08 GRP13 All Engines

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Intake Camshaft Position Actuator Solenoid Control Circuit Bank 1	#P0010	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Output driver commanded on Ignition switch is in crank or run 11 volts < Ignition Voltage < 18 volts	100 failures out of 100 samples 250ms loop continuous	DTC Type B
Intake Camshaft Position System Performance Bank 1	#P0011	Detects a VVT system error by comparing the desired and actual cam positions when VVT is activated	Camshaft position error [absolute value of (desired position - actual position)]: 4 degrees at 104C oil temp - varies with Oil Temp Table is a function of Engine RPM and Oil Temperature	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position > 4 for 3 seconds 11 volts ≤ System voltage ≤ 18 volts Power Take Off (PTO) not active DTCs not active for the following sub-systems: Cam sensors Crank sensors Cam to crank rationality Cam phase output drivers	100 fail counts out of 300 sample counts 100ms loop Continuous	DTC Type B
Exhaust Camshaft Position Actuator Solenoid Control Circuit Bank 1	#P0013	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Output driver commanded on Ignition switch is in crank or run 11 volts < Ignition Voltage < 18 volts	100 failures out of 100 samples 250ms loop continuous	DTC Type B
Exhaust Camshaft Position System Performance Bank 1	#P0014	Detects a VVT system error by comparing the desired and actual cam positions when VVT is activated	Camshaft position error [absolute value of (desired position - actual position)]: 4 degrees at 104C oil temp - varies with Oil Temp Table is a function of Engine RPM and Oil Temperature	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position > 4 for 3 seconds 11 volts ≤ System voltage ≤ 18 volts Power Take Off (PTO) not active DTCs not active for the following sub-systems: Cam sensors Crank sensors Cam to crank rationality	100 fail counts out of 300 sample counts 100ms loop Continuous	DTC Type B
Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 1 Sensor A	P0016	This diagnostic will determine if the Cam sensor and cam timing have been installed correctly compared to the crank timing.	Cam signal falling edge out of phase -10 or + 11 degrees from corresponding crank falling edge.	Engine is spinning No crank position sensor circuit or performance DTC's No Fault Pending CAM Circuit DTC's Engine speed <1200 rpm Crankshaft position signal is true	Engine Running: 1 Test failure is counted when all 4 cam pulses (4x cam sensor) are more than the allowed crank degrees. 25 test failures within a 35 test sample size. Engine Cranking: 4 test failures witnin 5 test samples. Time necessary to complete sample: Varies with engine speed 1 Sample = 1 engine cycle.	DTC Type B

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Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 1 Sensor B	#P0017	This diagnostic will determine if the Cam sensor and cam timing have been installed correctly compared to the crank timing.	Cam signal falling edge out of phase -10 or + 11 degrees from corresponding crank falling edge.	Engine is spinning No crank position sensor circuit or performance DTC's No Fault Pending CAM Circuit DTC's Engine speed < 1200 rpm Crankshaft position signal is true • Cam phase state is learned of default	1 Test failure is counted when all 4 cam pulses (4x cam sensor) are more than the allowed crank degrees. 25 test failures within a 35 test sample size. Engine Cranking: 4 test failures within 5 test samples. Time necessary to complete sample: Varies with engine speed 1 Sample = 1 engine cycle.	DTC Type B
Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 2 Sensor A	#P0018	This diagnostic will determine if the Cam sensor and cam timing have been installed correctly compared to the crank timing.	Cam signal falling edge out of phase -10 or + 11 degrees from corresponding crank falling edge.	Engine is spinning No crank position sensor circuit or performance DTC's No Fault Pending CAM Circuit DTC's Engine speed < 1200 rpm Crankshaft position signal is true • Cam phase state is learned of default	1 Test failure is counted when all 4 cam pulses (4x cam sensor) are more than the allowed crank degrees. 25 test failures within a 35 test sample size. Engine Cranking: 4 test failures within 5 test samples. Time necessary to complete sample: Varies with engine speed 1 Sample = 1 engine cycle.	DTC Type B
Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 2 Sensor B	#P0019	This diagnostic will determine if the Cam sensor and cam timing have been installed correctly compared to the crank timing.	Cam signal falling edge out of phase -10 or + 11 degrees from corresponding crank falling edge.	Engine is spinning No crank position sensor circuit or performance DTC's No Fault Pending CAM Circuit DTC's Engine speed < 1200 rpm Crankshaft position signal is true • Cam phase state is learned of default	1 Test failure is counted when all 4 cam pulses (4x cam sensor) are more than the allowed crank degrees. 25 test failures within a 35 test sample size. Engine Cranking: 4 test failures witjin 5 test samples. Time necessary to complete sample: Varies with engine speed 1 Sample = 1 engine cycle.	DTC Type B

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Intake Camshaft Position (CMP) Actuator Solenoid Control Circuit Bank 2	#P0020	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Output driver commanded on Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts	100 failures out of 100 samples 250ms loop continuous	DTC Type B
Intake Camshaft Position System Performance - Bank 2	#P0021	Detects a VVT system error by comparing the desired and actual cam positions when VVT is activated	Camshaft position error [absolute value of (desired position - actual position)]: 4 degrees at 104C oil temp - varies with Oil Temp Table is a function of Engine RPM and Oil Temperature	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position > 4 for 3 seconds System voltage ≥ 11 volts Power Take Off (PTO) not active DTC's not active for the following sub-systems: Cam sensors Crank sensors Cam to crank rationality • Cam phase output drivers	100 fail counts out of 300sample counts 100ms loop Continuous	DTC Type B
Exhaust Camshaft Position (CMP) Actuator Solenoid Control Circuit Bank 2	#P0023	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Output driver commanded on Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts	100 failures out of 100 samples 250ms loop continuous	DTC Type B
Exhaust Camshaft Position System Performance - Bank 2	P0024	Detects a VVT system error by comparing the desired and actual cam positions when VVT is activated	Camshaft position error [absolute value of (desired position - actual position)] : 4 degrees at 104C oil temp - varies with Oil Temp Table is a function of Engine RPM and Oil Temperature	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position > 4 for 3 seconds System voltage ≥ 11 volts Power Take Off (PTO) not active DTC's not active for the following sub-systems: Cam sensors Crank sensors Cam to crank rationality Cam phase output drivers •	100 fail counts out of 300 sample counts 100ms loop Continuous	DTC Type B
O2S Heater Control Circuit Bank 1 Sensor 1	P0030	This DTC checks the Heater Output Driver circuit for electrical integrity	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • RPM > 425	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B
Turbo/Super Charger Bypass Valve Control Circuit	#P0033	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	20 failures in a 25 sample test 250 msec / sample	DTC Type B
O2S Heater Control Circuit Bank 1 Sensor 2	P0036	This DTC checks the Heater Output Driver circuit for electrical integrity	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • RPM > 425	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).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • RPM > 425	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B

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HO2S Heater Resistance Bank 1 Sensor 1	P0053	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	3.03< Calculated Heater resistance < 9.21	• Coolant – IAT < 8ºC • Engine Soak Time > 28800 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.	3.33< Calculated Heater resistance < 9.51	• Coolant – IAT < 8ºC • Engine Soak Time > 28800 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
B2S2 Oxygen Sensor Heater Circuit (ODM)	#P0056	This DTC checks the Heater Output Driver circuit for electrical integrity	Output state shorted or open Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts RPM > 425	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B 4 Sensor Systems
HO2S Heater Resistance Bank 2 Sensor 1	P0059	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	3.03< Calculated Heater resistance < 9.21	• Coolant – IAT < 8ºC • Engine Soak Time > 28800 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
B2S2 Oxygen Sensor Heater Resistance	#P0060	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	3.13< Calculated Heater resistance < 9.31	• Coolant – IAT < 8ºC • Engine Soak Time > 28800 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 4 Sensor Systems

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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 > 33 kPa OR V5B OOR OR After Throt Blade MAP sensor TFTKO, then MAP leg failed 2. Difference between measured MAF and estimated MAF > 38 grams/sec OR MAF sensor TFTKO OR Vbatt < 10 volts, then MAF leg failed. 3. X, Y depend on throttle position, and maximum of X, and Y are 33 kPa, 38 gram/sec.	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
Barometric Pressure (BARO) - Supercharger Inlet Pressure Correlation	#P0069	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 > MAP_Lim kPa OR V5B OOR OR After Throt Blade MAP sensor TFTKO, then MAP leg failed 2. Difference between measured MAF and estimated MAF > MAF_Lim grams/sec OR MAF sensor TFTKO OR Vbatt < 10 volts, then MAF leg failed. TPS MAP_Lim MAF_Lim 1 5% 17.31 12.20 2 10% 14.96 12.84 3 15% 17.68 14.36 4 20% 15.57 17.57 5 25% 12.30 20.53 6 30% 11.59 21.81 7 35% 100.00 255.00 8 40% 100.00 255.00 9 100% 100.00 255.00	Engine running, engine speed > 800 rpm	Continuously fail MAP AND MAF legs for longer than 0.1875 msec Continuous in the main processor	DTC Type A
Manifold Absolute Pressure – Barometric Pressure Correlation	# P0069	Compares baro sensor to the calculated baro estimate (part throttle calculated or unthottled MAP)	If the difference between baro read from sensor and calculated baro is exceeded, the code is set Calculated > 20 when the distance traveled since wide open throttle baro update while Vehicle Speed >17.5 kph is >10meters Map > 15 when the distance traveled since wide open throttle baro update while Vehicle Speed >17.5 kph is <10meters	No circuit fault on the baro sensor No fault (circuit or performance) on the CLT sensor No fault (circuit or performance) on the IAT sensor No fault (circuit or performance) on the MAF sensor No fault (circuit or performance) on the ATP sensor (SCIAP on supercharged applications) No fault (circuit or performance) on the Throttle Position sensor No fault (circuit or performance) on vehicle speed	20 failures in a 25 sample test 250 msec / sample	DTC Type B

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Intake Air Temperature Sensor 2 Circuit Range/Performance	# P0096	Detects IAT and IAT2 temp sensors stuck in mid range	A failure will be reported if any of the following occur: The delta between IAT and IAT2 is greater than 20 degrees C after a minimum 8 hour soak (fast fail) and P0116 is passing.	No VSS DTC's No ECT DTC's No ECT sensor shorted DTC's Non-volatile memory failure has not been detected on power-up. Engine off time > 8 hours No stall Test run this trip = false Test aborted this trip = false	1 failure 500 ms loop	DTC Type B
Intake Air Temperature Sensor 2 Circuit Low	# P0097	This DTC detects a continuous short to ground in the IAT2 signal circuit or the IAT2 sensor.	Raw IAT2 < 45 ohms (151C)	Engine run time > 10 seconds, or Coolant ≤ 150°C Vehicle speed > 0 MAF < 512 g/s	50 test failures in a 63 sample test for short 1 sec / sample	DTC Type B
Intake Air Temperature Sensor 2 Circuit High	# P0098	This DTC detects a continuous short to high or open in the IAT2 signal circuit or the IAT2 sensor.	Raw IAT2 > 420,000 ohms (-60C)	Engine run time > 10 seconds, or Coolant ≥ -40°C Vehicle speed > 0 MAF < 512 g/s	50 test failures in a 63 sample test for short 1 sec / sample	DTC Type B
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 > 25 AND (Measured Manifold Air Pressure – Manifold Model 2 pressure)Filtered > 30	Engine rpm =>550 and <= 5000 MAP sensor high/low DTC's not active EGR DTC's P0401,.P0405, and P1404 not active MAF sensor high/low DTC's not active Crank sensor DTC's not active Engine Coolant DTC's not active Intake Air Temp. DTC's not active Engine Coolant > 70 deg C and < 129 deg C Intake Air Temp > -7 deg C and < 60 deg C Refer to "IFRD weight factors" attached at bottom Minimum total weight factor (all factors multiplied together) >.26	Continuous The Mass Air Flow reading and Mass Air Flow calculation are performed during the same 12.5 ms loop	DTC Type B
MASS AIR FLOW SENSOR CIRCUIT LOW FREQUENCY	P0102	Detects a continuous short to low or a open in either the signal circuit or the MAF sensor	MAF ≤ 850 Hz (approximately 1.5g/s)	Engine Running ≥ 1 second Engine Speed ≥ 300 RPM RunCrank Voltage ≥ 8 volts Above must be true ≥ 1 second	50 failures in a 63 sample test 1 sample every LoRes 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 ≥ 14500 Hz Hz (approximately 866g/s)	Engine Running ≥ 1 second Engine Speed ≥ 300 RPM RunCrank Voltage ≥ 8 volts Above must be true ≥ 1 second	50 failures in a 63 sample test 1 sample every LoRes event	DTC Type B

