

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Intake Camshaft Actuator Solenoid Circuit – Bank 1	P0010	Detects a VVT system error by monitoring the circuit for electrical integrity	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		System supply voltage is within limits Output driver is commanded on, Ignition switch is in crank or run position	> 11 Volts, and < 18 Volts	20 failures out of 25 samples 250 ms /sample, continuous	2 trips Type B MIL: YES
Intake Camshaft 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)] is compared to thresholds to determine if excessive	(Intake cam Bank 1)Cam Position Error > KtPHSD_phi_CamPosErrorLimlc 1 Deg (see Supporting Table)	The following DTC's are NOT active: P0010 IntkCMP B1 Circuit P0340, P0341, Intake B1 Cam sensors P0335, P0336, Crank sensors P0016, P0017, P0018, P0019 Cam to crank rationality Engine is running VVT is enabled Desired camshaft position > 0 Power Take Off (PTO) not active	System Voltage > 11 Volts, and System Voltage < 18 Volts Desired cam position cannot vary more than 3.0 Cam Deg for at least KtPHSD_t_StablePositionTimeIc1 seconds (see Supporting Table)	135 failures out of 150 samples 100 ms /sample	2 trips Type B MIL: YES
Exhaust Camshaft Actuator Solenoid Circuit – Bank 1	P0013	Detects a VVT system error by monitoring the circuit for electrical integrity	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		System supply voltage is within limits Output driver is commanded on, Ignition switch is in crank or run position	> 11 Volts, and < 18 Volts	20 failures out of 25 samples 250 ms /sample, continuous	2 trips Type B MIL: YES
Exhaust Camshaft 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)] is compared to thresholds to determine if excessive	(Exhaust cam Bank 1)Cam Position Error > KtPHSD_phi_CamPosErrorLimEc 1 Deg (see Supporting Table)	The following DTC's are NOT active: P0013 ExhCMP B1 Circuit P0365, P0366, Exh B1 Cam sensors P0335, P0336, Crank sensors P0016, P0017, P0018, P0019 Cam to crank rationality	System Voltage > 11 Volts, and System Voltage < 18 Volts Desired cam position cannot vary more than 3.0 Cam Deg for at least KtPHSD_t_StablePositionTimeEc1 seconds (see Supporting Table)	135 failures out of 150 samples	2 trips Type B

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					Engine is running VVT is enabled Desired camshaft position > 0 Power Take Off (PTO) not active		100 ms /sample	MIL: YES
Crankshaft Position (CKP)- Camshaft Position (CMP) Correlation Bank 1 Sensor A	P0016	Detects cam to crank misalignment by monitoring if cam sensor pulse for bank 1 sensor A occurs during the incorrect crank position	4 cam sensor pulses more than 9 crank degrees before or 12 crank degrees after nominal position in one cam revolution.		Engine Speed Crankshaft and camshaft position signals are synchronized Cam phaser is in "parked" position No Active DTCs: No Pending DTCs:	< 2400 P0335, P0336 P0340, P0341 5VoltReferenceA_FA 5VoltReferenceB_FA P0341	4 failures out of 5 samples if the engine is being assisted by the starter 24 failures out of 30 samples if the engine is running without assistance from the starter One sample per cam rotation	2 trips Type B MIL: YES
Crankshaft Position (CKP)- Camshaft Position (CMP) Correlation Bank 1 Sensor B	P0017	Detects cam to crank misalignment by monitoring if cam sensor pulse for bank 1 sensor B occurs during the incorrect crank position	4 cam sensor pulses more than 9 crank degrees before or 12 crank degrees after nominal position in one cam revolution.		Engine Speed Crankshaft and camshaft position signals are synchronized Cam phaser is in "parked" position No Active DTCs: No Pending DTCs:	< 2400 P0335, P0336 P0365, P0366 5VoltReferenceA_FA 5VoltReferenceB_FA P0366	4 failures out of 5 samples if the engine is being assisted by the starter 24 failures out of 30 samples if the engine is running without assistance from the starter One sample per cam rotation	2 trips Type B MIL: YES
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).		Ign Switch position Ignition Voltage Engine Speed	= Crank or Run position 11.0 volts < Ign Voltage < 18.0 volts > 400 RPM	20 failures out of 25 samples 250 ms /sample	2 trips Type B MIL: YES

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							Continuous	
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).		Ign Switch position Ignition Voltage Engine Speed	= Crank or Run position 11.0 volts < Ign Voltage < 18.0 volts > 400 RPM	20 failures out of 25 samples 250 ms /sample Continuous	2 trips Type B MIL: YES
HO2S Heater Resistance Bank 1 Sensor 1	P0053	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	Learned Heater Resistance.	Calculated Heater Resistance < 3.7 ohms -OR- Calculated Heater Resistance > 8.7 ohms	No Active DTC's Coolant – IAT Engine Soak Time Coolant Temp Ignition Voltage Engine Run Time	ECT_Sensor_FA P2610 IAT_SensorFA < 8.0 °C > 28800 seconds -30.0 °C ≤ Coolant ≤ 45.0 °C < 18.0 volts ≥ 0.20 seconds	Once per valid cold start	2 trips Type B MIL: YES
HO2S Heater Resistance Bank 1 Sensor 2	P0054	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	Learned Heater Resistance.	Calculated Heater Resistance < 9.6 ohms -OR- Calculated Heater Resistance > 20.2 ohms	No Active DTC's Coolant – IAT Engine Soak Time Coolant Temp Ignition Voltage Engine Run Time	ECT_Sensor_FA P2610 IAT_SensorFA < 8.0 °C > 28800 seconds -30.0 °C ≤ Coolant ≤ 45.0 °C < 18.0 volts ≥ 0.20 seconds	Once per valid cold start	2 trips Type B MIL: YES
MAP / MAF / Throttle Position Correlation	P0068	Detect when MAP and MAF do not match estimated engine airflow as established by the TPS	1) Difference between measured MAP and estimated MAP exceeds threshold (kPa), or P0651 (5 Volt Ref), or P0107 (MAP circuit low), or P0108 (MAP circuit high) have failed this key cycle, then MAP portion of diagnostic fails	Table, f(TPS). See supporting tables	Engine Speed	> 800 RPM Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	Continuously fail MAP and MAF portions of diagnostic for 0.1875 ms Continuous in MAIN processor	1 Trip Type: A MIL: YES

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			2) Difference between measured MAF and estimated MAF exceed threshold (grams/sec), or P0102 (MAF circuit low), or P0103 (MAF circuit hi) have failed this key cycle, or battery voltage < 10.0 volts, then MAF portion of diagnostic fails	Table, f(TPS). See supporting tables				
Mass Air Flow System Performance	P0101	Determines if the MAF sensor is stuck within the normal operating range	Filtered Throttle Model AND ABS(Measured Flow – Modeled Air Flow) Filtered AND ABS(Measured MAP – MAP Model 2) Filtered	<= 250 kPa/(g/s) > 15 grams/sec > 15.0 kPa	Engine Speed Engine Speed Coolant Temp Coolant Temp Intake Air Temp Intake Air Temp Minimum total weight factor (all factors multiplied together)	>= 400 RPM <= 6200 RPM > 70 Deg C < 125 Deg C > -20 Deg C < 125 Deg C < 0.00 Filtered Throttle Model multiplied by TPS Residual Weight Factor based on RPM Modeled Air Flow multiplied by MAF Residual Weight Factor based on RPM and MAF Residual Weight Factor Based on MAF Estimate MAP Model 2 multiplied by MAP2 Residual Weight Factor based on RPM See table "IFRD Residual Weighting	Continuous Calculation are performed every 12.5 msec	2 trips Type B MIL: YES

