive portion of diagnostic execution Ignition voltage > 5.23 V No PCM processor DTC	1. 2 counts; 156.25 msec w/immediate retest on an error, performed in the main processor 2. 99 counts continuous; 12.5 msec/count in the motor processor	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Control Module Throttle Position (TP) System Performance	P060E	1. Verify the PCMs ability to detect a short between the TPS 1 & 2 circuits 2. Verify that the throttle control system position sensor short diagnostic is functioning	1. TPS #2 Voltage > 2.05V 2. No detection of the sensor short diagnostic active state	1. Ignition voltage > 5.23 V No PCM processor DTC. 2. Ignition in unlock/accessory or run, not during TPS minimum learn active during intrusive portion of diagnostic execution	1. 2 counts; 156.25 msec w/immediate retest on an error, performed in the main processor 2. No sensor short diagnostic activity for 498 msec; detected by the motor processor	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
PCM - EEPROM General Failure	P062F	Checks for a PCM non-volatile memory write error	Incorrect/unsuccessful write to non-volatile memory	Ignition in unlock/accessory, run, or crank Ignition voltage > 5.23 V	Immediately on next key up if flagged on previous key down Once at key down	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
5 Volt Reference 1 Circuit	P0641	Detects a continuous or intermittent short on the #1 5 V sensor reference circuit	Vref1 voltage -Vcc voltage > 0.125 V OR Vcc voltage -Vref1 voltage > 0.175 V	Ignition in unlock/accessory, run or crank Ignition voltage > 5.23 V No ECM processor DTCs	20/40 counts or 200 msec continuous; 12.5 msec/count in main processor 125/250 counts or 99 counts continuous; 2 msec/count in motor processor	DTC Type A
Malfunction Indicator Lamp (MIL) Control Circuit	P0650	This DTC checks the malfunction indicator lamp circuit for electrical integrity	Output state invalid	The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match	100/120 counts 10 counts/sec Continuous check	DTC Type B
5 Volt Reference 2 Circuit	P0651	Detects a continuous or intermittent short on the #2 5 V sensor reference circuit	Vref2 voltage -Vcc voltage > 0.125 V OR Vcc voltage –Vref2 voltage > 0.175 V	Ignition in unlock/accessory, run or crank Ignition voltage > 5.23 V No ECM processor DTCs	20/40 counts or 200 msec continuous; 12.5 msec/count in main processor 125/250 counts or 99 counts continuous; 2 msec/count in main processor	DTC Type A
Intake Rationality Cross-check Out of Range	P1101	This DTC determines if there are multiple air induction system problems affecting airflow and/or manifold pressure.	1. Filtered throttle error > 350 kPa grams/sec 2. Filtered manifold pressure 2 error > 20 kPa 3. [Filtered manifold pressure 1 error > 20 kPa or Filtered airflow error > 15 grams/sec]	No MAF circuit, MAP circuit, EGR, ECT circuit, IAT circuit, crank sensor DTCs 375 RPM < Engine speed 70°C < ECT < 125°C -7°C < IAT < 125°C	Immediate Frequency: 12.5 msec loop Continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Insufficient Switching Bank 1 Sensor 1	P1133	This DTC determines if the O2 sensor is no longer sufficiently switching.	Half cycle L/R switches < 110 OR Half cycle R/L switches < 110 OR Slope Time L/R switches < 4 OR Slope Time R/L switches < 4	Common Enable Criteria • 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 • 11 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • O2 Heater on for ≥ 0 seconds • B1S1 DTCs = Not Active • Learned heater resistance is valid • Misfire DTC = Not Active • ECT > 70 °C • IAT > - 40 °C • Engine run time > 200 seconds • EVAP Canister purge duty cycle ≥ 0 % • 15 gps $\leq$ MAF $\leq$ 50 gps • 1000 $\leq$ RPM $\leq$ 3500 • Ethanol percentage < 85 % • Baro > 69.8 kPa • Throttle position $\geq$ 5.0 % • 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 2 second.	120 seconds Frequency: Once per trip	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Cold Start Emission Reduction Control	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) < -18 kJ/s OR (Average desired accumulated exhaust energy - Average estimated accumulated exhaust energy) > 0.2 kJ/s	• Cold start emission reduction strategy is active. • Vehicle speed < 2 kph. • Throttle position < 2%. • • No DTC's 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 • Manufacturers enable counter must be 0	100 ms loop Runs once per trip when the cold start emission reduction strategy is active. Test completes after 15 seconds of accumulated qualified data.	DTC Type A