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MAP SENSOR RANGE/ PERFORMANCE (RATIONALITY)	P0106	This DTC determines if the MAP sensor is stuck within the normal operation range	(Measured MAP - Manifold Model 1 pressure) filtered > 20 AND (Measured MAP – Manifold Model 2 pressure) filtered > 20	Engine rpm =>550 and <= 5000 MAP sensor high/low DTC's not active EGR DTC's P0401,.P0405, and P1404 not active MAF sensor high/low DTC's not active Crank sensor DTC's not active Engine Coolant DTC's not active Intake Air Temp. DTC's not active Engine Coolant > 70 deg C and < 129 deg C Intake Air Temp > -7 deg C and < 60 deg C Refer to "IFRD weight factors" attached at bottomMinimum total weight factor (all factors multiplied together) >.26	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 (0.1 volts)	Key-On test: Engine speed ≤ 400 RPM Run Test: No TPS failures present TPS ≥ 0%, and Engine Speed ≤ 800 RPM, or TPS >= 12.5%, Engine Speed > 800 RPM)	320 failures in a 400 sample test 12.5 msec / sample	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)	No TPS failures present Engine running Engine run time > Min based on power-up coolant temp (-30°C = 242 seconds, -15°C = 188 seconds, 0°C = 144 seconds, 15°C = 80 seconds, 30°C = 0 seconds) TPS < 1%, and Engine Speed ≤ 1200 RPM, or TPS < 20%, and Eengine Speed > 1200 RPM	320 failures in a 400 sample test 12.5 msec / sample	DTC Type B
Intake Air Temperature (IAT) Sensor Performance	# P0111	Detects IAT sensor stuck in range	A failure will be reported if any of the following occur: The delta between IAT and IAT2 is greater than 20 degrees C after a minimum 8 hour soak (fast fail) and P0116 is failing.	No VSS DTC's No ECT DTC's No ECT sensor shorted DTC's Non-volatile memory failure has not been detected on power-up. Engine off time > 8 hours No stall Test run this trip = false Test aborted this trip = false	1 failure 500 ms loop	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 (approximately 150 DegC)	No ECT failures present No Vehicle Speed failures present Coolant Temp < 150°C Vehicle speed ≥ 0 kph Engine run time > 10 seconds	50 failures in a 63 sample test 100 msec / sample	DTC Type B

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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 > 163000 ohms (approximately -60DegC)	No ECT failures present No MAF failures present No Vehicle Speed failures present Coolant Temp ≥ -40°C Mass Airflow < 512 g/s Vehicle speed < 512 kph Engine run time > 10 seconds	50 failures in a 63 sample test 100 msec / sample	DTC Type B
ENGINE COOLANT TEMP SENSOR RATIONALITY (HIGH-SIDED)	P0116	Detects coolant temp sensor stuck in mid range	A failure will be reported if any of the following occur: ECT at powerup > IAT at powerup by an IAT based table lookup value after a minimum 8 hour soak (fast fail) table attached at bottom. ECT at powerup > IAT at powerup by 10C after a minimum 8 hour soak and a block heater has not been detected. ECT at powerup > IAT at powerup by 10C after a minimum 8 hour soak and the time spent cranking the engine without starting is greater than 5 seconds with the fuel level being above a minimum level of 5%.	No VSS DTC's No IAT DTC's No ECT sensor shorted DTC's ECM/PCM Internal Engine Off Timer Performance DTC not active Non-volatile memory failure has not been detected on power-up. Engine off time > 8 hours Test run this trip = false Test aborted this trip = false Block heater detection: ECT at powerup > IAT at powerup by 20C Powerup IAT > -7C Vehicle driven a minumum of 400 seconds above 15 kph and IAT drops more than 4C from powerup IAT.	1 failure 500 ms loop	DTC Type B
ENGINE COOLANT TEMP SENSOR CIRCUIT LOW (HIGH TEMP)	P0117	This DTC detects a continuous short to ground in the ECT signal circuit or the ECT sensor.	OHMS < 45 ohms (approximate temperature 150 deg C)	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	This DTC detects a continuous short to high or open in the ECT signal circuit or the ECT sensor.	OHMS > 450,000 ohms (approximate temperature -60 deg C)	Engine run time > 10 seconds, or IAT ≥ 0°C	5 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	79/159 counts; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A

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TP SENSOR CIRCUIT PERFORMANCE (RATIONALITY)	P0121	The DTC determines if a TPS sensor is stuck within the normal operating range	(The calculated throttle residual from the MAF model and the Manifold Model) filtered > 300	Engine rpm =>550 and <= 5000 MAP sensor high/low DTC's not active EGR DTC's P0401,.P0405, and P1404 not active MAF sensor high/low DTC's not active Crank sensor DTC's not active Engine Coolant DTC's not active Intake Air Temp. DTC's not active Engine Coolant > 70 deg C and < 125 deg C Intake Air Temp > -7 deg C and < 100 deg C Refer to "IFRD weight factors" attached at bottomMinimum total weight factor (all factors multiplied together) >.26	Continuous Calculations are performed every 12.5 ms	DTC Type B
Throttle Position (TP) Sensor 1 Circuit Lo	P0122	Detects a continuous or intermittent OOR 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; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Throttle Position (TP) Sensor 1 Circuit Hi	P0123	Detects a continuous or intermittent OOR lo TPS	TPS > 4.75 V	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 55counts 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
COOLANT TEMPERATURE BELOW STAT REGULATING TEMPERATURE	P0128	Under driving conditions, target coolant temperature should be achieved based on amount of cumulative airflow ingested, and based on startup coolant temperature	A table attached at bottom defines maximum cumulative airflow based on startup coolant temperature and IAT at which target coolant temperature must have been reached For –7C < IAT < 10C, Target = 55C For IAT > 10C, Target = 70C	6 gps < Airflow < 45 gps Average Air Flow > 7gps required to fail Engine runtime <1370seconds before test completes Engine runtime > 120 seconds Minimum IAT > -7C Vehicle speed > 8 kph for 2.4 kilometers For –7C < IAT < 10C, Startup ECT< 70 For IAT > 10C, Startup ECT<70 Eng speed >8191 rpm for more than 65535 sec will abort test. No ECT, Throttle, IAT, VSS, MAF or MAP faults	Once per trip Time based on flow	DTC Type B

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Supercharger Inlet Pressure Sensor Performance	# P012B	This DTC determines if the SCIAP sensor is stuck within the normal operation range	(Measured SCIAP - SCIAP Model 1 pressure) filtered > 17 AND (Measured SCIAP – SCIAP 2 pressure) filtered > 24	Engine rpm =>550 and <= 5000 MAP sensor high/low DTC's not active EGR DTC's P0401,.P0405, and P1404 not active MAF sensor high/low DTC's not active Crank sensor DTC's not active Engine Coolant DTC's not active Intake Air Temp. DTC's not active Engine Coolant > 70 deg C and < 129 deg C Intake Air Temp > -7 deg C and < 60 deg C IAT_2 fault Not Active SCIAP Circuit Fault Not Active Ambient Air Pressure Estimate not Defaulted all the way to a calibration Refer to "IFRD weight factors" attached at bottomMinimum total weight factor (all factors multiplied together) >.26	Continuous The SCIAP reading and the Manifold Model calculations are performed in the same LoRes loop	DTC Type B
Supercharger Inlet Pressure Sensor Circuit Low Voltage	# P012C	This DTC detects a continuous short to low or open in either the signal circuit or the SCIAP sensor.	SCIAP voltage < 2% of Vref (0.1 volts)	Key-On test: Engine speed ≤ 400 RPM Run Test: No TPS failures present TPS ≥ 0%, and Engine Speed ≤ 800 RPM, or TPS >= 12.5%, Engine Speed > 800 RPM)	320 failures in a 400 sample test 12.5 msec / sample	DTC Type B
Supercharger Inlet Pressure Sensor Circuit High Voltage	# P012D	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the SCIAP sensor	SCIAP voltage > 98% of Vref (4.9 volts)	No TPS failures present Engine running Engine run time > Min based on power-up coolant temp (-30°C = 242 seconds, -15°C = 188 seconds, 0°C = 144 seconds, 15°C = 80 seconds, 30°C = 0 seconds) TPS < 1%, and Engine Speed ≤ 1200 RPM, or TPS < 20%, and Eengine Speed > 1200 RPM	320 failures in a 400 sample test 12.5 msec / sample	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit Low Voltage Bank 1 Sensor 1	P0131	This DTC determines if the O2 sensor circuit is shorted to low.	O2 sensor voltage < 25 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • 0.99 ≤ Equivalence ratio ≤ 1.01 • 0 % ≤ throttle position ≤ 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 3 seconds	80 test failures in a 100 sample test. Frequency: Continuous 100 ms loop	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.	O2 sensor voltage > 1050 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 • 10 volts < system voltage < 10 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • 0.99 ≤ Equivalence Ratio ≤ 1.01 • 0 % ≤ throttle position ≤ 60 % • Fuel State = Closed loop All of the above met for at least 3 seconds	40 test failures in a 50 sample test. Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Slow Response Bank 1 Sensor 1	P0133	This DTC determines if the O2 sensor response time is degraded	Refer to **"O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153) Pass/Fail 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault 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 > 202 seconds • EVAP Canister purge duty cycle ≥ 0 % • 20 gps ≤ MAF ≤ 40 gps • 1100 ≤ RPM ≤ 2500 • Ethanol percentage < 85 % • Baro > 70 kPa • Throttle position ≥ 3 %Fuel state = closed loopTransmission (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.	60 seconds Frequency: Once per trip Green Sensor Delay Criteria • The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than KeEOSD_dm_Green_O2_FlowMin g/sec for KaEOSD_m_Green_O2_AccumFlowLim grams of accumulated flow non-continuously. (Note that all other enable criteria must be met on the next ignition cycle for the test to run on that ignition cycle) Note: this feature is only enabled when the vehicle is new and cannot be enabled in service	DTC Type 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 millivolts < O2 sensor < 500 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 101 seconds • Ethanol percentage > 85 % • No B1S1 heater related DTCs	480 test failures in a 600 test samples Minimum of 0 occurrences of a delta TP sensor ≥ 5 % during diagnostic test Frequency: Continuous for pre catalyst sensors 100 ms loop 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 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	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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time ≥ 120 seconds • ECT ≥ 60° C • O2 heater not in Device control • B1S1 O2 heater resistance DTC not active All of the above met for at least 2 seconds	8 test failures in 10 test samples Frequency: 2 tests per trip 120 seconds delay between tests 1 second execution rate	DTC Type B
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 < 10 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • 0.99 ≤ Equivalence ratio ≤ 1.01 • 0 % ≤ throttle position ≤ 50 % • Fuel state = closed loop • All fuel injectors = ON • Traction Control = not active All of the above met for at least 3 seconds	320 test failures in a 400 sample test. Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit High Voltage Bank 1 Sensor 2	P0138	This DTC determines if the O2 sensor or circuit is shorted to high	O2 sensor voltage > 1075 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • 0.99 ≤ Equivalence Ratio ≤ 1.01 • 0 % ≤ throttle position ≤ 50 % • Fuel State = Closed loop All of the above met for at least 3 seconds	80 test failures in a 100 sample test. Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit Insufficient Activity Bank 1 Sensor 2	P0140	This DTC determines if the O2 sensor circuit is open.	400 millivolts < O2 sensor < 500 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • Ethanol percentage > 85 % • No B1S2 heater related DTCs • PCM State = run Fast Pass: • Engine run time ≤ 100 seconds (Fast pass cannot report a fail; if Fastpass fails, the regular open test is run) Regular Open Test • Engine run time > 101 seconds • Fuel state = closed loop	11200 test failures in a 1500 test samples Minimum of 5 occurrences of a delta TP sensor ≥ 5 % during diagnostic test (sample counts – failure counts) < 400 within 100 seconds of engine run time to fail the fast pass test (regular open test is run when fast pass fails; to fail DTC the regular open test must fail) Frequency: Once/trip for post catalyst sensors 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Heater Performance Bank 1 Sensor 2	P0141	This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	O2 sensor heater current is < 0.25 amps or > 3.125 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time ≥ 120 seconds • ECT ≥ 60° C • O2 heater not in Device control • B1S1 O2 heater resistance DTC not active All of the above met for at least 2 seconds	8 test failures in 10 test samples Frequency: 2 tests per trip 120 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 < 25 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • 0.99 ≤ Equivalence ratio ≤ 1.01 • 0 % ≤ throttle position ≤ 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 3 seconds	80 test failures in a 320 sample test. Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit High Voltage Bank 2 Sensor 1	P0152	This DTC determines if the O2 sensor or circuit is shorted to high.	O2 sensor voltage > 1050 millivolts 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • 0.99 ≤ Equivalence Ratio ≤ 1.01 • 0 % ≤ throttle position ≤ 60 % • Fuel State = Closed loop All of the above met for at least 3 seconds •	40 test failures in a 50 sample test. Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Slow Response Bank 2 Sensor 1	P0153	This DTC determines if the O2 sensor response time is degraded	Refer to **"O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153) Pass/Fail 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault 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 > 202 seconds • EVAP Canister purge duty cycle ≥ 0 % • 20 gps ≤ MAF ≤ 40 gps • 1100 ≤ RPM ≤ 2500 • Ethanol percentage < 85 % • Baro > 70 kPa • Throttle position ≥ 3 %Fuel state = closed loopTransmission (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.	60 seconds Frequency: Once per trip	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit Insufficient Activity Bank 2 Sensor 1	P0154	This DTC determines if the O2 sensor circuit is open.	400 millivolts < O2 sensor < 500 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 101 seconds • Ethanol percentage > 85 % • No B1S1 heater related DTCs	480 test failures in a 600 test samples Minimum of 0 occurrences of a delta TP sensor ≥ 5 % during diagnostic test Frequency: Continuous for pre catalyst sensors 100 ms loop rate	DTC Type B
O2S Heater Performance Bank 2 Sensor 1	P0155	This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	O2 sensor heater current is < 0.25 amps or > 3.125 amps	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector 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 Specific Enable Criteria • Engine Run Time ≥ 120 seconds • ECT ≥ 60° C • O2 heater not in Device control • B1S1 O2 heater resistance DTC not active All of the above met for at least 2 seconds	8 test failures in 10 test samples Frequency: 2 tests per trip 120 seconds delay between tests 1 second execution rate	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit Low Voltage Bank 2 Sensor 12	#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 < 10 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • 0.99 ≤ Equivalence ratio ≤ 1.01 • 0 % ≤ throttle position ≤ 50 % • Fuel state = closed loop • All fuel injectors = ON • Traction Control = not active All of the above met for at least KaEOSD_t_LeanDly seconds	320 test failures in a 400 sample test. Frequency: Continuous 100 ms loop	DTC Type B 4 Sensor systems
O2S Circuit High Voltage Bank 2 Sensor 2	#P0158	This DTC determines if the O2 sensor or circuit is shorted to high by checking for a rich condition during steady throttle.	O2 sensor voltage > KaEOSD_U_RichHiThrsh[x] millivolts to go fault pending O2 sensor voltage > 1075 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • 0.99 ≤ Equivalence Ratio ≤ 1.01 • 0 % ≤ throttle position ≤ 50 % • Fuel State = Closed loop All of the above met for at least 3 seconds	320 test failures in a 400 sample test. Frequency: Continuous 100 ms loop	DTC Type B 4 Sensor Systems