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					No Active DTCs:	Factors". MAP_SensorCircuitFA EGRValve_FP EGRValvePerformance_FA MAF_SensorCircuitFA CrankSensor_FA ECT_Sensor_FA ECT_Sensor_Ckt_FA IAT_SensorFA IAT_SensorFP CylIDeacSystemTFTKO		
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 Output	<= 300 Hertz (~ 0.5 gm/sec)	Engine Run Time Engine Speed Ignition Voltage Above criteria present for a period of time	> 1.0 seconds >= 300 RPM >= 11.0 Volts >= 1.0 seconds	200 failures out of 250 samples 1 sample every cylinder firing event	Type B 2 trips MIL: YES
Mass Air Flow Sensor Circuit High Frequency	P0103	Detects a high frequency output from the MAF sensor	MAF Output	>= 11000 Hertz (~ 200 gm/sec)	Engine Run Time Engine Speed Ignition Voltage Above criteria present for a period of time	> 1.0 seconds >= 300 RPM >= 11.0 Volts >= 1.0 seconds	200 failures out of 250 samples 1 sample every cylinder firing event	Type B 2 trips MIL: YES
Manifold Absolute Pressure Sensor Performance	P0106	Determines if the MAP sensor is stuck within the normal operating range	Filtered Throttle Model AND ABS(Measured MAP – MAP Model 1) Filtered AND ABS(Measured MAP – MAP Model 2) Filtered	<= 250 kPa/(g/s) > 15.0 kPa > 15.0 kPa	Engine Speed Engine Speed Coolant Temp Coolant Temp Intake Air Temp Intake Air Temp Minimum total weight factor (all factors multiplied together)	>= 400 RPM <= 6200 RPM > 70 Deg C < 125 Deg C > -20 Deg C < 125 Deg C < 0.00 Filtered Throttle Model multiplied by TPS Residual Weight Factor based on RPM MAP Model 1 multiplied by MAP1 Residual Weight Factor based	Continuous Calculations are performed every 12.5 msec	Type B 2 trips MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					No Active DTCs:	on RPM MAP Model 2 multiplied by MAP2 Residual Weight Factor based on RPM See table "IFRD Residual Weighting Factors". MAP_SensorCircuitFA EGRValve_FP EGRValvePerformance_FA MAF_SensorCircuitFA CrankSensorFA ECT_sensor_FA ECT_Sensor_FP IAT_SensorFA IAT_SensorCircuitFP CylDeacSystemTFTKO		
Manifold Absolute Pressure Sensor Circuit Low	P0107	Detects a continuous short to low or open in either the signal circuit or the MAP sensor.	MAP Voltage	< 3.0 % of 5 Volt Range (0.2 Volts = 3.5 kPa)	Continuous		320 failures out of 400 samples 1 sample every 12.5 msec	Type B 2 trips MIL: YES
Manifold Absolute Pressure Sensor Circuit High	P0108	Detects an open sensor ground or continuous short to high in either the signal circuit or the MAP sensor.	MAP Voltage	> 90.0 % of 5 Volt Range (4.5 Volts = 115.0 kPa)	Continuous		320 failures out of 400 samples 1 sample every 12.5 msec	Type B 2 trips MIL: YES
Intake Air Temperature Sensor Circuit Low (High Temperature)	P0112	Detects a continuous short to ground in the IAT signal circuit or the IAT sensor	Raw IAT Input	< 58 Ohms (~150 deg C)	Engine Run Time Coolant Temp Vehicle Speed	> 10.0 seconds < 150 deg C >= 0 KPH	50 failures out of 63 samples 1 sample every	Type B 2 trips MIL: YES

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					No Active DTCs:	ECT_Sensor_Ckt_FA ECT_Sensor_Ckt_FP VehicleSpeedSensorError	100 msec	
Intake Air Temperature Sensor Circuit High (Low Temperature)	P0113	Detects a continuous open circuit in the IAT signal circuit or the IAT sensor	Raw IAT Input	> 163000 Ohms (~-60 deg C)	Engine Run Time Coolant Temp Vehicle Speed Engine Air Flow No Active DTCs:	> 10.0 seconds > -40 deg C ≤ 512 KPH ≤ 512 gm/sec ECT_Sensor_Ckt_FA ECT_Sensor_Ckt_FP VehicleSpeedSensorError MAF_SensorFA MAF_SensorFP MAF_SensorTFTKO	50 failures out of 63 samples 1 sample every 100 msec	Type B 2 trips MIL: YES
Engine Coolant Temperature (ECT) Sensor Performance	P0116	This DTC detects ECT temp sensor stuck in mid range.	A failure will be reported if any of the following occur: 1) ECT at power up > IAT at power up by an IAT based table lookup value after a minimum 25200 second soak (fast fail). 2) ECT at power up > IAT at power up by 15.8 C after a minimum 25200 second soak and a block heater has not been detected. 3) ECT at power up > IAT at power up by 15.8 C after a minimum 25200 seconds soak and the time spent cranking the engine without starting is greater than 10.0 seconds with the LowFuelConditionDiag	See "P0116: Fail if power up ECT exceeds IAT by these values" in the Supporting tables section = False	No Active DTC's Non-volatile memory initialization Test complete this trip Test aborted this trip Low Fuel Condition Diag	VehicleSpeedSensor_F A IAT_SensorFA ECT_Sensor_Ckt_FA IgnitionOffTimeValid TimeSinceEngineRunningValid = Not occurred = False = False IAT ≥ -7 °C = False	1 failure 500 msec/sample Once per valid cold start	2 trips Type B MIL: YES
Diagnostic is aborted when Block Heater is detected. Block Heater is detected when the following occurs:								
						1) ECT at power up > IAT at power up by > 15.8 °C 2) Cranking time < 10.0 Seconds 3) Power up IAT > -7 °C 4a) Vehicle drive time > 400 Seconds 4b) Vehicle speed > 14.9 MPH 4c) IAT drops from power up IAT ≥ 5.3 °C		

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Engine Coolant Temp Sensor Circuit Low	P0117	This DTC detects a short to ground in the ECT signal circuit or the ECT sensor.	ECT Resistance (@ 150°C)	< 47 Ohms			5 failures out of 6 samples 1 sec/sample Continuous	2 trips Type B MIL: YES
Engine Coolant Temp Sensor Circuit High	P0118	Circuit Continuity This DTC detects a short to high or open in the ECT signal circuit or the ECT sensor.	ECT Resistance (@ -60°C)	> 420000 Ohms	Engine run time	> 10.0 seconds IAT min ≥ 0.0 °C	5 failures out of 6 samples 1 sec/sample Continuous	2 trips Type B MIL: YES
					Or			
TPS1 Circuit	P0120	Detects a continuous or intermittent short or open in TPS1 circuit on the secondary processor but sensor is in range on the primary processor	Secondary TPS1 Voltage < or Secondary TPS1 Voltage >	0.325 4.75		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions No 5 V reference error No 5 V reference DTCs	19/39 counts or 14 counts continuous; 12.5 msec/count in the secondary processor	1 Trip Type: Type:A MIL: YES
Throttle Position Sensor Performance	P0121	Determines if the Throttle Position Sensor input is stuck within the normal operating range	Filtered Throttle Model AND ABS(Measured Flow – Modeled Air Flow) Filtered	> 250 kPa/(g/s) > 15 grams/sec	Engine Speed Engine Speed Coolant Temp Coolant Temp Intake Air Temp Intake Air Temp Minimum total weight factor (all factors multiplied together)	>= 400 RPM <= 6200 RPM > 70 Deg C < 125 Deg C > -20 Deg C < 125 Deg C < 0.00 Filtered Throttle Model multiplied by TPS Residual Weight Factor based on RPM	Continuous Calculation are performed every 12.5 msec	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					No Active DTCs:	Modeled Air Flow multiplied by MAF Residual Weight Factor based on RPM and MAF Residual Weight Factor Based on MAF Estimate See table "IFRD Residual Weighting Factors". MAP_SensorCircuitFA EGRValve_FP EGRValvePerformance_FA MAF_SensorCircuitFA CrankSensorFA ECT_sensor_FA ECT_Sensor_FP IAT_SensorFA IAT_SensorCircuitFP CylDeacSystemTFTKO		