Throttle Actuator Control (TAC) Module - Throttle Actuator Position Performance	P1516	1. Detect a throttle positioning error. 2. Detect a throttle positioning error. 3. Detect excessive current draw on the actuator circuit. 4. Determine if the actuator has been miswired.	|Throttle error| ≥ |2%| after > 5 sec stability with no change in error sign, after 4 sec stable command. |Throttle error| > 10% (Actuator) > 9A TPS1< 2.36V	1-3. Ignition in run or crank [RPM>0 or (RPM=0 and not in battery saver mode)]. No airflow actuation, throttle actuation DTCs Engine running = true or System voltage > 6.5 V 4. Minimum TPS learn active state	1. 249 counts continuous; 2 msec/count in the motor processor 2. 99 counts continuous; 2 msec/count in the motor processor 3. 50 counts continuous; 2 msec/count in the motor processor 4. 99 counts continuous; 2 msec/count in the motor processor	DTC Type A
Ignition 1 Switch Circuit 2	P1682					DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Control Module Throttle Actuator Position Performance	P2101	Detect a throttle positioning error	Difference between measured throttle position and modeled throttle position > 10%	Ignition in run or crank [RPM>0 or (RPM=0 and not in battery saver mode)] No airflow actuation, throttle actuation DTCs Engine running or Ignition voltage > 8 V	<u>Positive error counter</u> Increments by 3 if TP error > 10%; decrements by 2 if 0% < TP error< 10%; decrements by 2 if -10% < TP error < 0%; clears if TP error < -10%. <u>Negative error counter</u> Increments by 3 if TP error< -10%; decrements by 2 if -10%< TP error < 0%; decrements by 2 if 0% < TP error < 10%; clears if TP error > 10%. Thresholds are 45 Check runs every 12.5 msec in the main processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 1	P2120	Detect a continuous or intermittent short or open in the APP sensor #1	0.625 V > Raw APP 1 > 4.684.65V	Ignition in unlock/accessory, run or crank Ignition voltage >5.23 V No PCM processor, 5 V reference DTCs	1. 20/40 counts or 10 counts continuous; 12.5 msec/count in the main processor 2. 92/217 counts or 67 counts continuous; 2 msec/count in the motor processor	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Accelerator Pedal Position (APP) Sensor 1 OOR Low	P2122	Detect a continuous or intermittent short or open in the APP sensor #1.	Raw APP sensor signal is < 0.625.75 V	Ignition in unlock/accessory, run or crank. Ignition voltage > 5.23 V No 5VR DTCs	20/40 Counts or 10 Counts continuous 12.5 ms /Ct in the main µP 92/217 Counts or 67 Counts continuous 2 ms/Ct in the MCP	DTC Type A
Accelerator Pedal Position (APP) Sensor 1 OOR High	P2123	Detect a continuous or intermittent short or open in the APP sensor #1.	Raw APP sensor signal is > 4.684.65V	Ignition in unlock/accessory, run or crank. Ignition voltage > 5.23 V No 5VR DTCs	20/40 Counts or 10 Counts continuous 12.5 ms /Ct in the main µP 92/217 Counts or 67 Counts continuous 2 ms/Ct in the MCP	DTC Type A
Accelerator Pedal Position (APP) Sensor 2 Circuit	P2125	Detect a continuous or intermittent short or open in the APP sensor #2	0.75.31 V > Raw APP 2 >4.375 4.65V	Ignition in unlock/accessory, run or crank Ignition voltage >5.23 V No PCM processor, 5 V reference DTCs	1. 15/35 counts or 10 counts continuous; 12.5 msec/count in the main processor 2. 92/217 counts or 67 counts continuous; 2 msec/count in the motor processor	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Accelerator Pedal Position (APP) Sensor 2 Circuit OOR Low	P2127	Detect a continuous or intermittent short or open in the APP sensor #2.	Raw APP sensor signal is < 0.75 V	Ignition in unlock/ accessory, run or crank. Ignition voltage > 5.23 V No 5VR DTCs	15/35 Counts or 10 Counts continuous 12.5 ms / Ct in the main µP 92/217 Counts or 67 Counts continuous 2 ms/Ct in the MCP	DTC Type A