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	#P0160	This DTC determines if the O2 sensor is open.	400 millivolts < O2 sensor < 500 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria • Ethanol percentage > 85 % • No B1S2 heater related DTCs • PCM State = run Fast Pass: Engine run time ≤ 100 seconds (Fast pass cannot report a fail; if Fastpass fails, the regular open test is run) Regular Open Test • Engine run time > 101 seconds Fuel state = closed loop	1200 test failures in a 1500 test samples Minimum of 5 occurrences of a delta TP sensor ≥ 5 % during diagnostic test (sample counts – failure counts) < 400 within 100 seconds of engine run time to fail the fast pass test (regular open test is run when fast pass fails; to fail DTC the regular open test must fail) Frequency: Once/trip for post catalyst sensors 100 ms loop	DTC Type B 4 Sensor Systems
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 > 3.125 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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time ≥ 120 seconds • O2 heater not in Device control • B2S1 O2 heater resistance DTC not active All of the above met for at least 2 seconds	8 test failures in 10 test samples Frequency: 2 tests per trip 120 seconds delay between tests 1 second execution rate	DTC Type B 4 Sensor Systems

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Lean Bank 1	P0171	Determines if the fuel control system is in a lean condition, based on the EWMA of the combined fuel trim correction consisting of the long-term fuel trim (LONG FT) and the short term fuel trim (SHORT FT). (Note: EWMA stands for "Exponentially Weighted Moving Average")	The EWMA of Combined FT (LONG FT + SHORT FT -1) samples ≥ 1.24	• No Misfire, pre-cat O2S, or EVAP DTC's, No Fuel Injector DTC's, No IAC, MAF, MAP, ECT, EGR, or AIR DTC's, No TP Sensor or TAC System DTC's, Engine speed > 400 RPM but < 6000 RPM, BARO > 70 kpa, ECT > -38°C but < 150°C, MAP >-5 kpa but < 255 kpa, IAT > -38°C but < 150°C, MAF > 0.5 g/s but < 510 g/s, VSS < 83 mph (134 km/h) • Closed Loop and LONG FT enabled, Not in Device Control, EGR Flow Diagnostic Intrusive Test = Not Active, Catalyst Monitor Diag. 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; enable if fuel sender is faulty) General Notes: 1. At least 55 seconds of data must accumulate on each trip, with at least 45 seconds of data in the current fuel trim cell and the short term fuel trim is stable 2. or at least 10 seconds of data must accumulate on each trip, and the combined FT must be stable before a pass or fail decision can be made. The fuel trim correction is stable if it has not changed by more than .04. The SHORT FT is stable if it has been at least 10 seconds since the last FT cell change or the SHORT FT has not changed by more than .04 in the past 3 seconds. 3. Development data indicates that the Fuel Adjustment System Diagnostic (FASD) is typically enabled during (95) % of the EPAIII drive cycle. This is also typical of real-world driving, however values will vary (higher or lower) based on the actual conditions present during the drive cycle.	The EWMA of Combined FT (LONG FT + SHORT FT -1) samples ≥ 1.24 for ≥ 100 ms Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Rich Bank 1	P0172	Determines if the fuel control system is in a rich condition, based on the EWMA of the combined fuel trim correction consisting of the long-term fuel trim (LONG FT).and the short-term fuel trim (SHORT FT). (Note: EWMA stands for "Exponentially Weighted Moving Average")	There exists both a Passive and, if needed, Intrusive rich test. Passive: The EWMA of purge-off LONG FT+ SHORT FT -1 samples $\leq$ 0.79 Intrusive: If a passive decision cannot be made, and the EWMA of purge-on LONG FT + SHORT FT -1 samples $\leq$ 0.80, 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 LONG FT + SHORT FT -1 samples with purge off $\leq$ 0.79 for at least 10 seconds during each of 2 intrusive segments. Intrusive Notes: 1. Segments can last up to 60 seconds, and are separated by the lesser of 10 seconds of purge-on time or enough time to purge 5 grams of vapor. 2. A maximum of 3 completed segments or 20 intrusive attempts are allowed for each intrusive test.	No Misfire, pre-cat O2S, or EVAP DTC's, No Fuel Injector DTC's, No IAC, MAF, MAP, ECT, EGR, or AIR DTC's, No TP Sensor or TAC System DTC's, Engine speed > 400 RPM but < 6000 RPM, BARO > 70 kpa ECT > -38°C but < 150°C, MAP > 5 kpa but < 255 kpa, IAT > -38°C but < 150°C, MAF > 0.5 g/s but < 510 g/s VSS < 83 mph (134 km/h), Closed Loop and LONG FT enabled, Not in Device Control, EGR Flow Diagnostic Intrusive Test = Not Active, Catalyst Monitor Diag. Intrusive Test = Not Active, Post O2 Diagnostic Intrusive Test = Not Active, EVAP diagnostic is at any stage except the "tank pull down" portion of the test, General Notes: 1. At least 55 seconds of data must accumulate on each trip, with at least 45 seconds of data in the current fuel trim cell and the short term fuel trim is stable 2. or at least 10 seconds of data must accumulate on each trip, and the combined FT must be stable before a pass or fail decision can be made. The fuel trim correction is stable if it has not changed by more than .04. The SHORT FT is stable if it has been at least 10 seconds since the last FT cell change or the SHORT FT has not changed by more than .04 in the past 3 seconds. 3. Development data indicates that the Fuel Adjustment System Diagnostic (FASD) is typically enabled during (95) % of the EPAIII drive cycle. This is also typical of real-world driving, however values will vary (higher or lower) based on the actual conditions present during the drive cycle	Passive: The EWMA of purge-off LONG FT+ SHORT FT -1 samples $\leq$ 0.79 for $\geq$ 100ms Intrusive: If rich fail counter is $\geq$ 2 before pass counter $\geq$ 2, diagnostic fails. Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Lean Bank 2	P0174	Determines if the fuel control system is in a lean condition, based on the EWMA of the combined fuel trim correction consisting of the long-term fuel trim (LONG FT) and the short term fuel trim (SHORT FT). (Note: EWMA stands for "Exponentially Weighted Moving Average")	The EWMA of Combined FT (LONG FT + SHORT FT -1) samples ≥ 1.24	• No Misfire, pre-cat O2S, or EVAP DTC's, No Fuel Injector DTC's, No IAC, MAF, MAP, ECT, EGR, or AIR DTC's, No TP Sensor or TAC System DTC's, Engine speed > 400 RPM but < 6000 RPM, BARO > 70 kpa, ECT > -38°C but < 150°C, MAP >-5 kpa but < 255 kpa, IAT > -38°C but < 150°C, MAF > 0.5 g/s but < 510 g/s, VSS < 83 mph (134 km/h) • Closed Loop and LONG FT enabled, Not in Device Control, EGR Flow Diagnostic Intrusive Test = Not Active, Catalyst Monitor Diag. 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; enable if fuel sender is faulty) General Notes: 1. At least 55 seconds of data must accumulate on each trip, with at least 45 seconds of data in the current fuel trim cell and the short term fuel trim is stable 2. or at least 10 seconds of data must accumulate on each trip, and the combined FT must be stable before a pass or fail decision can be made. The fuel trim correction is stable if it has not changed by more than .04. The SHORT FT is stable if it has been at least 10 seconds since the last FT cell change or the SHORT FT has not changed by more than .04 in the past 3 seconds. 3. Development data indicates that the Fuel Adjustment System Diagnostic (FASD) is typically enabled during (95) % of the EPAIII drive cycle. This is also typical of real-world driving, however values will vary (higher or lower) based on the actual conditions present during the drive cycle.	The EWMA of Combined FT (LONG FT + SHORT FT -1) samples ≥ 1.24 for ≥ 100 ms Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Rich Bank 2	P0175	Determines if the fuel control system is in a rich condition, based on the EWMA of the combined fuel trim correction consisting of the long-term fuel trim (LONG FT).and the short-term fuel trim (SHORT FT). (Note: EWMA stands for "Exponentially Weighted Moving Average")	There exists both a Passive and, if needed, Intrusive rich test. Passive: The EWMA of purge-off LONG FT+ SHORT FT -1 samples $\leq$ 0.79 Intrusive: If a passive decision cannot be made, and the EWMA of purge-on LONG FT + SHORT FT -1 samples $\leq$ 0.80, 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 LONG FT + SHORT FT -1 samples with purge off $\leq$ 0.79 for at least 10 seconds during each of 2 intrusive segments. Intrusive Notes: 1. Segments can last up to 60 seconds, and are separated by the lesser of 10 seconds of purge-on time or enough time to purge 5 grams of vapor. 2. A maximum of 3 completed segments or 20 intrusive attempts are allowed for each intrusive test.	No Misfire, pre-cat O2S, or EVAP DTC's, No Fuel Injector DTC's, No IAC, MAF, MAP, ECT, EGR, or AIR DTC's, No TP Sensor or TAC System DTC's, Engine speed > 400 RPM but < 6000 RPM, BARO > 70 kpa ECT > -38°C but < 150°C, MAP > 5 kpa but < 255 kpa, IAT > -38°C but < 150°C, MAF > 0.5 g/s but < 510 g/s VSS < 83 mph (134 km/h), Closed Loop and LONG FT enabled, Not in Device Control, EGR Flow Diagnostic Intrusive Test = Not Active, Catalyst Monitor Diag. Intrusive Test = Not Active, Post O2 Diagnostic Intrusive Test = Not Active, EVAP diagnostic is at any stage except the "tank pull down" portion of the test, General Notes: 1. At least 55 seconds of data must accumulate on each trip, with at least 45 seconds of data in the current fuel trim cell and the short term fuel trim is stable 2. or at least 10 seconds of data must accumulate on each trip, and the combined FT must be stable before a pass or fail decision can be made. The fuel trim correction is stable if it has not changed by more than .04. The SHORT FT is stable if it has been at least 10 seconds since the last FT cell change or the SHORT FT has not changed by more than .04 in the past 3 seconds. 3. Development data indicates that the Fuel Adjustment System Diagnostic (FASD) is typically enabled during (95) % of the EPAIII drive cycle. This is also typical of real-world driving, however values will vary (higher or lower) based on the actual conditions present during the drive cycle	Passive: The EWMA of purge-off LONG FT+ SHORT FT -1 samples $\leq$ 0.79 for $\geq$ 100ms Intrusive: If rich fail counter is $\geq$ 2 before pass counter $\geq$ 2, diagnostic fails. Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Engine Oil Temperature Sensor Performance	# P0196	Determines if the oil temperature sensor is stuck/biased in range.	Cold Start Fast Fail: Delta between powerup oil temp and coolant temp > 30° C & Delta between powerup ECT and IAT <= 15.75 ° C OR Cold Start Block Heater Test Enable is True Delta between powerup ECT and IAT <= 15.75 ° C & Delta between powerup ECT and minimum observed IAT <= 15.75 ° C Cold Start Fast Pass: Delta between powerup oil temp and coolant temp <= 15.75 ° C & Delta between powerup oil temp and inlet air temp <= 15.75 ° C OR If Cold Start Driving EOTD Enable is True Delta between powerup oil temp and coolant temp <= 15.75 ° C & Delta between powerup oil temp and minimum observed inlet air temp <= 15.75 ° C OR	Oil Temp Diagnostics Enabled (KeEOTD_b_DiagnosticsEnable) == TRUE Continuous Model Diagnostic Enabled: (KeEOTD_b_ContinuousDiagEnbl) == TRUE Engine Running == TRUE Engine Oil Model Temp State == Equilibrium (KeEOTI_b_QuickTransToEquilState) == TRUE Modeled Oil Temp >= 70.0° C -7° C >= Powerup Coolant Temp <= 105° C 45° C >= Coolant Temp <= 95° C Oil Temp Cold Start Diagnostic Enabled: (KeEOTD_b_ColdStartDiagEnbl) == TRUE Engine Off Time > 540 seconds EOTD Diagnostic Disable Fault Detected: Engine Coolant DTC's not active Intake Air Temp DTC's not active Vehicle Speed error not present Engine Oil Temp Sensor Circuit DTC's not active Mass Airflow Sensor DTC's not active ECM Internal Eng Off Timer DTC's not active Cold Start Driving EOTD Enable Test: Vehicle Speed > 15 kph for 400 seconds Cold Start Block Heater Enable Test: 30 ° C > Minimum observed inlet air temp OR -10 ° C > Minimum observed inlet air temp & Delta between powerup IAT and minimum observed IAT < 5.25 ° C	Cold Start Fast Fail: 1 sample at 1 second Cold Start Fast Pass: 1 sample at 1 second Continuous Pass Test: 1 sample every 1 second Continuous Fail Test: 1 sample every 1 second **Increment Rate Based Numerator when:** EOT Performance Fault is detected or when Cold Start Fail Criteria Met == TRUE Cold Start Fail Criteria is True when the following three conditions are True: 1. Delta between powerup EOT and ECT > 15.75 ° C or Delta between powerup EOT and minimum observed IAT > 15.75 ° C 2. either a or b 2a. Delta between powerup EOT and ECT < 15.75 ° C or **{**Minimum observed IAT < 30 ° C & Minimum observed IAT > -10 ° C **}** 2b. Delta between powerup EOT and ECT < 15.75 ° C or **{**Minimum observed IAT > 10.25 ° C & Delta between powerup IAT and minimum observed IAT > 5.25 ° C **}**	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
	# P0196 Continued		Cold Start Block Heater Test Enable is True Delta between powerup oil temp and powerup IAT <= 15.75 ° C & Delta between powerup oil temp and minimum observed inlet air temp <= 15.75 ° C Continuous Pass Test: Oil temp sensed minus oil temp model >= 0.0° C & Delta between oil temp model and oil temp sensed <= 40.0° C OR Oil temp sensed minus oil temp model <0° C & Delta between oil temp sensed and oil temp model <= 40.0° C Continuous Fail Test: Oil temp sensed minus oil temp model >= 0.0° C & Delta between oil temp model and oil temp sensed >= 40.0° C **OR** Oil temp sensed minus oil temp model <0° C & Delta between oil temp sensed and oil temp model => 40.0° C		3. either a or b 3a. Delta between powerup EOT and ECT > 15.75 ° C & **{**Delta between powerup EOT and IAT <= 15.75 ° C & Delta between powerup EOT and minimum observed IAT <= 15.75 ° C **}** 3b. Delta between powerup EOT and ECT > 15.75 ° C & **{**Delta between powerup ECT and IAT <= 15.75 ° C & Delta between powerup ECT and minimum observed IAT <= 15.75 ° C **}** **Increment Rate Based Denominator when**: KeEOTI_b_DiagEnable = True	
Engine Oil Temperature Circuit Low	# P0197	Determines if the oil temperature sensor circuit has low voltage.	OHMS < 25 ohms (approximate temperature greater than 169.2 deg C)	KeEOTI_b_DiagEnable = True & Engine Run Time > 20 seconds Or Coolant Resistance <= 25 ohms	Fail Counts > 25 counts In 50 sample counts Performed every 1 second	DTC Type B
Engine Oil Temperature Circuit High	# P0198	Determines if the oil temperature sensor circuit has high voltage.	OHMS > 450,000 ohms (approximate temperature -60 deg C)	KeEOTI_b_DiagEnable = True & Engine Run Time > 20 seconds Or Coolant Resistance >= 1.8e6 ohms	Fail Counts > 25 counts In 50 sample counts Performed every 1 second	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Injector 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 PT_RelayInRange (9 volts < Ignition < 18 volts) Ignition voltage in range > 1 seconds	20 failures in a 25 sample test 250 msec / sample	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; 52 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 ; 52 counts continuous; 3.125 msec /count in the ecm main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Throttle Position (TP) Sensor 2 Circuit 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 ; 52 counts continuous; 3.125 msec /count in the ecm main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
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 (11 volts < Ignition < 18 volts) Engine speed >= 0 RPM	8 failures in a 10 sample test 250 msec / sample	DTC Type B
Turbo/Supercharger Intercooler Coolant Pump Control Circuit	#P023A	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	20 failures in a 25 sample test 250 msec / sample	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 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 =2.0% (Kt_MISF_Emission_Misfire), depending on engine speed and engine load Catalyst Damage Threshold = 5 – 11.75% (Kt_MISF_Catalyst _Misfire), depending on engine speed and engine load	• Engine run time > 2 crankshaft revolutions • DTCs not active for VSS, CKP, TP, MAP, ECT, MAF, and IAT sensors . • No engine protection faults. • P0315 (Crankshaft Position System Variation Not Learned) not active or engine speed < 1000 RPM • Deceleration Fuel and Clutch cutoff not active. • Power management is not active. • Not an automatic transmission shift with a throttle position >95%. • Brake torque management not active. • Fuel level > 10% (disablement ends 500 engine cycles, after a low fuel level condition ceases, and fuel disable does not occur with a fuel sensor DTC). • -7°C < ECT < 129 ° C. • If ECT at startup < -7 °C, then disable until ECT > 21 °C. • 150 RPM below minimum hot idle < Engine speed < 400 RPM below Engine Over Speed Protection.. • 9 volts < System voltage 18 volts. • + Throttle position delta < 50 % per 100 ms. • - Throttle position delta <50% per 100 ms. • Abnormal engine speed is not present. • ABS rough road not detected. • ABS / TCS / VSES is not active. • Not an abusive engine speed condition, 500 RPM above maximum engine over speed protection. Abusive engine speed delay = 1250 cycles (Manual Transmission Only) • 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) Throttle open or VSS < 48 KPH. • EGR Intrusive test not active. • 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) •	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	The DTC will determine if the Crankshaft Position System Variation has not been learned	Sum of compensation factors not within range	• PCM State =Run • Manufacturers enable counter must be Zero.	100 ms loop continuous	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Knock Sensor (KS) Module Performance	P0324	This diagnostic will detect a failed internal ECM component associated with knock control	Any Cylinder's Avg Gain Signal > 4.5 if RPM>2000 OR All Cylinder's Actual Signals < 0.2 if RPM>1500	APC >300	50 out of 63 100ms sample rate Continuous	DTC Type A