TPS1 Circuit Low	P0122	Detects a continuous or intermittent short or open in TPS1 circuit on both processors or just the primary processor	Primary TPS1 Voltage < Secondary TPS1 Voltage <	0.325 0.325		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions No 5 V reference error No 5 V reference DTCs	79/159 counts; 57 counts continuous; 3.125 msec /count in the Primary processor 19/39 counts or 14 counts continuous; 12.5 msec/count in the Secondary processor	1 Trip Type: Type:A MIL: YES

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TPS1 Circuit High	P0123	Detects a continuous or intermittent short in TPS1 circuit on both processors or just the primary processor	Primary TPS1 Voltage > Secondary TPS1 Voltage >	4.75 4.75		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions No 5 V reference error No 5 V reference DTCs	79/159 counts; 57 counts continuous; 3.125 msec /count in the Primary processor 19/39 counts or 14 counts continuous; 12.5 msec/count in the Secondary processor	1 Trip Type: A MIL: YES
Engine Coolant Temperature Below Stat Regulating Temperature	P0128	This DTC detects if the engine coolant temperature rises too slowly due to an ECT or Cooling system fault	Actual accumulated airflow is > predicted accumulated airflow before: <u>Range #1 (Primary)</u> ECT reaches 71.0 °C when IAT min is ≤ 54.5°C and ≥ 10.0°C. <u>Range #2 (Alternate)</u> ECT reaches 71.0 °C when IAT min is < 10.0°C and ≥ -7.0°C.	See "P0128: Maximum Accumulated Airflow for IAT and Start-up ECT conditions" in the Supporting tables section	No Active DTC's	MAP_SensorFA MAF_SensorFA TPS_Performance_FA TPS_FA TPS_ThrottleAuthority Defaulted IAT_SensorFA ECT_Sensor_Ckt_FA ECT_Sensor_Perf_FA VehicleSpeedSensor_FA A Engine run time Fuel Condition	30 failures to set DTC 1 sec/sample Once per ignition cycle 30 ≤ Eng Run Tme ≤ 1800 seconds Ethanol ≤ 100%	2 trips Type B MIL: YES
						<u>Range #1 (Primary) Test</u> ECT at start run ≤ 66.0 °C Average Airflow ≥ 1.0 gps Vehicle speed > 5 mph for at least 0.8 miles		
						<u>Range #2 (Alternate) Test</u> ECT at start run ≤ 66.0 °C Average Airflow ≥ 1.0 gps Vehicle speed > 5 mph for at least 0.8 miles		
						<u>Accumulated Airflow Adjustments</u> 1) Max. airflow amount added		

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					when accumulating airflow is 2) Zero Airflow accumulated when airflow is 3) With AFM active Airflow added to accumulated is multiplied by 4) With Decel Fuel Cut Off active, accumulated airflow is reduced by multiplying actual airflow by	30.0 gps < 2.0 gps 50.00% 1.00 times		
O2S Circuit Low Voltage Bank 1 Sensor 1	P0131	This DTC determines if the O2 sensor circuit is shorted to low.	Measure Oxygen Sensor Signal.	Oxygen Sensor signal is < 50 mvolts	No Active DTC's AIR intrusive test = Not active Fuel intrusive test = Not active Idle intrusive test = Not active EGR intrusive test = Not active System Voltage EGR Device Control = Not active Idle Device Control = Not active Fuel Device Control = Not active AIR Device Control = Not active Low Fuel Condition Diag = False Equivalence Ratio	TPS_ThrottleAuthority Defaulted MAP_SensorFA AIR System FA Ethanol Composition Sensor FA EvapPurgeSolenoidCircuit_FA EvapFlowDuringNonPurge_FA EvapVentSolenoidCircuit_FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSnrCkt_FA FuelInjectorCircuit_FA 10.0 volts < system voltage < 18.0 volts 1.0 <= equiv. ratio <= 1.0	380 failures out of 475 samples Frequency: Continuous in 100 milli - second loop	2 trips Type B MIL: YES

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					Throttle Position % Fuel Control State = Closed Loop Closed Loop Active = TRUE All Fuel Injectors for active Cylinders Enabled (On) Fuel Condition Ethanol <= 87% Fuel State DFCO not active <u>All of the above met for</u> Time > 5.0 seconds	15 % <= Throttle <= 50		
O2S Circuit High Voltage Bank 1 Sensor 1	P0132	This DTC determines if the O2 sensor circuit is shorted to high.	Measure Oxygen Sensor Signal.	Oxygen Sensor signal is > 1050 mvolts	No Active DTC's AIR intrusive test = Not active Fuel intrusive test = Not active Idle intrusive test = Not active EGR intrusive test = Not active System Voltage > 10.0 volts & < 18.0 volts EGR Device Control = Not active Idle Device Control = Not active Fuel Device Control = Not active AIR Device Control = Not active Low Fuel Condition Diag = False Equivalence Ratio 1.0 <= equiv. ratio <= 1.0 Throttle Position 0.0 % <= Throttle <= 50.0 % Fuel Control State = Closed Loop not = Power Fuel Control State Enrichment Closed Loop Active = TRUE All Fuel Injectors for active	TPS_ThrottleAuthority Defaulted MAP_SensorFA MAF_SensorFA EvapPurgeSolenoidCircuit_FA EvapFlowDuringNonPurge_FA EvapVentSolenoidCircuit_FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSnrCkt_FA FuelInjectorCircuit_FA	100 failures out of 125 samples Frequency: Continuous in 100 milli - second loop	2 trips Type B MIL:YES

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					Learned Htr resistance = Valid Engine Coolant > 70 °C IAT > -40 °C Engine Run Time > 120 seconds Time since any AFM status change > 2.0 seconds Time since Purge On to Off change > 0.0 seconds Time since Purge Off to On change > 1.5 seconds Purge duty cycle >= 0 % duty cycle Engine airflow <= 40 gps Engine speed 1000 <= RPM <= 3500 Fuel < 87 % Ethanol Baro > 70 kpa Throttle Position >= 4 % Low Fuel Condition Diag = False Fuel Control State = Closed Loop Closed Loop Active = TRUE LTM fuel cell = Enabled Transient Fuel Mass <= 100.0 mgrams Baro = Not Defaulted not = Power Fuel Control State Enrichment Fuel State DFCO not active Commanded Proportional Gain >= 0.0 % All of the above met for Time > 3.0 seconds			
O2S Circuit Insufficient Activity Bank 1 Sensor 1	P0134	This DTC determines if the O2 sensor circuit is open.	Measure Oxygen Sensor Signal.	400 mvolts < Oxygen Sensor signal < 500 mvolts	No Active DTC's System Voltage > 18.0 volts AFM Status = All Cylinders active Heater Warm-up delay = Complete Predicted Exhaust Temp (by location) = Wamed Up Engine Run Time > 200 seconds Fuel <= 87 % Ethanol	TPS_ThrottleAuthority Defaulted MAF_SensorFA EthanolCompositionSensor_FA 10.0 volts < system voltage voltage < 18.0 volts = Complete = Wamed Up > 200 seconds <= 87 % Ethanol	400 failures out of 500 samples. Minimum of 0 delta TPS changes required to report fail. Delta TPS is incremented when the TPS % change >= 1.0 % Frequency:	2 trips Type B MIL: YES

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							Continuous 100msec loop	
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.	Measured Heater Current.	Measured Heater current < 0.3 amps -OR- Measured Heater current > 2.5 amps	No Active DTC's System Voltage Heater Warm-up delay O2S Heater device control B1S1 O2S Heater Duty Cycle All of the above met for Time	ECT_Sensor_FA 10.0 volts < system voltage < 18.0 volts = Complete = Not active > zero > 120 seconds	8 failures out of 10 samples Frequency: 2 tests per trip 30 seconds delay between tests and 1 second execution rate	2 trips Type B MIL: YES