Accelerator Pedal Position (APP) Sensor 2 Circuit OOR High	P2128	Detect a continuous or intermittent short or open in the APP sensor #2.	Raw APP sensor signal is > 4.65V	Ignition in unlock/ accessory, run or crank. Ignition voltage > 5.23 V No 5VR DTCs	15/35 Counts or 10 Counts continuous 12.5 ms / Ct in the main µP 92/217 Counts or 67 Counts continuous 2 ms/Ct in the MCP	DTC Type A
Throttle Position (TP) Sensor 1-2 Correlation	P2135	Detects a continuous or intermittent correlation fault between TP sensors #1 and #2	Difference between (raw min. learned TPS#1 voltage-raw min. TPS#1 voltage) and (raw TPS#2 voltage - raw min. learned TPS#2 voltage) < 5% 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 PCM processor, TPS circuit DTCs	1. 15/35 counts or 12 counts continuous; 12.5 msec/count in the main processor 2. 92/217 counts or 67 counts continuous; 2 msec/count in the motor 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 1-2 Correlation	P2138	1. Detect an invalid minimum mechanical position correlation between APP sensor #1 and #2 2. Detect a short between APP sensors #1 and #2 circuits.	1. Difference between (5V-raw learned min. APPS#2 voltage)*2 and (raw learned min. APPS#1 voltage) > 0.25 .275V at min throttle position to 0.5 V at max throttle position 2. Difference between APP#1 and APP#2 < 1 V	1. Ignition in unlock/accessory, run or crank System voltage >5.23 V No PCM processor, APP sensor, 5 V reference DTCs 2. Ignition in unlock/accessory, run or crank System voltage >5.23 V No PCM processor DTCs	1. 15/35 counts or 12 counts continuous, 12.5 msec/count in the main processor. 92/217 counts or 80 counts continuous, 2 msec/count in the motor processor 2. 2 counts 156.25 msec w/ immediate test on an error, performed in the main processor	DTC Type A
Minimum Throttle Position Not Learned	P2176	TP minimum learning not completed	TPS > 0.82 V	Minimum TPS learn active state Stable throttle position reading for 40 msec Ignition in run or crank No TPS circuit DTCs	3 secs	DTC Type A
Secondary Air Injection System Pressure Sensor Circuit Bank 1	P2430	This DTC determines a stuck in range pressure sensor signal	Average Error < 0.5 kPa And Signal Variation < 1	No active P0412 DTC No active P0418 DTC No active DTC P0606 No active DTC P2432 No active DTC P2433 No active 5 Volt DTCs SAI pump commanded On	Stuck in range cumulative info > 5 seconds Frequency: Once per trip when SAI pump commanded On	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Secondary Air Injection System Pressure Sensor Performance Bank 1	P2431	This DTC determines a skewed pressure sensor signal	Difference between SAI pressure sensor and BARO sensor > 10kPa with SAI pump commanded Off OR Difference between SAI pressure sensor and BARO sensor > 50kPa with SAI pump commanded On	No active P0412 DTC No active P0418 DTC No active DTC P0606 No active DTC P2432 No active DTC P2433 No active 5 Volt DTCs No active MAP DTCs	Skewed sensor cumulative info > 30 seconds Cumulative info is depending on BARO quality BARO quality is determined based on distance traveled since last BARO update Frequency: Continuous 100ms loop	DTC Type B
Secondary Air Injection System Pressure Sensor Circuit Low Voltage Bank 1	P2432	This DTC determines an out of range low SAI pressure sensor signal	SAI Pressure Sensor signal < 5% of 5V Ref	No active DTC P0606 No active 5 Volt DTCs	50 failures out of 63 samples frequency: 100ms cont.	DTC Type B