Knock Sensor (KS) Circuit Bank 1	P0325	This diagnostic checks for an open to the knock sensor	Gated Low Pass Filter Voltage > 4V or < 1.24 V	Coolant>75 and Engine Run Time > 90 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 (KS) Performance Bank 1	P0326	This diagnostic checks for an overactive knock sensor caused by noisy engine components (e.g. lifters)	Fast Retard = 9	Engine Speed = 800 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 (KS) Circuit Low Bank 1	P0327	This diagnostic checks for an out of range low knock sensor signal	Sensor Input Signal Line > 2.86 V or Sensor Return Signal Line < 1.48 V	Coolant>75and Engine Run Time > 90 PTO not active	50 out of 63 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit High Bank 1	P0328	This diagnostic checks for an out of range high knock sensor signal	Sensor Input Signal Line < 2.02 V or Sensor Return Signal Line > 3.76 V	Coolant>75 and Engine Run Time > 90 PTO not active	50 out of 63 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit Bank 2	P0330	This diagnostic checks for an open to the knock sensor	Gated Low Pass Filter Voltage > 4V or < 1.24 V	Coolant>75 and Engine Run Time > 90 PTO not active. Temporarily disabled ('Indeterminate' state reported) for samples in which P032 or P0333 report 'Failed' state.	50 out of 63 100ms sample rate Continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Knock Sensor (KS) Circuit Low Bank 2	P0332	This diagnostic checks for an out of range low knock sensor signal	Sensor Input Signal Line > 2.86 V or Sensor Return Signal Line < 1.48 V	Coolant>75a nd Engine Run Time > 90 PTO not active	50 out of 63 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit High Bank 2	P0333	This diagnostic checks for an out of range high knock sensor signal	Sensor Input Signal Line < 2.02 V or Sensor Return Signal Line > 3.76 V	Coolant>75 and Engine Run Time > 90 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 4 seconds 2. No crankshaft position sync 3. No crankshaft position sensor pulses received	1. Engine cranking and either CMP pulses being received or MAF > 3 grams per second 2. Engine is spinning and no 5V reference DTCs set Engine is spinning and no 5V reference or cam position sensor DTCs set	1. Continuous - 12.5 ms 2. Continuous - 12.5 ms 3. Continuous - 12.5 ms 2 test failures out of 10 samples	DTC Type B
Crankshaft Position (CKP) Sensor A Performance	P0336	This diagnostic determines whether a performance fault exists with crank position sensor signal	Twenty crank resyncs occur within 25 seconds 55 > number of crank pulses received in one engine revolution >61	- Engine speed > 450 RPM - Engine is spinning and no 5V reference or cam position sensor DTCs set	1. Continuous – 2 test failures 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	1. Crank is synchronized and no 5V ref DTCs set 2. Engine is cranking and either crank pulses are received or MAF > 3 grams per second 3. Engine is spinning and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 4 seconds 2. Continuous – 1.5 seconds	DTC Type B
Camshaft Position (CMP) Sensor Performance Bank 1 Sensor A	P0341	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	1. 4 > number of cam pulses received in 24 MEDRES events > 10 2. 397> number of cam pulses received in 100 engine cycles > 403	Crank is synchronized and no 5V ref DTCs set	1. Continuous 4. Continuous – 8 test failures out of 10 samples	DTC Type B
Camshaft Position (CMP) Sensor Circuit Bank 2 Sensor A	#P0345	This diagnostic will detect if a fault exists on the camshaft position sensor signal.	1. No Cam pulses received during first 24 MEDRES events 2. No Cam pulses received for 100 engine cycles 3. No Cam pulses received	1. Crank is synchronized and no 5V ref DTCs set 2. Engine is cranking and either crank pulses are received or MAF > 3 grams per second 3. Engine is spinning and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 4 seconds 2. 4. Continuous – 1.5 seconds	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Camshaft Position (CMP) Sensor Performance Bank 2 Sensor A	#P0346	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	1. 4 > number of cam pulses received in 24 MEDRES events > 10 2. 397> number of cam pulses received in 100 engine cycles > 403	Crank is synchronized and no 5V ref DTCs set	1. Continuous 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.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine cranking or Engine Running RunCrank Active (Ignition > 6 volts)	50 failures in a 63 sample test 100 msec / sample	DTC Type B
Camshaft Position (CMP) Sensor Circuit Bank 1 Sensor B	#P0365	This diagnostic will detect if a fault exists on the camshaft position sensor signal.	1. No Cam pulses received during first 24 MEDRES events 2. No Cam pulses received for 100 engine cycles 3. No Cam pulses received	1. Crank is synchronized and no 5V ref DTCs set 2. Engine is cranking and either crank pulses are received or MAF > 3 grams per second 3. Engine is spinning and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 4 seconds 4. Continuous – 1.5 seconds	DTC Type B
Camshaft Position (CMP) Sensor Performance Bank 1 Sensor B	#P0366	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	1. 4 > number of cam pulses received in 24 MEDRES events > 10 2. 397> number of cam pulses received in 100 engine cycles > 403	Crank is synchronized and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples	DTC Type B
Camshaft Position (CMP) Sensor Circuit Bank 2 Sensor B	#P0390	This diagnostic will detect if a fault exists on the camshaft position sensor signal.	1. No Cam pulses received during first 24 MEDRES events 2. No Cam pulses received for 100 engine cycles 3. No Cam pulses received	1. Crank is synchronized and no 5V ref DTCs set 2. Engine is cranking and either crank pulses are received or MAF > 3 grams per second 3. Engine is spinning and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 4 seconds 4. Continuous – 1.5 seconds	DTC Type B
Camshaft Position (CMP) Sensor Performance Bank 2 Sensor B	#P0391	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	1. 4 > number of cam pulses received in 24 MEDRES events > 10 2. 397> number of cam pulses received in 100 engine cycles > 403	Crank is synchronized and no 5V ref DTCs set	1 Continuous 2. Continuous – 8 test failures out of 10 samples	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Exhaust Gas Recirculation (EGR) Flow Insufficient	P0401	During a closed throttle decel condition, the EGR valve is normally closed. This diagnostic opens the valve to a pre-determined position, and the change in MAP is computed. This change in MAP correlates to the flow rate of the EGR system.	With EGR valve open, the peak + MAP Δ is monitored over a period of time. This value is compared with a threshold from Engine Speed vs Baro table and the difference computed. The result is statistically filtered (EWMA) and compared to a decision limit. DTC is set when the filtered result exceeds the decision limit of 0.897 kpa	***Test Enables*** No fuel injector DTCs set No CKP DTCs set No TP sensor DTC's set No MAP DTC's set No VSS DTC's set No ETC DTC's set No 5 volt reference DTC's set No IAT sensor DTC's set No ECT sensor DTC's set No IAC DTC's set No EGR Pintle Position DTC set No Misfire DTC's set No MAF DTC's set No CPP (Clutch) DTC's set No PCM DTC's set No Engine Metal Overtemperature Protection Not in Power Take Off (PTO) Mode Not in device control Traction control not active EGR valve icing not occurring (IAT -10 to -5.5) EGR valve over temperature not occuring (ECT < 128°C) EGR Engine run time expired Not in Power Enrichment Not in Catalyst protection mode ECT > 5°C BARO > 74Kpa BARO data is valid IAT < 100°C Ignition Voltage < 18V Ignition Voltage > 11V Transmission is in 3 or 4gear In decel fuel cut off decel fuel cut off status is unchanged Vehicle speed < 130 kph Vehicle Speed > 32 kph Throttle Position is virtually closed (.0763 .100 hysterisis pair) Transmission status is unchanged ***Stability Mode Enables*** EGR Position < 1% 1000_RPM < Engine Speed < 1800 MAP Δ < 1.1 kpa 5 kPa < Compensated MAP 45 kpa Throttle Area Delta < 1.1% Difference between desired & actual airflow < 2 g/s ***Intrusive Mode Enables*** Vehicle Speed Δ < 5.6 kph + RPM Δ < 100 rpm - RPM Δ < 200 rpm	*Test Time* 0.5 sec. + 0.3 sec = 0.8 sec ***Frequency*** 6.26 ms loop Once per trip (typically) **Rapid Step Response feature will initiate multiple tests:** IF the difference between the current EWMA and the current map diff > 3.19 kPa AND current map diff > -0.039 kPa THEN 7 tests will be run per trip until 42 tests have been completed Fast Initial Response feature will initiate multiple tests upon code clear or a non-volatile memory failure: Several tests per trip will run until 10 tests have been completed.	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Exhaust Gas Recirculation (EGR) Solenoid Control Circuit	P0403	This DTC checks the 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
Exhaust Gas Recirculation (EGR) Open Position Performance	P0404	This diagnostic detects if the pintle position error is too large	Pintle position error [absolute value of (desired position - actual position)] > 15 %	5 Volt reference DTC's not active P1258 not active Engine is running Off-board device not active Power Take Off (PTO) not active P0401 not intrusive Ignition voltage ≥ 11V EGR is enabled Desired EGR position > 0% Δ Desired EGR position < 14.5 % for 2 sec.	336 counts out of 420 counts 100ms loop Continuous	DTC Type B
Exhaust Gas Recirculation (EGR) Position Sensor A Circuit Low Voltage	P0405	This diagnostic detects if the pintle position feedback circuit is open or shorted to ground	EGR feedback sensor signal < 4 % of A/D reference voltage	5 Volt reference DTC's not active Engine is running Off-board device not active Power Take Off (PTO) not active P0401 not intrusive Ignition voltage ≥ 11 volts	50 counts out of 55 counts 100ms loop Continuous	DTC Type B
Exhaust Gas Recirculation (EGR) Position Sensor A Circuit HIgh Voltage	P0406	This diagnostic detects if the pintle position feedback circuit is shorted to high voltage or the 5V return is open.	EGR feedback sensor signal > 94.7 % of A/D reference voltage	5 Volt reference DTC's not active Engine is running Off-board device not active Power Take Off (PTO) not active P0401 not intrusive Ignition voltage ≥ 11 volts Enable conditions met for	180 counts out of 200 counts 100ms loop Continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
AIR System Incorrect Flow	P0411	Detects an AIR system insufficient flow condition. This test is run during the phase 1 (AIR pump commanded On, Valve commanded Open) Leaks downstream of the valve are detected via an evaluation of both pressure error and average pressure "String Length" – a term that represents the absolute pressure delta accumulated every 6.25ms, then averaged over the duration of the test. Low "String Length" values are indicative of downstream leaks or blockages.	AIR normalized pressure error > 5 kPa OR System Pressure Error < -5 kPa OR [System Pressure Error > 3 kPa OR System Pressure Error < -3 kPa] while the Average String Length < 20	No active AIR pressure sensor circuit DTCs No active AIR pressure sensor performance DTCs No active MAP sensor DTC No active AIR pump relay DTC No active AIR control valve relay DTC No active MAF sensor DTCs No active 5 volt reference DTCs No active IAT DTCs No active ECT DTCs No active Misfire DTCs No active catalyst monitor DTCs No active fuel injector DTCs No active EST DTCs No active DTC P06 AIR pressure sensor circuit fault pending = False. AIR operation is allowed this start.. IAT > 5° C 18 volts > System voltage > 11 volts. BARO > 70 kPa(10,000 ft) 3 g/s < MAF < 33 g/s Stability Time > 4 seconds AIR System commanded On Additional "String Length" accumulation criterion: AIR commanded On for > 5) sec.	SAID phase 1 conditional test weight > 7 seconds Conditional test weight is based on Baro, Mass air flow & System voltage. Total "String Length" accumulation time > 14 sec Once per trip where AIR pump operation is requested at startup.	DTC Type B
Secondary Air Injection (AIR) Solenoid Control Circuit Bank 1	P0412	This DTC checks the AIR solenoid circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	RunCrankIgnInRange 11 volts < Ignition < 18 volts)	20 failures in a 25 sample test 250 msec / sample	DTC Type B
Secondary Air Injection (AIR) Pump Control Circuit Bank 1	P0418	This DTC checks the AIR pump relay circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	RunCrankIgnInRange (11 volts < Ignition < 18 volts)	20 failures in a 25 sample test 250 msec / sample	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Catalyst System Low Efficiency Bank 1	P0420	Oxygen Storage	Normalized Ratio OSC Value < 0.30 (EWMA filtered) Normalized Ratio OSC Value Calculation Information and Definitions = 1. Raw OSC Calculation = (post cat O2 Resp time - pre cat O2 Resp time) 2. BestFailing OSC value from a calibration table (based on temp and exhaust gas flow) 3. WorstPassing OSC value (based on temp and exhaust gas flow) Normalized Ratio Calculation = (1-2) / (3-2) A Normalized Ratio of 1 essentially represents a good part and a ratio of 0 essentially represents a very bad part.	*General Enable* • No EVAP, PTO not active, TAC system, MAF, CAM, ECT, CKP, EGR, BARO, AIR, EST, Fuel Injector, Fuel Trim, Idle Air, MAP, IAT, Misfire, O2 Sensor, TP Sensor, VSS or Engine Overtemp Protection Mode DTCs ***Valid Idle Period Criteria*** • Throttle Position < 2% Vehicle Speed <= 2 kph • Engine speed >= 1000 RPM for a minimum of 20 seconds since end of last idle period. • Engine run time >= 100 seconds . Tests attempted this trip < 18.00 • The catalyst diagnostic has not yet completed for the current trip. *Catalyst Idle Conditions Met Criteria* General Enable met and the Valid Idle Period Criteria met • Green Converter Delay = Not Active • Induction Air> -20° C • Induction Air < 250° C • FASD and/ or POS Diagnostic Intrusive Test and/or AIR Diagnostic Intrusive Test not Active • RunCrank Voltage > 11 volts • Ethanol Estimation Is NOT in Progress • ECT >= 40° C • ECT <= 129 ° C • Barometric Pressure > 70 KPA • Idle Time before going intrusive is <= 50 seconds ⇒ Idle time is incremented if the vehicle speed <= 2 kph and the throttle position <= 2% as identified in the Valid Idle Period Criteria section. • Short Term Fuel Trim < 1.10 • Short Term Fuel Trim > 0.90 • Predicted catalyst temp ≥ 400°C AND engine airflow > 12 grams per second 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	1 test attempted per valid idle period Minimum of 1 test per trip Maximum of 6 tests per trip Frequency: • Fueling Related : 12.5 ms • OSC Measurements: 100 ms • Temp Prediction: 1000ms Rapid Step Response (RSR) feature will initiate multiple tests: • If the difference between current EWMA value and the current OSC Normalized Ratio value is >= 0.65 The current OSC Normalized Ratio value is <= 0.3 Maximum of 6 tests per trip . Maximum of 18 tests to detect failure when RSR is enabled. *Green Converter Delay Criteria* This is part of the check for the Catalyst Idle Conditions Met Criteria section • The diagnostic will not be enabled until the following has been met: Predicted catalyst temperature >= 500° C for 3600 seconds non-continuously. • Note: this feature is only enabled when the vehicle is new and cannot be enabled in service	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Catalyst System Low Efficiency Bank 1 (continued)	P0420	Oxygen Storage		***Idle Stable Criteria :: Must hold true from after Catalyst Idle Conditions Met to the end of test*** • MAF >= 3 grams per second • MAF <=18 grams per second • Predicted catalyst temperature <= 640 degC *Engine Fueling Criteria at Beginning of Idle Period* The following fueling related must also be met from between 4 and 7 seconds after the Catalyst Idle Conditions Met Criteria has been met for at least 4 seconds prior to allowing intrusive control • Number of pre-O2 switches >= 1 • Short Term Fuel Trim Avg >= 0.96 • Short Term Fuel Trim Avg <= 1.04		