O2S Circuit Low Voltage Bank 1 Sensor 2	P0137	This DTC determines if the O2 sensor circuit is shorted to low.		Oxygen Sensor signal is < 50 mvolts	No Active DTC's AIR intrusive test Fuel intrusive test Idle intrusive test EGR intrusive test System Voltage EGR Device Control Idle Device Control Fuel Device Control AIR Device Control Low Fuel Condition Diag Equivalence Ratio	TPS_ThrottleAuthority Defaulted MAP_SensorFA AIR System FA Ethanol Composition Sensor FA EvapPurgeSolenoidCircuit_FA EvapFlowDuringNonPurge_FA EvapVentSolenoidCircuit_FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSnrCkt_FA FuelInjectorCircuit_FA = Not active = Not active = Not active = Not active 10.0 volts < system voltage < 18.0 volts = Not active = Not active = Not active = Not active = False 1.0 <= equiv. ratio <= 1.0	430 failures out of 540 samples Frequency: Continuous in 100 milli - second loop	2 trips Type B MIL: YES

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					Throttle Position % Fuel Control State = Closed Loop Closed Loop Active = TRUE All Fuel Injectors for active Cylinders Enabled (On) Fuel Condition Ethanol <= 87% Fuel State DFCO not active <u>All of the above met for</u> Time > 5.0 seconds	15 % <= Throttle <= 50		
O2S Circuit High Voltage Bank 1 Sensor 2	P0138	This DTC determines if the O2 sensor circuit is shorted to high.	Measure Oxygen Sensor Signal.	Oxygen Sensor signal is > 1050 mvolts	No Active DTC's AIR intrusive test = Not active Fuel intrusive test = Not active Idle intrusive test = Not active EGR intrusive test = Not active System Voltage > 10.0 volts < system voltage < 18.0 volts EGR Device Control = Not active Idle Device Control = Not active Fuel Device Control = Not active AIR Device Control = Not active Low Fuel Condition Diag = False Equivalence Ratio > 1.0 Throttle Position > 5.2 % <= Throttle <= 50.0 % Fuel Control State = Closed Loop not = Power Fuel Control State = Enrichment Closed Loop Active = TRUE All Fuel Injectors for active	TPS_ThrottleAuthority Defaulted MAP_SensorFA MAF_SensorFA EvapPurgeSolenoidCircuit_FA EvapFlowDuringNonPurge_FA EvapVentSolenoidCircuit_FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSnrCkt_FA FuelInjectorCircuit_FA	100 failures out of 125 samples Frequency: Continuous in 100 milli - second loop	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Cylinders Fuel State Fuel Condition All of the above met for Time	Enabled (On) DFCO not active Ethanol <= 87%		
O2 Sensor Slow Response Rich to Lean Bank 1 Sensor 2	P013A	This DTC determines if the post catalyst O2 sensor has Slow Response in a predefined Rich to Lean voltages range during Rich to Lean transition. The diagnostic is an intrusive test which runs in a DFCO mode to achieve the required response.	The EWMA of the Post O2 sensor normalized integral value is greater than the threshold. OR The Accumulated mass air flow monitored during the Slow Response Test (between the upper and lower voltage thresholds) is greater than the airflow threshold.	1) B1S2 EWMA normalized integral value > 8.4 units OR 2) Accumulated air flow during slow rich to lean test > 28 grams (upper threshold is 450 mvolts and lower threshold is 150 mvolts)	No Active DTC's B1S2 Failed this key cycle System Voltage Learned heater resistance ICAT MAT Burnoff delay Green O2S Condition Low Fuel Condition Diag Post fuel cell DTC's Passed DTC's Passed	TPS_ThrottleAuthority Defaulted ECT_Sensor_FA IAT_SensorFA MAF_SensorFA MAP_SensorFA AIR System FA FuelInjectorCircuit_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EthanolCompositionSensor_FA P013B, P013E, P013F, P2270 or P2271 10.0 volts < system voltage < 18.0 volts = Valid = Not Valid = Not Valid = False = enabled = P2270 (and P2272 (if applicable)) = P013E (and P014A (if applicable))	Frequency: Once per trip Note: if NaPOPD_b_Reset FastRespFunc= FALSE for the given Fuel Bank OR NaPOPD_b_Rapid ResponseActive = TRUE, multiple tests per trip are allowed Green Sensor Delay Criteria The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than 22 gps for 120000 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	1 trip Type A EWMA MIL: YES
After above conditions are met: DFCO mode is continued (wo driver initiated pedal input).								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
							is only enabled when the vehicle is new and cannot be enabled in service	
O2 Sensor Slow Response Lean to Rich Bank 1 Sensor 2	P013B	This DTC determines if the post catalyst O2 sensor has Slow Response in a predefined Lean to Rich voltages range during Lean to Rich transition. The diagnostic is an intrusive test which increases the delivered A/F ratio to achieve the required rich threshold.	The EWMA of the Post O2 sensor normalized integral value is greater than the threshold. OR The Accumulated mass air flow monitored during the Slow Response Test (between the lower and upper voltage thresholds) is greater than the airflow threshold.	1) B1S2 EWMA normalized integral value > 8.2 units OR 2) Accumulated air flow during slow lean to rich test > 130 grams (lower threshold is 300 mvolts and upper threshold is 600 mvolts)	No Active DTC's B1S2 Failed this key cycle System Voltage Learned heater resistance ICAT MAT Burnoff delay Green O2S Condition Low Fuel Condition Diag Post fuel cell DTC's Passed DTC's Passed DTC's Passed DTC's Passed DTC's Passed DTC's Passed	TPS_ThrottleAuthority Defaulted ECT_Sensor_FA IAT_SensorFA MAF_SensorFA MAP_SensorFA AIR System FA FuelInjectorCircuit_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EthanolCompositionSensor_FA P013A, P013E, P013F, P2270 or P2271 10.0 volts < system voltage < 18.0 volts = Valid = Not Valid = Not Valid = False = enabled = P2270 (and P2272 (if applicable)) = P013E (and P014A (if applicable)) = P013A (and P013C (if applicable)) = P2271 (and P2273 (if applicable)) = P013F (and P014B (if applicable))	Frequency: Once per trip Note: if NaPOPD_b_ResetFastRespFunc= FALSE for the given Fuel Bank OR NaPOPD_b_RapidResponseActive = TRUE, multiple tests per trip are allowed <u>Green Sensor Delay Criteria</u> The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than 22 gps for 120000 grams of accumulated flow non-continuously. (Note that all other enable criteria must be met on the next ignition cycle for the test to	1 trips Type A EWMA MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
							run on that ignition cycle). Note: This feature is only enabled when the vehicle is new and cannot be enabled in service	
O2 Sensor Delayed Response Rich to Lean Bank 1 Sensor 2	P013E	This DTC determines if the post catalyst O2 sensor has an initial delayed response to an A/F change from Rich to Lean. The diagnostic is an intrusive test which runs in a DFCO mode to achieve the required response.	Post O2 sensor cannot go below the threshold voltage. AND The Accumulated mass air flow monitored during the Delayed Response Test is greater than the threshold.	1) Post O2S signal > 450 mvolts AND 2) Accumulated air flow during stuck rich test > 28 grams.	No Active DTC's B1S2 Failed this key cycle System Voltage Learned heater resistance ICAT MAT Burnoff delay Green O2S Condition Low Fuel Condition Diag Post fuel cell DTC's Passed	TPS_ThrottleAuthority Defaulted ECT_Sensor_FA IAT_SensorFA MAF_SensorFA MAP_SensorFA AIR System FA FuelInjectorCircuit_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EthanolCompositionSensor_FA P013A, P013B, P013F, P2270 or P2271 10.0 volts < system voltage< 18.0 volts = Valid = Not Valid = Not Valid = False = enabled = P2270 and P2272 (if applicable)	Frequency: Once per trip Note: if NaPOPD_b_Reset FastRespFunc= FALSE for the given Fuel Bank OR NaPOPD_b_Rapid ResponseActive = TRUE, multiple tests per trip are allowed <u>Green Sensor Delay Criteria</u> The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than 22 gps for 120000 grams of accumulated flow non-continuously. (Note that all other enable criteria must be met on the next ignition	2 trips Type B MIL:YES