Secondary Air Injection System Pressure Sensor Circuit High Voltage Bank 1	P2433	This DTC determines an out of range high SAI pressure sensor signal	SAI Pressure Sensor signal < 94% of 5V Ref	No active DTC P0606 No active 5 Volt DTCs	50 failures out of 63 samples frequency: 100ms cont.	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Secondary Air Injection System Shut-off Valve Stuck Open	P2440	This DTC determines if the SAI system control valve is stuck open Phase 2 test (Pump commanded On, valve commanded closed)	SAI pressure error < -3kPa (actual pressure lower than predicted during Phase 2)	No active MAF DTCs No active MAP DTCs No active SAI Pressure Sensor Performance DTCs No active SAI Pressure Sensor Circuit DTCs No active SAI pump relay DTCs No active SAI valve relay DTCs No active IAT DTCs No active ECT DTCs No active Misfire DTCs No active Catalyst Monitor DTCs No active P0606 DTC No active 5 Volt DTCs No active EST DTCs No active Fuel Injector DTCs BARO > 70 kPa Engine Airflow < 33 g/s 9V < System Voltage < 18V Stability Time > 5 seconds SAI System commanded On	Phase 2 Test cumulative info > 1.5 seconds Frequency: Once per trip when SAI pump commanded On	DTC Type B
Secondary Air Injection System Pump Stuck On	P2444	This DTC determines if the SAI pump is stuck On Phase 3 test (Pump commanded Off)	SAI Pressure Error > 1.5kPa (actual pressure higher than predicted during Phase 3 test)	No active MAF DTCs No active MAP DTCs No active SAI Pressure Sensor Performance DTCs No active SAI Pressure Sensor Circuit DTCs No active SAI pump relay DTCs No active SAI valve relay DTCs No active IAT DTCs No active ECT DTCs No active Misfire DTCs No active Catalyst Monitor DTCs No active P0606 DTC No active 5 Volt DTCs No active EST DTCs No active Fuel Injector DTCs BARO > 70 kPa Engine Airflow < 33 g/s 9V < System Voltage < 18V Stability Time > 5 seconds SAI System commanded On	Phase 3 Test cumulative info > 4 seconds Frequency: Once per trip when SAI pump commanded On	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Control Module Ignition Off Timer Performance	P2610	Determines if the ignition off timer has failed	1. A failure will be reported if the following occurs 3 times: Ignition off time < 0 Or Ignition off time > 10 2. A failure will be reported if any of the following occur 15 times out of 20 tests: • Time since last ignition off timer increment > 1.39375 • Current ignition off time < Old ignition off time • Time between ignition off timer increments < 0.575 • Time between ignition off timer increments > 1.39375 • Current ignition off time - old ignition off Time =1	Test run this trip = FALSE Ignition off timer enabled = TRUE -40°C < IAT < 125°C	Frequency 100 msec loop Continuous check	DTC Type B
O2 Sensor Circuit Range/Performance Bank 1 Sensor 1	P2A00	This DTC determines if the O2 sensor voltage is not meeting the voltage criteria to enable closed loop fueling.	Closed loop fuel control O2 sensor Ready flag set to "Not Ready." O2 sensor voltage must be > 550 millivolts or < 350 millivolts to set closed loop fuel O2 Ready flag. Once set to "Ready," the O2 sensor voltage cannot be > 350 millivolts and < 550 millivolts for > 10 seconds or the O2 Ready flag will be reset to "Not Ready."	• No TP Sensor, MAF, MAP, IAT, ECT, EVAP, Secondary Air, Injector DTC's • No B1S1 O2 DTC's • Engine Run Time ≥ 200 seconds • ECT ≥ 70° C • Engine Metal Overtemp = Not Active • Traction Control = Not Active • No default throttle action • Not in Catalyst Protection Mode • 11 volts ≤ Ignition Voltage ≤ 18 volts • 1000 ≤ Engine Speed ≤ 3400 • 10 gps ≤ Mass Airflow ≤ 50 gps • Not in Decel Fuel Cutoff Mode • Not in Power Enrichment • Predicted O2 temp ≥ 0°C All of the above met for 2 seconds.	400 test failures in a 500 test sample Frequency: Continuous 100ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 $\geq$ 650 millivolts or voltage $\leq$ 250 millivolts	Common Enable Criteria • 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 • 11 volts < system voltage < 18 volts • Learned heater resistance is valid • ICAT MAT Burnoff delay is not active Specific Enable Criteria: • No Fuel Trim or Misfire DTC's active • 500 rpm $\leq$ Engine Speed $\leq$ 5000 rpm • 2 gps $\leq$ Airflow $\leq$ 50 gps • 24 kph $\leq$ Vehicle Speed $\leq$ 100 kph • 0.95 $\leq$ Short term fuel trim $\leq$ 1.05 • 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 All of the above met for at least 1 seconds, and then: Purge Duty Cycle = 0 % For 5 seconds	Up to 550 grams of accumulated air flow for the Lean Test and 550 grams of accumulated air flow for the Rich Test. Frequency: Once per trip	DTC Type B