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Exhaust Gas Recirculation (EGR) Closed Position Performance	P042E	This diagnostic detects if the valve is stuck open when commanded closed.	Actual pintle position >= 5.5 % of reference voltage from learned closed position	5 Volt reference DTC's not active Engine is running Off-board device not active Power Take Off (PTO) not active P0401 not intrusive Ignition voltage ≥ 11 volts EGR is enabled EGR stroked (>30pct lift for 5 sec) Desired EGR position = 0, for 1 sec.	4 detections of: 240 counts out of 300 counts with pintle movement between failure detections of 30 % for at least 5 seconds open time 100ms loop Continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
CATALYTIC CONVERTER LOW OXYGEN STORAGE	#P0430	Oxygen Storage.	Normalized Ratio OSC Value < 0.30 (EWMA filtered) Normalized Ratio OSC Value Calculation Information and Definitions = 1. Raw OSC Calculation = (post cat O2 Resp time - pre cat O2 Resp time) 2. BestFailing OSC value from a calibration table (based on temp and exhaust gas flow) 3. WorstPassing OSC value (based on temp and exhaust gas flow) Normalized Ratio Calculation = (1-2) / (3-2) A Normalized Ratio of 1 essentially represents a good part and a ratio of 0 essentially represents a very bad part.	*General Enable* • No EVAP, PTO not active, TAC system, MAF, CAM, ECT, CKP, EGR, BARO, AIR, EST, Fuel Injector, Fuel Trim, Idle Air, MAP, IAT, Misfire, O2 Sensor, TP Sensor, VSS or Engine Overtemp Protection Mode DTCs ***Valid Idle Period Criteria*** • Throttle Position < 2% Vehicle Speed <= 2 kph • Engine speed >= 1000 RPM for a minimum of 20 seconds since end of last idle period. • Engine run time >= 100 seconds . Tests attempted this trip < 18.00 • The catalyst diagnostic has not yet completed for the current trip. *Catalyst Idle Conditions Met Criteria* General Enable met and the Valid Idle Period Criteria met • Green Converter Delay = Not Active • Induction Air> -20° C • Induction Air < 250° C • FASD and/ or POS Diagnostic Intrusive Test and/or AIR Diagnostic Intrusive Test not Active • RunCrank Voltage > 11 volts • Ethanol Estimation Is NOT in Progress • ECT >= 40° C • ECT <= 129 ° C • Barometric Pressure > 70 KPA • Idle Time before going intrusive is <= 50 seconds ⇒ Idle time is incremented if the vehicle speed <= 2 kph and the throttle position <= 2% as identified in the Valid Idle Period Criteria section. • Short Term Fuel Trim < 1.10 • Short Term Fuel Trim > 0.90 • Predicted catalyst temp ≥ 400°C AND engine airflow > 12 grams per second 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	1 test attempted per valid idle period Minimum of 1 test per trip Maximum of 6 tests per trip Frequency: • Fueling Related : 12.5 ms • OSC Measurements: 100 ms • Temp Prediction: 1000ms Rapid Step Response (RSR) feature will initiate multiple tests: • If the difference between current EWMA value and the current OSC Normalized Ratio value is >= 0.65 The current OSC Normalized Ratio value is <= 0.3 Maximum of 6 tests per trip . Maximum of 18 tests to detect failure when RSR is enabled. *Green Converter Delay Criteria* This is part of the check for the Catalyst Idle Conditions Met Criteria section • The diagnostic will not be enabled until the following has been met: Predicted catalyst temperature >= 500° C for 3600 seconds non-continuously. • Note: this feature is only enabled when the vehicle is new and cannot be enabled in service	DTC Type A Dual Bank Systems
Catalyst System Low Efficiency Bank 2 (continued)	P0430	Oxygen Storage		***Idle Stable Criteria :: Must hold true from after Catalyst Idle Conditions Met to the end of test*** • MAF >= 3 grams per second • MAF <=18 grams per second • Predicted catalyst temperature <= 640 degC *Engine Fueling Criteria at Beginning of Idle Period*		