					After above conditions are met: DFCO mode entered (wo driver initiated pedal input).			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
							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	
O2 Sensor Delayed Response Lean to Rich Bank 1 Sensor 2	P013F	This DTC determines if the post catalyst O2 sensor has an initial delayed response to an A/F change from Lean to Rich. The diagnostic is an intrusive test which increases the delivered A/F ratio to achieve the required rich threshold.	Post O2 sensor cannot go above the threshold voltage. AND The Accumulated mass air flow monitored during the Delayed Response Test is greater than the threshold.	1) Post O2S signal < 300 mvolts AND 2) Accumulated air flow during lean to rich test > 130 grams.	No Active DTC's B1S2 Failed this key cycle System Voltage Learned heater resistance ICAT MAT Burnoff delay Green O2S Condition Low Fuel Condition Diag Post fuel cell DTC's Passed DTC's Passed DTC's Passed DTC's Passed DTC's Passed	TPS_ThrottleAuthority Defaulted ECT_Sensor_FA IAT_SensorFA MAF_SensorFA MAP_SensorFA AIR System FA FuelInjectorCircuit_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EthanolCompositionSensor_FA P013A, P013B, P013E, P2270 or P2271 10.0 volts < system voltage < 18.0 volts = Valid = Not Valid = Not Valid = False = enabled = P2270 (and P2272 (if applicable)) = P013E (and P014A (if applicable)) = P013A (and P013C (if applicable)) = P2271 (and P2273 (if applicable))	Frequency: Once per trip Note: if NaPOPD_b_Reset FastRespFunc= FALSE for the given Fuel Bank OR NaPOPD_b_Rapid ResponseActive = TRUE, multiple tests per trip are allowed <u>Green Sensor Delay Criteria</u> The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than 22 grams for 120000 grams of accumulated flow non-continuously. (Note that all other enable criteria must be met on the next ignition	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					After above conditions are met: Fuel Enrich mode entered.		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	
O2S Circuit Insufficient Activity Bank 1 Sensor 2	P0140	This DTC determines if the O2 sensor circuit is open.	Measure Oxygen Sensor Signal.	400 mvolts < Oxygen Sensor signal < 500 mvolts	No Active DTC's System Voltage AFM Status Heater Warm-up delay Predicted Exhaust Temp (by location) Engine Run Time Fuel	TPS_ThrottleAuthority Defaulted MAF_SensorFA EthanolCompositionSensor_FA 10.0 volts < system voltage < 18.0 volts = All Cylinders active = Complete = Wamed Up > 200 seconds <= 87 % Ethanol	590 failures out of 740 samples. Minimum of 3 delta TPS changes required to report fail. Delta TPS is incremented when the TPS % change >= 1.0 % Frequency: Once per trip for post sensors 100msec loop	2 trips Type B MIL:YES
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.	Measured Heater Current.	Measured Heater current < 0.3 amps -OR- Measured Heater current > 2.5 amps	No Active DTC's System Voltage Heater Warm-up delay O2S Heater device control B1S1 O2S Heater Duty Cycle <u>All of the above met for</u> Time	ECT_Sensor_FA 10.0 volts < system voltage < 18.0 volts = Complete = Not active > zero > 120 seconds	8 failures out of 10 samples Frequency: 2 tests per trip 30 seconds delay between tests and 1 second execution rate	2 trips Type B MIL:YES
Fuel System Too Lean Bank 1	P0171	Determines if the fuel control system is in a lean condition, based on the filtered long-term fuel trim.	The filtered long-term fuel trim metric	≥ Long Term Trim Lean Table	Engine speed BARO Coolant Temp MAP	400 <rpm< 6100 > 70 kPa -38 <°C< 130 15 <kPa< 256	> 100 ms Frequency: Continuous	2 trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Inlet Air Temp MAF VSS Fuel Level Long Fuel Trim data accumulation:	-20 <°C< 150 1.0 <g/s< 512.0 < 318 mph > 10 % or if fuel sender is faulty > 44 seconds of data must accumulate on each trip, with at least 30 seconds of data in the current fuel trim cell before a pass or fail decision can be made.	Development data indicates that the Fuel Adjustment System Diagnostic (FASD) is typically enabled during (70.7) % 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.	
				Closed loop fueling Enabled Long Fuel Trim enabled	Closed Loop Enabled and coolant temp > 40 and < 120 and > 0.2 liters of fuel consumed after a fuel fill event (Flex Fuel Only)			
				disable conditions:	Engine speed Fuel Level EGR Flow Diag. Intrusive Test Active Catalyst Monitor Diag. Intrusive Test Active Post O2 Diag. Intrusive Test Active Device Control Active EVAP Diag. "tank pull down" portion of the test Active fuel trim metric updated during decels? NO No active DTCs:	rpm< 400 or rpm> 6100 < 10 % for at least 30 seconds IAC_SystemRPM_FA MAP_SensorFA MAF_SensorFA MAF_SensorTFTKO AIR System FA EvapPurgeSolenoidCircuit FA EvapFlowDuringNonPurge FA EvapVentSolenoidCircuit FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSensorCircuit FA		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
						Ethanol Composition Sensor FA FuelInjectorCircuit_FA EngineMisfireDetected FA EGRValvePerformance FA EGRValveCircuit_FA MAP_EngineVacuumStatus AmbientAirDefault_NA		
Fuel System Too Rich Bank 1	P0172	Determines if the fuel control system is in a rich condition, based on the filtered long-term fuel trim metric. There are two different, yet related tests that are used to determine a Rich fault, they are Passive and Intrusive and are described below:				BARO > 70 kPa Coolant Temp -38 <°C< 130 MAP 15 <kPa< 256 IAT -20 <°C< 150 MAF 1.0 <g/s< 512.0 VSS < 318 mph Fuel Level < 10 % for at least 30 seconds Long Fuel Trim data accumulation: > 44 seconds of data must accumulate on each trip, with at least 30 seconds of data in the current fuel trim cell before a pass or fail decision can be made.		2 trips Type B MIL:YES
						Closed loop fueling Enabled		
		Passive Test- Non-purge cells are monitored to determine if a rich condition exists.	The filtered Non-Purge Long Term Fuel Trim metric	≤ Non Purge Rich Limit Table	Long Fuel Trim enabled	Closed Loop Enabled and coolant temp > 40 and < 120 and > 0.2 liters of fuel consumed after a fuel fill event (Flex Fuel Only)	> 100 ms Frequency: Continuous	
		Intrusive Test- When the Purge Long Term fuel trim metric is ≤ the Purge Rich Limit Table, Purge is ramped off	If the Purge Long Term Fuel Trim metric AND	≤ Purge Rich Limit Table		Passive Test decision cannot be made. A passive decision cannot be made when	Fail determinations require that the Malfunction Criteria be	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		to determine if excess purge vapor is the cause of the Rich condition. If the filtered Purge-on Long Term fuel trim > Purge Rich Limit Table the test passes without checking the Non-Purge Long Term fuel trim metric.	The filtered Non-Purge Long Term Fuel Trim metric	\leq Non Purge Rich Limit Table		Purge is enabled.	satisfied for 2 out of 3 intrusive segments.	