LOOK UP TABLES

TABLE - O2S Slow Response Bank 1 Sensor 1 (P0133) Pass/Fail Thresholds

Lean-Rich Ave

Seconds   0.000 0.024 0.036 0.048 0.060 0.072 0.084 0.096 0.108 0.120 0.132 0.144 0.156 0.168 0.180 0.192   0.204.

Rich-Lean Ave

0.000	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.036	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.048	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.060	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.072	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.084	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.096	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.108	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.120	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL
0.132	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL
0.144	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL
0.156	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.168	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL
0.180	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL
0.192	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.204	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.216	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL

ADDENDUM -

The following Sensed Parameters are additional parameters that are not used for the LL8 engine but are used on all the LLR (5 cylinder) engine applications.

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

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Camshaft Position Sensor-A Bank-1 Correlation (Non-Encoded Cam Sensor)	P0016	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position (Cam to Crank Correlation Diagnostic)	Cam sensor pulse occurs outside crank MedRes region: KaEPSD_Cnt_NE_CamPerf_Region_1 = 2 KaEPSD_Cnt_NE_CamPerf_Region_2 = 3 The crank MedRes region is a certain number of crank sensor pulses. ECM throughput prohibits using every crank sensor pulse. Typical crank MedRes region is twice per cylinder, but varies in each engine.	IF [CAM_TYPE = NON_ENCODED_CAM AND CAM_TYPE ≠ CSI_CAM AND CKP_MedRes_Active = TRUE AND Crank_Sync_Flag = Crank_In_Sync AND Fault_Pending[CMP_CKT_Perf] = FALSE AND Fault_Active[CMP_CKT] = FALSE AND Fault_Active[CKP_SnsrA_Ckt] = FALSE AND Fault_Active[CKP_SnsrA_Perf] = FALSE AND Fault_Active[CKP_SnsrB_Ckt] = FALSE AND Fault_Active[CKP_SnsrB_Perf] = FALSE AND Fault_Active[CKP_SnsrAB_Corr] = FALSE] THEN ENABLE DIAGNOSTIC ELSE DISABLE DIAGNOSTIC ENDIF	8 cam pulses out of the last 10 cam sensor pulses are outside malfunction criteria Continuous check	DTC Type B
Camshaft Position Sensor-A Bank-1 Circuit	P0340	Detects cam sensor circuit malfunctions by monitoring for the absence of cam sensor pulses	See 'TIME LENGTH AND FREQUENCY' column	IF [MAF ≥ 0 AND [(Engine Cranking = TRUE AND Cam Sync Flag ≠ CAM_CYLINDER) OR Engine Running = TRUE]] THEN Enable diagnostic ELSE Disable diagnostic ENDIF	1 cam pulse does not occur within 3 secs	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE (S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE

Camshaft Position Sensor-A Bank-1 Performance	P0341	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	After Engine Start (slow event based) 275 > cam sensor pulses > 325
			
			Near Engine Start (fast event based) 2 > cam pulses > 4
				After Engine Start (slow event based)
				IF [{(CAM_TYPE ≠ CSI AND) } AND
				　　　CKP_MedRes_Active = TRUE AND
				　　　Crank_Sync_Flag = Crank_In_Sync AND
				　　　Fault_Active[CMP_Ckt] = FALSE AND
				　　　Fault_Active[CKP_SnsrA_Ckt] = FALSE
				AND
				　　　Fault_Active[CKP_SnsrA_Perf] = FALSE
				AND
				　　　Fault_Active[CKP_SnsrB_Ckt] = FALSE
				AND
				　　　Fault_Active[CKP_SnsrB_Perf] = FALSE
				AND
				　　　Fault_Active[CKP_SnsrAB_Corr] = FALSE
				THEN
				　　　Enable diagnostic
				ELSE
				　　　Disable diagnostic
				ENDIF
				
				Near Engine Start (fast event based)
				IF[　　MedRes_CKP_Counter ≤ 10 AND
				　　　CKP_MedRes_Active = TRUE AND
				　　　Crank_Sync_Flag = Crank_In_Sync AND
				　　　CAM_TYPE ≠ CSI_CAM AND
				　　　Fault_Active[CMP-Ckt] = FALSE]
				THEN
				　　　ENABLE DIAGNOSTIC
				ELSE
				　　　DISABLE DIAGNOSTIC
				ENDIF
				Footnote: the crank MedRes counter increments when the diagnostic is enabled and counts the number of crank MedRes software interrupts. ECM throughput prohibits interrupting on every crank sensor pulse. Typical crank MedRes software interrupts occur twice per cylinder, but varies in each engine.
					After Engine Start One Test = 1000 MedRes software interrupts
					
					8 failed tests out of the last 10 tests
					
					Near Engine Start One Test = 10 MedRes software interrupts
					
					Fail Report = 1 failed test
						DTC Type B