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
				The following fueling related must also be met from between 4 and 7 seconds after the Catalyst Idle Conditions Met Criteria has been met for at least 4 seconds prior to allowing intrusive control • Number of pre-O2 switches >= 1 • Short Term Fuel Trim Avg >= 0.96 • Short Term Fuel Trim Avg <= 1.04		
Evaporative Emission (EVAP) System Small Leak Detected	P0442	This DTC will detect a small leak (>= 0.020") in the EVAP system between the fuel fill cap and the purge solenoid. The engine off natural vacuum method (EONV) is used.	***SMALL LEAK TEST FAIL:*** Engine Off Natural Vacuum (EONV) while the engine is off. The total pressure change achieved during the test is normalized against a target value that is based upon fuel level and ambient temperature. ((values range from 398.5 to 622.7 Pa). The normalized value is entered into EWMA (with 0= perfect pass and 1=perfect fail). Once EWMA exceeds the fail threshold, the DTC light is illuminated. The DTC light can be turned off if the EWMA falls below the re-pass threshold for 3 consecutive trips. Fail threshold = 0.70 Re-Pass threshold = **0.35**	***TEST ENABLE :*** No MAP DTC's No MAF Sensor 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 >10.0% but < 85.0% Drive time >= 600 seconds. Drive length >= 8 kilometers. Coolant >= 70°C. No fuel filling (fuel level increment >= 10%) During EONV test. BARO > 70.0kPa(10,000 ft) Estimated ambient temperature at end of drive >**0**°C but < **34**°C. 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 5 kilometers)	Once per trip, during hot soak (up to **2400** sec.). Time since last complete test >= 17 hours if EWMA is passing, or >= 10 hours if EWMA is failing. No more than 2 attempts per day.	DTC Type A EWMA Average run length is 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 (11 volts < Ignition < 18 volts)	20 failures in a 25 sample test 250 msec / sample	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Evaporative Emission (EVAP) Vent System Performance	P0446	This DTC will determine if a restriction is present in the vent solenoid, vent filler, vent hose or EVAP canister	Tank Vacuum > 2989 Pa for 5 seconds BEFORE Purge Volume > 6 liters OR Vented Vacuum < -623 Pa or Vented Vacuum > 1245 Pa for 5 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 10 % < Fuel Level < 85. % 11.00 V < System Voltage < 18.00 V 4 °C < IAT < 30°C ECT < 35 °C BARO > 70.00 kPa (10,000 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 (11 volts < Ignition < 18 volts)	20 failures in a 25 sample test 250 msec / sample	DTC Type A
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 Used on EONV 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
Fuel Tank Pressure (FTP) Sensor Circuit Low Voltage	P0452	This DTC will detect a fuel tank pressure sensor signal that is too low out of range.	Fuel tank pressure sensor signal < 3% of Vref (0.15 volts or ~ 1681 Pa) produces a failing sample. Otherwise, the sample is considered passing. The normal operating range of the fuel tank pressure sensor is 0.5 volts (~1245 Pa) to 4.5 volts (~ -3736 Pa).	• 0.10 second delay after sensor power up for sensor warm-up ECM State ≠ crank	If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC. Frequency: Continuous 100ms loop	DTC Type B
Fuel Tank Pressure (FTP) Sensor Circuit High Voltage	P0453	This DTC will detect a fuel tank pressure sensor signal that is too high out of range.	Fuel tank pressure sensor signal > 97% of Vref (4.85 volts or ~ -4172 Pa) produces a failing sample. Otherwise, the sample is considered passing. The normal operating range of the fuel tank pressure sensor is 0.5 volts (~1245 Pa) to 4.5 volts (~ -3736 Pa).	• 0.10 second delay after sensor power up for sensor warm-up • ECM state ≠ crank	If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC. 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 > 112 Pa and < 249 Pa vacuum in the span of 1.0 seconds. A refueling event is confirmed if the fuel level has a persistent change of 10.0 % for 30 seconds.	• This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	This test is executed during an engine-off natural vacuum small leak test. The test can only execute up to once per engine-off period. The length of the test is determined by the refueling rationality test which can take up to 600 seconds to complete. The test will report a failure if 2 out of 3 samples are failures.	DTC Type A Used on EONV 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
Evaporative Emission (EVAP) System Large Leak Detected	P0455	This DTC will detect a weak vacuum condition (large leak or purge blockage) in the Evap system.	Purge volume > 9.00 liters BEFORE Tank vacuum < 2740 Pa 2 liters of fuel must be consumed after setting the DTC active the first time to set the DTC active the second time. Weak Vacuum Follow-up Test (fuel cap replacement test) Weak Vacuum Test failed previous trip and this trip. Passes if tank vacuum > 2740 Pa. Note: Weak Vacuum Follow-up Test can only report a pass.	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 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 • 10 % < Fuel Level < 85. % • 11.00 V < System Voltage < 18.00 V • 4 °C < IAT < 30°C • ECT < 30 °C • BARO > 70.00 kPa (10,000 ft) Cold Start Test • IAT < 30°C • Cold temperature Δ(ECT-IAT): < 8 °C if ECT > IAT • Cold Test Timer < 1000 seconds	Once per cold start Time is dependent on driving conditions Max. before test abort is 1000 seconds Weak Vacuum Follow-up Test On 2nd trip with large leak detected, the follow-up test is limited to 1300 seconds. Once the MIL is on, the follow-up test runs indefinitely.	DTC Type B
Fuel Level No Change, Stuck in Range Pirmary Tank	P0461	This DTC will detect a fuel sender stuck in range .	IF Delta Fuel Volume change less than 10 liters over a accumulated 200 Kilometers.	No VSS DTC's set Engine Running	Continous 250 ms / sample	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 less than 10 %	RunCrankIgnInRange (11 volts ≤ Ignition ≤ 18 volts)	runs continuously 240 failures out of 300 samples 1 sample = 100 ms	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 > than 60%	RunCrankIgnInRange (11 volts ≤ Ignition ≤ 18 volts)	runs continuously 240 failures out of 300 samples 1 sample = 100 ms	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel Level Sensor 1 Circuit Intermittent	P0464	This DTC will detect intermittent fuel level sensor signals that would have caused the engine-off natural vacuum small leak test to abort due to an apparent re-fueling event.	If a change in fuel level is detected the engine-off natural vacuum test is aborted due to an apparent refueling event. Subsequent to the abort, a refueling rationality test is executed to confirm that a refueling event occurred. If a refueling is confirmed, then the test sample is considered passing. Otherwise, the sample is considered failing indicating an intermittent signal problem. The refuel event is defined as a change of 10% fuel level during the engine-off test. A refueling event is confirmed if the fuel level has a persistent change of 10% for 30 seconds.	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	This test is executed during an engine-off natural vacuum small leak test. The test can only execute up to once per engine-off period. The length of the test is determined by the refueling rationality test which can take up to 600 seconds to complete. The test will report a failure if 2 out of 3 samples are failures.	DTC Type A Used on EONV Applications
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 (11 volts < Ignition < 18 volts) Engine speed greater than 400 rpm	20 failures in a 25 sample test 250 msec / sample	DTC Type B
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 (11 volts < Ignition < 18 volts) Engine speed greater than 400 rpm	20 failures in a 25 sample test 250 msec / sample	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Evaporative Emission (EVAP) System Flow During Non-Purge	P0496	This DTC will determine if the purge solenoid is leaking to engine manifold vacuum.	Tank Vacuum > 2491 Pa for 5.00 sec BEFORE Test time > 60 seconds (cold start)	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 • 10 % < Fuel Level < 85. % • 11.00 V < System Voltage < 18.00 V • 4 °C < IAT < 30°C • ECT < 30 °C • BARO > 70.00 kPa (10,000 ft) Cold Start Test • IAT < 30°C • Cold temperature Δ(ECT-IAT): < 8 °C if ECT > IAT • Cold Test Timer < 1000 seconds	Once per cold start. Cold start: max time is 1000 seconds	DTC Type B
Idle System - Low Engine Speed	P0506	This DTC will determine if a low idle exists.	Filtered Engine Speed Error > Fault threshold where the fault threshold = 90 Filter coefficient for engine speed error = .003	No MAF, MAP, Baro, IAT, ECT, TP, Injector, Fuel System, Misfire, EST (spark), ETC, VSS, EGR or Purge DTC's TCM Communication Fault not active Engine Run > 60 sec. ECT > 60 C BARO > 70 kPa IGN. voltage > 11 volts but < 18 volts IAT > -20 C Time since a gear state change > 3 seconds Time since a TCC mode change is > 3 seconds Idle control logic indicates that the engine is in an idle condition Idle conditions present for > 7 seconds to enable diagnostic test Vehicle Speed < 2 Kph Engine overtemperature light not on Clutch pedal must be at the top or the bottom of travel to enable the diagnostic test. PTO (power take-off) must not be active. Off-vehicle device control (service bay control) must not be active.	**Time for each test:** Filtered engine speed error must be within pass criteria continuously for 10 seconds to consider a pass. Filtered engine speed must reach the fault threshold to set a fault. Frequency: Continuous after enable 100ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Idle System - High Engine Speed	P0507	This DTC will determine if a high idle exists	Filtered Engine Speed Error < Fault threshold where the fault threshold = 180	No MAF, MAP, Baro, IAT, ECT, TP, Injector, Fuel System, Misfire, EST (spark), ETC, VSS, EGR or Purge DTC's TCM Communication Fault not active Engine Run > 60 sec. ECT > 60 C BARO > 70 kPa IGN. voltage > 11 volts but < 18 volts IAT > -20 C Time since a gear state change > 3 seconds Time since a TCC mode change is > 3 seconds Idle control logic indicates that the engine is in an idle condition Idle conditions present for > 7 seconds to enable diagnostic test Vehicle Speed < 2 Kph Engine overtemperature light not on Clutch pedal must be at the top or the bottom of travel to enable the diagnostic test. PTO (power take-off) must not be active. Off-vehicle device control (service bay control) must not be active.	**Time for each test:** Filtered engine speed error must be within pass criteria continuously for 10 seconds to consider a pass. Filtered engine speed must reach the fault threshold to set a fault. Frequency: Continuous after enable 100ms loop	DTC Type B
Control Module Read Only Memory (ROM)	P0601	This DTC will be stored if the calibration check sum is incorrect	Output state invalid	• PCM state = crank or run Ignition voltage ≥ 5 volts	1 failure if it occurs on the first pass, 5 failures after the first pass has completed successfully <u>Frequency:</u> Runs continuously in the background	DTC Type A
Control Module Not Programmed	P0602	This DTC will be stored if the PCM is a service PCM that has not been programmed.	Output state invalid	• PCM state = crank or run • PCM is identified through calibration as a Service PCM	Test is run at Powerup Test also runs: <u>Frequency:</u> 100ms loop Continuous	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	•	1 failure Once at power-up	DTC Type A
ECM RAM FAILURE	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	Should finish within 30 seconds at all engine conditions.	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 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 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. In the main processor, 159/400 counts intermittent or 15 counts continuous; 39 counts continuous @ initialization 4. In the MHC processor 475 ms at initialization, 175 msec continuous or 20/200 intermittent. 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