<p style="text-align: center;">Segment Definition -</p> <p style="text-align: center;">Segments can last up to 35, and are separated by the lesser of 30 seconds of purge-on time or enough time to purge 18 grams of vapor.</p> <p style="text-align: center;">A maximum of 3 completed segments or 30 intrusive attempts are allowed for each intrusive test.</p> <p>After an intrusive test report is completed, another intrusive test cannot occur for 300 seconds to allow sufficient time to purge excess vapors from the canister. During this period, fuel trim will pass if the filtered Purge-on Long Term fuel trim > Purge Rich Limit Table for at least 60 seconds, indicating that the canister has been purged.</p> <p style="text-align: center;">Performing intrusive tests too frequently may also affect EVAP and EPAIII emissions, and the execution frequency of other diagnostics.</p>								
				<p>disable</p> <p>conditions:</p>	Engine speed EGR Flow Diag. Intrusive Test Not Active Fuel Level < 10 % for at least 30 seconds Catalyst Monitor Diag. Intrusive Test Not Active Post O2 Diag. Intrusive Test Not Active Device Control Not Active EVAP Diag. "tank pull down" portion of the test Not Active fuel trim metric updated during decels? NO No active DTCs:	rpm < 400 or rpm > 6100 IAC_SystemRPM_FA MAP_SensorFA MAF_SensorFA MAF_SensorTFTKO AIR_System FA EvapPurgeSolenoidCircuit FA EvapFlowDuringNonPurge FA EvapVentSolenoidCircuit FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSensorCircuit FA Ethanol Composition Sensor FA FuelInjectorCircuit_FA EngineMisfireDetected FA EGRValvePerformance FA	Development data indicates that the Fuel Adjustment System Diagnostic (FASD) is typically enabled during (70.7) % 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.	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
						EGRValveCircuit_FA MAP_EngineVacuumStatus AmbientAirDefault_NA		
Injector 1	P0201	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match		Powertrain Relay Voltage within range and stable according to Enable Conditions Engine Running	11 volts ≤ Voltage ≤ 18 volts greater than 1 seconds	20 failures out of 25 samples 250 ms /sample Continuous	2 trips Type B MIL:YES
Injector 2	P0202	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match		Powertrain Relay Voltage within range and stable according to Enable Conditions Engine Running	11 volts ≤ Voltage ≤ 18 volts greater than 1 seconds	20 failures out of 25 samples 250 ms /sample Continuous	2 trips Type B MIL:YES
Injector 3	P0203	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match		Powertrain Relay Voltage within range and stable according to Enable Conditions Engine Running	11 volts ≤ Voltage ≤ 18 volts greater than 1 seconds	20 failures out of 25 samples 250 ms /sample Continuous	2 trips Type B MIL:YES
Injector 4	P0204	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match		Powertrain Relay Voltage within range and stable according to Enable Conditions Engine Running	11 volts ≤ Voltage ≤ 18 volts greater than 1 seconds	20 failures out of 25 samples 250 ms /sample Continuous	2 trips Type B MIL:YES
TPS2 Circuit	P0220	Detects a continuous or intermittent short or open in TPS2 circuit on the secondary processor but sensor is in range on the primary processor	Secondary TPS2 Voltage < or Secondary TPS2 Voltage >	0.25 4.59		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions No 5 V reference error No 5 V reference DTCs	19/39 counts or 14 counts continuous; 12.5 msec/count in the Secondary processor	1 Trip Type:A MIL:YES
TPS2 Circuit Low	P0222	Detects a continuous or intermittent short in TPS2 circuit on both processors or just the primary processor	Primary TPS2 Voltage < Secondary TPS2 Voltage <	0.25 0.25		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions No 5 V reference error No 5 V reference DTCs	79/159 counts; 57 counts continuous; 3.125 msec /count in the Primary processor 19/39 counts or 14 counts continuous;	1 Trip Type:A MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
							12.5 msec/count in the Secondary processor	
TPS2 Circuit High	P0223	Detects a continuous or intermittent short or open in TPS2 circuit on both processors or just the primary processor	Primary TPS2 Voltage > Secondary TPS2 Voltage >	4.59 4.59		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions No 5 V reference error No 5 V reference DTCs	79/159 counts; 57 counts continuous; 3.125 msec /count in the Primary processor 19/39 counts or 14 counts continuous; 12.5 msec/count in the Secondary processor	1 Trip Type:A MIL:YES
Fuel Pump Primary 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.		Run/Crank Voltage Engine Speed	11 volts ≤ Voltage ≤ 18 volts ≥ 0 RPM	8 failures out of 10 samples 250 ms /sample Continuous	2 trips Type B MIL:YES
Random Misfire Detected Cylinder 1 Misfire Detected Cylinder 2 Misfire Detected Cylinder 3 Misfire Detected Cylinder 4 Misfire Detected	P0300 P0301 P0302 P0303 P0304	These DTC's will determine if a random or a cylinder specific misfire is occurring by monitoring crankshaft velocity	Deceleration index vs. Engine Speed Vs Engine load Deceleration index calculation is tailored to specific veh. Tables used are 1st tables encountered that are not max of range. Undetectable region at a given speed/load point is where all tables are max of range point. see Algorithm Description Document for additional details.	(>Idle SCD AND > Idle SCD ddt Tables) OR (>SCD Delta AND > SCD Delta ddt Tables) OR (>Idle Cyl Mode AND > Idle Cyl Mode ddt Tables) OR (>Cyl Mode AND > Cyl Mode ddt Tables) OR (>Rev Mode Table) OR (> AFM Table in Cyl Deact mode)	Engine Run Time ECT ECT System Voltage + Throttle delta - Throttle delta	> 2 crankshaft revolutions -7°C < ECT < 125°C < -7°C 21°C < ECT < 125°C 9.00<volts<18.00 < 95.00% per 25 ms < 95.00% per 25 ms	Emission Exceedence = (5) failed 200 rev blocks of 16. Failure reported with (1) Exceedence in 1st (16) 200 rev block, or (4) Exceedences thereafter. 1st Catalyst Exceedence = (1) 200 rev block as data supports for catalyst damage. 2nd and 3rd Catalyst Exceedence = (1)	2 Trips Type B (Mil Flashes with Catalyst Damaging Misfire)

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			Misfire Percent Emission Failure Threshold Misfire Percent Catalyst Damage	≥ 1.00% P0300 ≥ 1.00% emission >"Catalyst Damaging Misfire Percentage" Table disable conditions:	Engine Speed No active DTCs: P0315 & engine speed Fuel Level Low Cam and Crank Sensors Misfire requests TCC unlock Fuel System Status	450 < rpm < 6100 Engine speed limit is a function of inputs like Gear and temperature typical Engine Speed Limit = 6500 rpm TPS_FA EnginePowerLimited MAF_SensorTFTKO n IAT_SensorTFTKO ECT_Sensor_Ckt_TFTKO 5VoltReferenceB_FA CrankSensorTestFailedTKO CrankSensorFaultActive CrankIntakeCamCorrelationFA CrankExhaustCamCorrelationFA CrankCamCorrelationTFTKO AnyCamPhaser_FA AnyCamPhaser_TFTKO > 1000 rpm LowFuelConditionDiagnostic in sync with each other Not honored because Transmission in hot mode ≠ Fuel Cut	Exceedence (1) 200 rev block with catalyst damage. Failure reported with (3) Exceedences in FTP, or (1) Exceedence outside FTP. Continuous 4 cycle delay 500 cycle delay 4 cycle delay 4 cycle delay 4 cycle delay	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Active Fuel Management	Transition in progress	0 cycle delay	
					Undetectable engine speed and engine load region	invalid speed load range in decel index tables	4 cycle delay	
					Abusive Engine Over Speed	> 7000 rpm	1050 cycle delay	
					Below zero torque (except CARB approved 3000 rpm to redline triangle.)	<" Zero torque engine load" in Supporting Tables tab	4 cycle delay	
					Below zero torque: TPS (area)	≤ 0%	4 cycle delay	
					Veh Speed	> 512 KPH		
					EGR Intrusive test	Active	12 cycle delay	
					Manual Trans	Clutch shift	4 cycle delay	
					Throttle Position	> 200.00%	0 cycle delay	
					AND Automatic transmission shift			
					Driveline Ring Filter active			
					After a low level misfire, another misfire may not be detectable until driveline ringing ceases. If no ringing seen, stop filter early.			