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	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% If your program does not have equal slope pedal sensors, delete number one above as it does not apply.	1. Ignitions in unlock/ accessory and run, System voltage > 5.23 V No PCM processor DTC Ignition in unlock, accessory, run or crank System voltage > 5.23 V No PCM processor DTC, 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 No ECM processor DTCs	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 (11 volts < Ignition < 18 volts) Remove 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	Vref1 < 4.43 or > 4.66 volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No ECM processor DTCs	19/39counts 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 (11 volts < Ignition < 18 volts)	8 failures in a 10 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
Transmission Control Module (TCM) Requested MIL Illumination	P0700	Monitors the TCM MIL request line to determine when the TCM has detected a MIL illuminating fault.	Transmission Emissions-Related DTC set	Time since power-up > 3 seconds	Continuous	DTC Type A No 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
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
Inlet Airflow System Performance	P1101	This DTC detects flaws with all Inlet Airflow sensors suggesting a major inlet flow problem.	(Measured Flow – Modeled air Flow) Filtered > 25 or (Measured MAP - Manifold Model 1 pressure) filtered > 20 and (Measured MAP – Manifold Model 2 pressure) filtered > 20 and (The calculated throttle residual from the MAF model and the Manifold Model) filtered > 300	Engine rpm =>500 and <= 5000 MAP sensor high/low DTC's not active EGR DTC's P0401,.P0405, and P1404 not active MAF sensor high/low DTC's not active Crank sensor DTC's not active Engine Coolant DTC's not active Intake Air Temp. DTC's not active Engine Coolant > 70 deg C and < 129 deg C Intake Air Temp > -7 deg C and < 60 deg C Refer to "IFRD weight factors" attached at bottomMinimum total weight factor (all factors multiplied together) >.26	Continuous Evaluated every 12.5 ms	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Insufficient Switching Bank 1 Sensor 1	P1133	This DTC determines if the O2 sensor is no longer sufficiently switching.	Half cycle L/R switches < 40 OR Half cycle R/L switches < 40 OR Slope Time L/R switches < 1OR Slope Time R/L switches < 1	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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault 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 > 202 seconds • EVAP Canister purge duty cycle ≥ 0 % • 20 gps ≤ MAF ≤ 40 gps • 1100 ≤ RPM ≤ 2500 • Ethanol percentage < 85 % • Baro > 70 kPa • Throttle position ≥ 3 %Fuel state = closed loopTransmission (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.	60 seconds Frequency: Once per trip Green Sensor Delay Criteria • The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than KeEOSD_dm_Green_O2_FlowMin g/sec for KaEOSD_m_Green_O2_AccumFlowLim grams of accumulated flow non-continuously. (Note that all other enable criteria must be met on the next ignition cycle for the test to run on that ignition cycle) Note: this feature is only enabled when the vehicle is new and cannot be enabled in service	DTC Type B

60 seconds
Frequency:
Once per trip

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Insufficient Switching Bank 2 Sensor 1	P1153	This DTC determines if the O2 sensor is no longer sufficiently switching.	Half cycle L/R switches < 40 OR Half cycle R/L switches < 40 OR Slope Time L/R switches < 40 OR Slope Time R/L switches < 40	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 • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Inj, and AIR Device controls = Not Active • Fuel Level > 10 % or fuel level data fault 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 > 202 seconds • EVAP Canister purge duty cycle ≥ 0 % • 20 gps ≤ MAF ≤ 40 gps • 1100 ≤ RPM ≤ 2500 • Ethanol percentage < 85 % • Baro > 70 kPa • Throttle position ≥ 3 %Fuel state = closed loopTransmission (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.	60 seconds Frequency: Once per trip Green Sensor Delay Criteria • The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than KeEOSD_dm_Green_O2_FlowMin g/sec for KaEOSD_m_Green_O2_AccumFlowLim grams of accumulated flow non-continuously. (Note that all other enable criteria must be met on the next ignition cycle for the test to run on that ignition cycle) Note: this feature is only enabled when the vehicle is new and cannot be enabled in service	DTC Type B
ENGINE PROTECTION MODE ACTIVE	P1258	Monitor for engine protection mode active.	Coolant temperature >= 137°C Condition exists ≥ 2 seconds.	No coolant sensor failures	Set immediately upon engine protection mode active.	DTC Type A
ABS Rough Road Malfunction	P1380	This diagnostic detects if the ABS Controller is indicating a fault. When this occurs, misfire will continue to run.	ABS Controller sends a message to the ECM indicating that a failure has occurred in the ABS Module.	VS ≥ 0 kph	40 failures out of 80 samples 100 msec loop continuous	DTC Type C (DTC can only set when a P0300 Light Request is True)

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
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.	• None	40 failures out of 80 samples 100 msec loop continuous	DTC 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) < -2.0 OR (Average desired accumulated exhaust energy - Average estimated accumulated exhaust energy) > 0.75	•Cold start emission reduction strategy is active. •Vehicle speed < 2 kph •Throttle position without Idle < 2 percent •TPS close delay time > 5 seconds •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
Throttle Actuator Control (TAC) Module - Throttle Actuator Position Performance	P1516	1. Detect a throttle positioning error. Determine if the actuator has been miswired.	1. |throttle error| >= |2.00%| after > 0.4875 sec stability with no change in error sign, OR |throttle error| > 9.13 % TPS1< 1.91 Volts	Ignition in run or crank [(RPM>0 and system voltage > 5.4 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 No ignition correlation DTC active.	187.5ms in the MHC processor	DTC Type A
Ignition Correlation	P1682	Detect a continuous or intermittent OOC between the Run/Crank Ignition Voltage & ETC Run/Crank Ignition Voltage	|Run/Crank – ETC Run/Crank| > 3.00 V	Ignition in unlock/accessory, run or crank System voltage > 5.23 V & Powertrain Relay Commanded on. Run/Crank Ignition ≥ voltage required to engage relay at the current IAT temperature, or ETC Run/Crank > voltage required to hold relay in once engaged. Pull-In Voltage / Hold-In Voltage 23° C = 7.00 volts / 5.50 volts 85° C = 8.70 volts 95° C = 9.00 volts 105° C = 9.20 volts 125° C = 10.00 volts	14 / 14 counts , 12.5msec loop time, in main processor	DTC Type A
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 a accumulated 100 Kilometers.	No VSS DTC's set Engine Running	Continous	DTC Type B
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 less than 10 %	runs continuously	240 failures out of 300 samples 1 sample = 100 ms Continous	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 Stuck High Secondary Tank	#P2068	This DTC will detect a fuel sender stuck out of range high	Fuel level Sender % of 5V range > than 70%	runs continuously	240 failures out of 300 samples 1 sample = 100 ms Continous	DTC Type B
Control Module Throttle Actuator Position Performance	P2101	1. Detect a throttle positioning error 2. Detect excessive motor driver current (PWM)	Difference between measured throttle position and modeled throttle position > 9.13% 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 > 11.0 Volts)] Throttle not at default position 2. NA No ignition correlation DTC active.	1. 15/15 counts continuous 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 2. APP1< 0.325 OR APP1 > 4.75	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 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	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	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	P2125	1. Detect a continuous or intermittent short or open in the APP sensor #1 on Main processor Detect a continuous or intermittent short or open in the APP sensor #1 on MHC processor	1. APP2 < 0.325 OR APP2 > 4.75 2. APP2< 0.325 OR APP2 > 4.75	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 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	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	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

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Throttle Position (TP) Sensor 1-2 Correlation	P2135	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	1. Difference between TPS1 displaced and TPS2 displaced > 7.00 % offset at min. throttle position with an increasing to 10% at max. throttle position 2. Different between (raw min TPS1) and (raw_min TPS2) > 4.99 % of Vref	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	1. 79/159 counts or 63 counts continuous; 3.125 msec/count in the main processor 19/39 counts or 15 counts continuous; 12.5 msec/count in the MHCprocessor	DTC Type A
Accelerator Pedal Position (APP) Sensor 1-2 Correlation	P2138	Detect an invalid minimum mechanical position correlation between APP sensor #1 and #2	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) >5.00 % offset at min. throttle position with an increasing to 10% (0.5v)at max. throttle position for Main processor. OR 2. Difference between the learned PPS1 min and PPS2 min > 5.00 % Vref	1. Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTC's 2. Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTC's	1. 19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the main processor 2. 19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the MHC processor	DTC Type A
Minimum Throttle Position Not Learned	P2176	TP minimum learning not completed	1. TPS > 0.935 Volts during TPS min learn on the Main processor OR TPS > 0.935 Volts during TPS min learn on the MHC processor	Minimum TPS learn active state Stable throttle position reading for 40 msec Ignition in run or crank No TPS circuit DTCs No ignition correlation DTC active.	1.8secs	DTC Type A
Barometric Pressure (BARO) Sensor Performance	#P2227	This DTC determines if the Baro sensor is stuck within the normal operation range	(Measured Baro – Previous Baro) > 10	Engine rpm =>550 and <= 5000 MAP sensor high/low DTC's not active EGR DTC's P0401,.P0405, and P1404 not active MAF sensor high/low DTC's not active Crank sensor DTC's not active Engine Coolant DTC's not active Intake Air Temp. DTC's not active Engine Coolant > 70 deg C and < 129 deg C Intake Air Temp > -7 deg C and < 60 deg C	20 failures in a 25 sample test 250 msec / sample	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Barometric Pressure (BARO) Sensor Low Voltage	#P2228	This DTC detects a continuous short to low or open in either the signal circuit or the Baro sensor.	Baro voltage < 21% of Vref (0.1 volts) Or 50kPa	Key-On test: Engine speed ≤ 400 RPM Run Test: No TPS failures present TPS ≥ 0%, and Engine Speed ≤ 800 RPM, or TPS >= 12.5%, Engine Speed > 800 RPM)	320 failures in a 400 sample test 12.5 msec / sample	DTC Type B
Barometric Pressure (BARO) Sensor High Voltage	#P2229	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the Baro sensor	Baro voltage > 53.5%% of Vref (4.9 volts) or 115kPa	No TPS failures present Engine running Engine run time > Min based on power-up coolant temp (-30°C = 242 seconds, -15°C = 188 seconds, 0°C = 144 seconds, 15°C = 80 seconds, 30°C = 0 seconds) TPS < 1%, and Engine Speed ≤ 1200 RPM, or TPS < 20%, and Eengine Speed > 1200 RPM	320 failures in a 400 sample test 12.5 msec / sample	DTC Type B
O2S Signal Stuck Lean Bank 1 Sensor 2	P2270	This DTC determines if the post catalyst O2 sensor is stuck in a normal voltage range and thereby can no longer be used for post oxygen sensor fuel control or for catalyst monitoring. The diagnostic is an intrusive test which reduces delivered fuel to achieve the required lean threshold.	Post catalyst O2 sensor cannot achieve voltage ≤ 100 millivolts	Common Enable Criteria • Engine Runtime ≥ 290 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 • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria: • No Fuel Trim or Misfire DTC's active • 500 rpm ≤ Engine Speed ≤ 5000 rpm • 3 gps ≤ Airflow ≤ 50 gps • 5 kph ≤ Vehicle Speed ≤ 132 kph • 0.95 ≤ Short term fuel trim ≤ 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 2 seconds	Up to 475 grams of accumulated air flow for the Lean Test and 475 grams of accumulated air flow for the Rich Test. 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 Signal Stuck Rich Bank 1 Sensor 2	P2271	This DTC determines if the post catalyst O2 sensor is stuck in a normal voltage range and thereby can no longer be used for post oxygen sensor fuel control or for catalyst monitoring. The diagnostic is an intrusive test which increases delivered fuel to achieve the required rich threshold.	Post catalyst O2 sensor cannot achieve voltage ≥ 775 millivolts.	Common Enable Criteria • Engine Runtime ≥ 290 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 • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria: • No Fuel Trim or Misfire DTC's active • 500 rpm ≤ Engine Speed ≤ 5000 rpm • 3 gps ≤ Airflow ≤ 50 gps • 5 kph ≤ Vehicle Speed ≤ 132 kph • 0.95 ≤ Short term fuel trim ≤ 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 2 seconds	Up to 475 grams of accumulated air flow for the Lean Test and 475 grams of accumulated air flow for the Rich Test. 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 Signal Stuck Lean Bank 2 Sensor 2	#P2272	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 reduces delivered fuel to achieve the required lean threshold.	Post catalyst O2 sensor cannot achieve voltage ≤ 100 millivolts	Common Enable Criteria • Engine Runtime ≥ 290 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 • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria: • No Fuel Trim or Misfire DTC's active • 500 rpm ≤ Engine Speed ≤ 5000 rpm • 3 gps ≤ Airflow ≤ 50 gps • 5 kph ≤ Vehicle Speed ≤ 132 kph • 0.95 ≤ Short term fuel trim ≤ 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 2 seconds	Up to 475 grams of accumulated air flow for the Lean Test and 475 grams of accumulated air flow for the Rich Test. 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 Signal Stuck Rich Bank 2 Sensor 2	#P2273	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 delivered fuel to achieve the required rich threshold.	Post catalyst O2 sensor cannot achieve voltage ≥ 775 millivolts.	Common Enable Criteria • Engine Runtime ≥ 290 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 • Fuel Level > 10 % or fuel level data fault active Specific Enable Criteria: • No Fuel Trim or Misfire DTC's active • 500 rpm ≤ Engine Speed ≤ 5000 rpm • 3 gps ≤ Airflow ≤ 50 gps • 5 kph ≤ Vehicle Speed ≤ 132 kph • 0.95 ≤ Short term fuel trim ≤ 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 2 seconds	Up to 475 grams of accumulated air flow for the Lean Test and 475 grams of accumulated air flow for the Rich Test. Frequency: Once per trip	DTC Type B
AIR System Pressure Sensor A Circuit	P2430	This DTC detects a stuck-in-range AIR pressure sensor signal.	Stuck in Range Average Error < 0.5 AND Stuck in Range Variance < 1.0	No active DTC P0412 No active DTC P0418 No active DTC P0606 No active DTC P2432 No active DTC P2433 No active 5 volt reference DTCs AIR pump is commanded ON	Stuck in Range Cumulative Info > 5 sec. Once per trip where AIR pump operation is requested at startup.	DTC Type B
AIR System Pressure Sensor A Performance	P2431	This DTC detects a skewed pressure sensor signal via a comparison of the AIR pressure sensor signal and estimated BARO, as well as an evaluation of the quality of the comparison.	Difference between AIR pressure sensor and BARO > 14kPa with AIR pump commanded off OR Difference between AIR pressure sensor and BARO > 50kPa with AIR pump commanded On	No active DTC P0412 No active DTC P0418 No active DTC P0606 No active DTC P2432 No active DTC P2433 No active 5 volt reference DTCs AIR pump is commanded OFF	Performance Cumulative Info > 30 sec. Continuous, 6.25ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
AIR System Pressure Sensor A Circuit Low	P2432	This DTC detects a low out-of-range AIR pressure sensor signal	AIR Pressure Sensor signal < 5% of 5V ref.	No active DTC P0606 No active 5 volt reference DTCs	800 fail counts out of 1000 sample counts. Continuous, 6.25 ms loop.	DTC Type B
AIR System Pressure Sensor A Circuit High	P2433	This DTC detects a high out-of-range AIR pressure sensor signal	AIR Pressure Sensor signal > 94% of 5V ref.	No active DTC P0606 No active 5 volt reference DTCs	800 fail counts out of 1000 sample counts. Continuous, 6.25 ms loop.	DTC Type B
AIR System Switch / Valve Stuck Open	P2440	This DTC detects an AIR system control valve stuck open condition. This test is run during the phase 2 (pump on, control valve shut) portion of the SAI diagnostic.	AIR normalized pressure error < a table value (lower than predicted pressure) during SAID phase 2 test Cumul. Wght. time / Pres. Err. 0 / -2 1 / –2 2 / –2 3 / –1.5 4 / –1.5 5 / –1.5 6 / –1.5 7 / –1.5 8 / –1.5	No active AIR pressure sensor circuit DTCs No active AIR pressure sensor performance DTCs No active MAP sensor DTCs No active AIR pump relay circuit DTC No active AIR control valve relay circuit DTC No active MAF sensor DTCs No active 5 volt reference DTCs No active IAT DTCs No active ECT DTCs No active Misfire DTCs No active catalyst monitor DTCs No active fuel injector DTCs No active EST DTCs No active DTC P0606 BARO > 70 kPa(10,000 ft) 3 g/s < MAF < 33 g/s Stability Time > 5 seconds 18 volts > System voltage > 11 volts. AIR System commanded On	SAID phase 2 conditional test weight > 1.5 seconds Conditional test weight is based on Baro, Mass air flow & System voltage. Once per trip where AIR pump operation is requested at startup.	DTC Type B
AIR System Pump Stuck On	P2444	This DTC detects an AIR pump stuck ON condition. This test is run during the phase 3 (Pump commanded Off, valve commanded closed) portion of the SAI diagnostic.	AIR normalized pressure error > 2.5 kPa (higher than predicted pressure) during SAID phase 3 test	No active AIR pressure sensor circuit DTCs No active AIR pressure sensor performance DTCs No active MAP sensor DTCs No active AIR pump relay circuit DTC No active AIR control valve relay circuit DTC No active MAF sensor DTCs . No active 5 volt reference DTCs No active IAT sensor DTCs No active ECT sensor DTCs No active Misfire DTCs No active catalyst monitor DTCs No active fuel injector DTCs. No active EST DTCs. No active DTC P0606 No active DTC P2440 BARO > 70 kPa (10,000 ft) 3 g/s < MAF < 33 g/s 11V < System Voltage < 18V Stability Time > 4 seconds AIR System commanded On	Phase 3 Test cumulative info >2 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
Transmission Control Torque Request Circuit	P2544	Determines if torque request from the TCM is valid	1. Serial Communication 2's complement not equal for message $199 (PTEI3) 2. Serial Communication rolling count value shall be + 1 from previous $199 message (PTEI3) 3. 2's complement not equal of torque requested value or torque requested type when stored in ECM 4. If TCM Requested Torque in message $199 (PTEI3) > 400	No Serial communication loss to TCM (U0101) Engine Running == TRUE Power Mode = Run Crank Active	1. # of Protect Errors >= 16 2. # of Alive Rolling Errors >= 6 in 10 samples 3. # of RAM errors >= 3 4. # of range errors >= 3 in 10 samples If any the above exist for > 2 seconds then increment fail counter else fail counter is reset If the fail counter is => 2 fault is active Pass diagnostic if none of the above conditions are present for => 2 seconds 12.5ms loop	DTC Type B
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 < 0 sec OR Initial ignition off timer value > 10 sec Clock rate test: • Time between ignition off timer increments < 0.8 sec • Time between ignition off timer increments > 1.2 sec • Time since last ignition off timer increment ≥ 1.375 sec • 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: 3 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 Flow Insufficient	#P2636	DTC monitors that enough fuel is transferred from the secondary fuel tank to the primary fuel tank	Both primary and secondary fuel levels are in the readable range for more then 300 seconds.	runs continuously	Continous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2 Sensor Circuit Range/Performance Bank 1 Sensor 1	P2A00	This DTC determines if the O2 sensor voltage is not meeting the voltage criteria to enable closed loop fueling.	Closed loop fuel control O2 sensor Ready flag set to "Not Ready." O2 sensor voltage must be > 650 millivolts or < 250 millivolts to set closed loop fuel O2 Ready flag. Once set to "Ready," the O2 sensor voltage cannot be > 650 millivolts and < 250 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 or B2S1 O2 DTC's • Engine Run Time ≥ 100 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 • 500 ≤ Engine Speed ≤ 5000 • 3 gps ≤ Mass Airflow ≤ 45 gps • Not in Decel Fuel Cutoff Mode • Not in Power Enrichment • Predicted O2 temp ≥ 0°C All of the above met for 5 seconds.	240 test failures in a 300 test sample Frequency: Continuous 100ms loop	DTC Type B
O2 Sensor Circuit Range/Performance Bank 2 Sensor 1	P2A03	This DTC determines if the O2 sensor voltage is not meeting the voltage criteria to enable closed loop fueling.	Closed loop fuel control O2 sensor Ready flag set to "Not Ready." O2 sensor voltage must be > 650 millivolts or < 250 millivolts to set closed loop fuel O2 Ready flag. Once set to "Ready," the O2 sensor voltage cannot be > 650 millivolts and < 250 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 or B2S1 O2 DTC's • Engine Run Time ≥ 100 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 • 500 ≤ Engine Speed ≤ 5000 • 3 gps ≤ Mass Airflow ≤ 45 gps • Not in Decel Fuel Cutoff Mode • Not in Power Enrichment • Predicted O2 temp ≥ 0°C All of the above met for 5 seconds.	240 test failures in a 300 test sample Frequency: Continuous 100ms loop	DTC Type B
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.		5 seconds Frequency: Continuous 1 second 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.		12 seconds Frequency: Continuous 1 second loop	DTC Type B

TABLE - O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153)

Lean-Rich Ave

Rich-Lean Ave

Seconds	0.000	0.045	0.060	0.075	0.090	0.105	0.125	0.140	0.155	0.170	0.180	0.190	0.200	0.210	0.219	0.220	1.000
0.000	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.045	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.060	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.075	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.090	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.105	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.120	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL
0.130	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL
0.150	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.170	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.180	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.190	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.200	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.210	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.219	FAIL	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL
0.220	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
1.0	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL

TABLE - IFRD weight factors	RPM																
	0	1500	1700	1790	1800	3100	3200	3300	3500	3700	4000	4200	4500	5000	5500	6500	8000
MAF residual weight (RPM)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.9	0.9
MAP1 residual weight	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.9	0.9
MAP2 residual weight	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TPS residual weight	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	MAF g/s																
	0	50	70	73	76	79	82	85	89	95	100	110	150	170	180	200	350
MAF residual weight (MAF)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.9	0.9	0.9

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

Throtte position %	**5.000**	**10.000**	**15.000**	**20.000**	**25.000**	**30.000**	**35.000**	**40.000**	**100.000**
Max MAP delta	26.812	33.210	28.565	26.197	24.854	21.853	100.000	100.000	100.000
Max MAF delta	16.762	21.395	20.522	22.716	30.465	37.660	255.000	255.000	255.000

P0116

Induction Air Temperature at Powerup Powertrain (VeEITI_T_InductAirCvrtdPwrUp)	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
The minimum temperature difference required to allow a gross failure of the ECT to bypass the engine block heater algorithm and promptly fail the diagnostic (KtECTD_T_HSC_FastFailTempDiff)	106	94	82	70	60	46	38	26	19	19	19	19	20	30	37	49	61

P0128
For IAT > 10C, Threshold = 70C

Coolant Temp at Begin Run Transition (SfECTI_T_EngCoolBRn)	-40	-28	-16	-4	8	20	32	44	56	68	80
Calculated minimum total air threshold as a function of Coolant Temp (KaECTD_m_EngTotAirGramsStartRun)	9375	9375	9375	9375	9375	8220	7068	5908	4753	3597	3597

P0128
For –7C < IAT < 10C, Threshold = 55C

Coolant Temp at Begin Run Transition (SfECTI_T_EngCoolBRn)	-40	-28	-16	-4	8	20	32	44	56	68	80

Calculated minimum total air threshold as a function of Coolant Temp (KaECTD_m_EngTotAirGramsStartRun)	10077	10077	10077	8964	7851	6737	56241	4511	3398	3398	3398