					Filter Driveline ring: Stop filter early:			
						7 engine cycles after misfire		
						3 Engine cycles after misfire		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Abnormal engine speed oscillations: (Rough road etc) Off Idle, number of consecutive decelerating cylinders after accelerating. (Number of decels can vary with misfire detection equation) TPS Engine Speed Veh Speed SCD Cyl Mode Rev Mode	> 3 % > 1000 rpm > 5 kph = 2 consecutive cyls = 2 consecutive cyls		
Crankshaft Position System Variation Not Learned	P0315	Monitor for valid crankshaft error compensation factors	Sum of Compensation factors	≥ 2.0040 OR ≤ 1.9960	OBD Manufacturer Enable Counter	0	0.50 seconds Frequency Continuous 100 msec	1 Trip Type A MIL: YES
Knock Sensor (KS) Circuit Bank 1	P0325	This diagnostic checks for an open in the knock sensor circuit	Gated FFT Output	< OpenCircuitThresh See Supporting Tables for OpenCircuitThresh	Diagnostic Enabled (1 = Enabled) Engine Speed ECT Enginer Run Time No Active DTC's Power Take-Off	= 1 ≥ 1500 RPM ≥ -40 deg. C ≥ 1 seconds KS_Ckt_Perf_B1B2_F A Disabled	50 Failures out of 63 Samples 100 msec rate	2 trips Type B MIL: YES
Knock Sensor (KS) Performance Bank 1	P0326	This diagnostic checks for an overactive knock sensor caused by excessive knock or noisy engine components	Knock Fast Retard (spark degrees)	> (FastRtdMax + 4.0 degrees - 1.0 degrees spark See Supporting Tables for FastRtdMax	Diagnostic Enabled (1 = Enabled) Knock Detection Enabled	= 1 > 0 Knock Detection Enabled is calculated by multiplying the following three factors: FastAttackRate FastAttackCoolGain FastAttackBaroGain (see Supporting	50 Failures out of 63 Samples 100 msec rate	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
						(See Supporting Tables)		
					Engine Speed MAP No Active DTC's Power Take-Off	≥ 575 RPM ≥ 10 kPa TPS_ThrottleAuthority Defaulted Disabled		
Knock Sensor (KS) Circuit Low Bank 1	P0327	This diagnostic checks for an out of range low knock sensor signal	Sensor Input Signal Line or Sensor Return Signal Line	< ShortLowThresh * (5 / 65,535) Volts < 2 * [ShortLowThresh * (5 / 65,535) - 2.5] Volts See Supporting Tables for ShortLowThresh	ECT Engine Run Time Engine Oil Temp No Active DTC's	≥ -40 deg. C ≥ 1 seconds < 150 deg. C EngOilModeledTempValid	50 Failures out of 63 Samples 100 msec rate	2 trips Type B MIL:YES
Knock Sensor (KS) Circuit High Bank 1	P0328	This diagnostic checks for an out of range high knock sensor signal	Sensor Input Signal Line or Sensor Return Signal Line	> ShortHiThresh * (5 / 65,535) Volts > 2 * [ShortLowThresh * (5 / 65,535) - 2.5] Volts See Supporting Tables for ShortHiThresh	ECT Engine Run Time Engine Oil Temp No Active DTC's	≥ -40 deg. C ≥ 1 seconds < 150 deg. C EngOilModeledTempValid	50 Failures out of 63 Samples 100 msec rate	2 trips Type B MIL:YES
Crankshaft Position (CKP) Sensor A Circuit	P0335	Determines if a fault exists with the crank position sensor signal	<u>Engine-Cranking Crankshaft Test:</u> Time since last crankshaft position sensor pulse received	 >= 4.0 seconds	<u>Engine-Cranking Crankshaft Test:</u> Starter engaged AND (cam pulses being received) OR (DTC P0101 AND DTC P0102 AND DTC P0103 AND	 = FALSE = FALSE = FALSE	<u>Engine-Cranking Crankshaft Test:</u> Continuous every 100 msec	2 trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			<u>Time-Based Crankshaft Test:</u> No crankshaft pulses received <u>Event-Based Crankshaft Test:</u> No crankshaft pulses received	>= 1.0 seconds	Engine Air Flow <u>Time-Based Crankshaft Test:</u> Engine is Running Starter is not engaged No DTC Active: <u>Event-Based Crankshaft Test:</u> Engine is Running OR Starter is engaged No DTC Active:	> 3.0 grams/second)) 5VoltReferenceB_FA 5VoltReferenceA_FA 5VoltReferenceB_FA P0365 P0366	<u>Time-Based Crankshaft Test:</u> Continuous every 12.5 msec <u>Event-Based Crankshaft Test:</u> 2 failures out of 10 samples One sample per engine revolution	
Crankshaft Position (CKP) Sensor A Performance	P0336	Determines if a performance fault exists with the crank position sensor signal	<u>Crank Re-synchronization Test:</u> Time in which 20 or more crank re-synchronizations occur <u>Time-Based Crankshaft Test:</u> No crankshaft synchronization gap found <u>Engine Start Test during Crank:</u> Time since starter engaged without detecting crankshaft	< 25.0 seconds >= 0.4 seconds	<u>Crank Re-synchronization Test:</u> Engine Air Flow Cam-based engine speed No DTC Active: <u>Time-Based Crankshaft Test:</u> Engine is Running Starter is not engaged No DTC Active: <u>Engine Start Test during Crank:</u> Starter engaged AND	>= 3.0 grams/second > 450 RPM 5VoltReferenceB_FA P0335 5VoltReferenceB_FA	<u>Crank Re-synchronization Test:</u> Continuous every 250 msec <u>Time-Based Crankshaft Test:</u> Continuous every 12.5 msec <u>Engine Start Test during Crank:</u> Continuous every 100 msec	2 trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			synchronization gap	>= 1.5 seconds	(cam pulses being received OR (DTC P0101 AND DTC P0102 AND DTC P0103 AND Engine Air Flow	= FALSE = FALSE = FALSE > 3.0 grams/second))		
			<u>Event-Based Crankshaft Test:</u> Crank Pulses received in one engine revolution OR Crank Pulses received in one engine revolution	< 51 > 65	<u>Event-Based Crankshaft Test:</u> Engine is Running OR Starter is engaged No DTC Active:	5VoltReferenceA_FA 5VoltReferenceB_FA P0365 P0366	<u>Event-Based Crankshaft Test:</u> 8 failures out of 10 samples One sample per engine revolution	
Camshaft Position (CMP) Sensor Circuit Bank 1 Sensor A	P0340	Determines if a fault exists with the cam position bank 1 sensor A signal	<u>Engine Cranking Camshaft Test:</u> Time since last camshaft position sensor pulse received OR Time that starter has been engaged without a camshaft sensor pulse <u>Time-Based Camshaft Test:</u> Fewer than 4 camshaft pulses received in a time <u>Fast Event-Based Camshaft Test:</u>	>= 5.5 seconds >= 4.0 seconds > 3.0 seconds	<u>Engine Cranking Camshaft Test:</u> Starter engaged AND (cam pulses being received OR (DTC P0101 AND DTC P0102 AND DTC P0103 AND Engine Air Flow	= FALSE = FALSE = FALSE > 3.0 grams/second)) <u>Time-Based Camshaft Test:</u> Engine is Running Starter is not engaged No DTC Active: <u>Fast Event-Based Camshaft Test:</u>	Continuous every 100 msec <u>Time-Based Camshaft Test:</u> Continuous every 100 msec <u>Fast Event-Based Camshaft Test:</u>	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			<p>No camshaft pulses received during first 12 MEDRES events</p> <p>(There are 12 MEDRES events per engine cycle)</p> <p><u>Slow Event-Based Camshaft Test:</u></p> <p>The number of camshaft pulses received during 100 engine cycles</p>	= 0	<p>Crankshaft is synchronized</p> <p>Starter must be engaged to enable the diagnostic, but the diagnostic will not disable when the starter is disengaged</p> <p>No DTC Active:</p> <p><u>Slow Event-Based Camshaft Test:</u></p> <p>Crankshaft is synchronized</p> <p>No DTC Active:</p>	<p>5VoltReferenceA_FA</p> <p>5VoltReferenceB_FA</p> <p>CrankSensor_FA</p> <p>5VoltReferenceA_FA</p> <p>5VoltReferenceB_FA</p> <p>CrankSensor_FA</p>	<p>Continuous every MEDRES event</p> <p><u>Slow Event-Based Camshaft Test:</u></p> <p>8 failures out of 10 samples</p> <p>Continuous every engine cycle</p>	
Camshaft Position (CMP) Sensor Performance Bank 1 Sensor A	P0341	Determines if a performance fault exists with the cam position bank 1 sensor A signal	<p><u>Fast Event-Based Camshaft Test:</u></p> <p>The number of camshaft pulses received during first 12 MEDRES events is less than 4 or greater than 10</p> <p>(There are 12 MEDRES events per engine cycle)</p> <p><u>Slow Event-Based Camshaft Test:</u></p> <p>The number of camshaft pulses received during 100 engine cycles</p>		<p><u>Fast Event-Based Camshaft Test:</u></p> <p>Crankshaft is synchronized</p> <p>Starter must be engaged to enable the diagnostic, but the diagnostic will not disable when the starter is disengaged</p> <p>No DTC Active:</p> <p><u>Slow Event-Based Camshaft Test:</u></p> <p>Crankshaft is synchronized</p> <p>No DTC Active:</p>	<p>5VoltReferenceA_FA</p> <p>5VoltReferenceB_FA</p> <p>CrankSensor_FA</p> <p>5VoltReferenceA_FA</p>	<p><u>Fast Event-Based Camshaft Test:</u></p> <p>Continuous every MEDRES event</p> <p><u>Slow Event-Based Camshaft Test:</u></p> <p>8 failures out of 10 samples</p>	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			AND	< 398 > 402		5VoltReferenceB_FA CrankSensor_FA	Continuous every engine cycle	
IGNITION CONTROL #1 CIRCUIT	P0351	This diagnostic checks the circuit for electrical integrity during operation. Monitors EST for Cylinder 1 (Cylinders 1 and 4 for V6 with waste spark)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		Engine running Ignition Voltage	> 6.00 Volts	50 Failures out of 63 Samples 100 msec rate	2 trips Type B MIL:YES
IGNITION CONTROL #2 CIRCUIT	P0352	This diagnostic checks the circuit for electrical integrity during operation. Monitors EST for Cylinder 2 (Cylinders 2 and 5 for V6 with waste spark)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		Engine running Ignition Voltage	> 6.00 Volts	50 Failures out of 63 Samples 100 msec rate	2 trips Type B MIL:YES
IGNITION CONTROL #3 CIRCUIT	P0353	This diagnostic checks the circuit for electrical integrity during operation. Monitors EST for Cylinder 3 (Cylinders 3 and 6 for V6 with waste spark)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		Engine running Ignition Voltage	> 6.00 Volts	50 Failures out of 63 Samples 100 msec rate	2 trips Type B MIL:YES
IGNITION CONTROL #4 CIRCUIT	P0354	This diagnostic checks the circuit for electrical integrity during operation. Monitors EST for Cylinder 4 (if applicable)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		Engine running Ignition Voltage	> 6.00 Volts	50 Failures out of 63 Samples 100 msec rate	2 trips Type B MIL:YES
Camshaft Position (CMP) Sensor Circuit Bank 1 Sensor B	P0365	Determines if a fault exists with the cam position bank 1 sensor B signal	<u>Engine Cranking Camshaft Test:</u> Time since last camshaft position sensor pulse received OR	 >= 5.5 seconds	<u>Engine Cranking Camshaft Test:</u> Starter engaged AND (cam pulses being received)		<u>Engine Cranking Camshaft Test:</u> Continuous every 100 msec	2 trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			Time that starter has been engaged without a camshaft sensor pulse	>= 4.0 seconds	OR (DTC P0101 AND DTC P0102 AND DTC P0103 AND Engine Air Flow	= FALSE = FALSE = FALSE > 3.0 grams/second))		
			<u>Time-Based Camshaft Test:</u> Fewer than 4 camshaft pulses received in a time	> 3.0 seconds	<u>Time-Based Camshaft Test:</u> Engine is Running Starter is not engaged No DTC Active:	5VoltReferenceA_FA	<u>Time-Based Camshaft Test:</u> Continuous every 100 msec	
			<u>Fast Event-Based Camshaft Test:</u> No camshaft pulses received during first 12 MEDRES events (There are 12 MEDRES events per engine cycle)		<u>Fast Event-Based Camshaft Test:</u> Crankshaft is synchronized Starter must be engaged to enable the diagnostic, but the diagnostic will not disable when the starter is disengaged	5VoltReferenceA_FA 5VoltReferenceB_FA CrankSensor_FA	<u>Fast Event-Based Camshaft Test:</u> Continuous every MEDRES event	
			<u>Slow Event-Based Camshaft Test:</u> The number of camshaft pulses received during 100 engine cycles	= 0	<u>Slow Event-Based Camshaft Test:</u> Crankshaft is synchronized No DTC Active:	5VoltReferenceA_FA 5VoltReferenceB_FA CrankSensor_FA	<u>Slow Event-Based Camshaft Test:</u> 8 failures out of 10 samples Continuous every engine cycle	
Camshaft Position (CMP) Sensor Performance Bank 1 Sensor B	P0366	Determines if a performance fault exists with the cam position bank 1 sensor B signal	<u>Fast Event-Based Camshaft Test:</u> The number of camshaft pulses received during first 12 MEDRES		<u>Fast Event-Based Camshaft Test:</u> Crankshaft is synchronized		<u>Fast Event-Based Camshaft Test:</u> Continuous every MEDRES event	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			<p>events is less than 4 or greater than 10</p> <p>(There are 12 MEDRES events per engine cycle)</p> <p><u>Slow Event-Based Camshaft Test:</u></p> <p>The number of camshaft pulses received during 100 engine cycles</p> <p>AND</p>	<p>< 398</p> <p>> 402</p>	<p>Starter must be engaged to enable the diagnostic, but the diagnostic will not disable when the starter is disengaged</p> <p>No DTC Active:</p> <p><u>Slow Event-Based Camshaft Test:</u></p> <p>Crankshaft is synchronized</p> <p>No DTC Active:</p>	<p>5VoltReferenceA_FA</p> <p>5VoltReferenceB_FA</p> <p>CrankSensor_FA</p> <p>5VoltReferenceA_FA</p> <p>5VoltReferenceB_FA</p> <p>CrankSensor_FA</p>	<p><u>Slow Event-Based Camshaft Test:</u></p> <p>8 failures out of 10 samples</p> <p>Continuous every engine cycle</p>	
Secondary AIR Incorrect Airflow Single Bank Systems	P0411	<p>Detects an insufficient flow condition</p> <p>This test is run during Phase 1 (AIR pump commanded On, Valve commanded Open)</p> <p>Leaks downstream of the valve are detected via an evaluation of both pressure error and average pressure "String Length"(SL) – a term that represents the absolute pressure delta accumulated every 6.25ms, then averaged over the duration of the test. Low SL values are indicative of downstream leaks or blockages.</p>	<p>Predicted System Pressure versus Actual System Pressure Error</p> <p>OR</p> <p>System Pressure Error</p> <p>while the Average String Length</p>	<p>> 4.0 kPa</p> <p>or</p> <p>< -4.0 kPa</p> <p>> 0.0 kPa</p> <p>or</p> <p>< 0.0 kPa</p> <p>>SL Threshold Bank 1 Table</p>	<p>BARO > 60 kPa</p> <p>Inlet Air Temp > -11.0 deg C.</p> <p>Coolant Temp > -11.0 deg C.</p> <p>Engine off time > 3600.0 seconds</p> <p>System Voltage > 10.0 OR < 18.0 Volts</p> <p>SL Stability time > 4.0 seconds</p> <p>SL Range rpm < 4700 and > 4900</p> <p>Conditional test weight is calculated by multiplying the following Factors</p> <p>Phase 1 Baro Test Weight Factor</p> <p>Phase 1 MAF Test Weight Factor</p> <p>Phase 1 System Volt Test Weight Factor</p> <p>Phase 1 Ambient Temp Test Weight Factor</p>	<p>> 10 seconds</p>	<p>Phase 1 Conditional test weight > 7.0 seconds</p> <p>Total 'String Length' accumulation time</p> <p>Frequency: Once per trip when AIR pump commanded On</p>	2 trips Type B MIL: YES
				<p>disable</p> <p>conditions:</p>	<p>MAP < 20 kPa for 2 seconds</p> <p>Engine Speed > 5000 RPM</p> <p>MAF > 50 gm/s for 3 seconds</p> <p>No active DTCs: AIRSystemPressureSensor FA</p>			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
						AIRValveControlCircuit FA AIRPumpControlCircuit FA MAF_SensorFA MAP_SensorFA IAT_SensorFA ECT_Sensor_FA EngineMisfireDetected _FA CatalystSysEfficiencyL oB1_FA CatalystSysEfficiencyL oB2_FA ControllerProcessorPer f_FA 5VoltReferenceA_FA 5VoltReferenceB_FA IgnitionOutputDriver_F A FuelInjectorCircuit_FA		
Secondary AIR Solenoid Control Circuit	P0412	This DTC checks the AIR solenoid circuit for electrical integrity	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		System Voltage	> 10.0 Volts < 18.0 Volts	20 failures out of 25 samples 250 ms loop Continuous	2 trips Type B MIL:YES
Secondary AIR Pump Control Circuit	P0418	This DTC checks the AIR Pump circuit for electrical integrity	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		System Voltage	> 10.0 Volts < 18.0 Volts	20 failures out of 25 samples 250 ms loop Continuous	2 trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Catalyst System Low Efficiency Bank 1	P0420	Oxygen Storage	Normalized Ratio OSC Value (EWMA filtered)	< 0.350			1 test attempted per valid idle period Minimum of 1 test per trip Maximum of 8 tests per trip <i>Valid Idle Period Criteria</i> Frequency: Fueling Related : 12.5 ms OSC Measurements: 100 ms Temp Prediction:	1 Trip Type A MIL:YES
		<p>The catalyst washcoat contains Cerium Oxide. Cerium Oxide reacts with NO and O2 during lean A/F excursions to store the excess oxygen (I.e. Cerium Oxidation). During rich A/F excursions, Cerium Oxide reacts with CO and H2 to release this stored oxygen (I.e. Cerium Reduction). This is referred to as the Oxygen Storage Capacity, or OSC. CatMon's strategy is to "measure" the OSC of the catalyst through forced Lean and Rich A/F excursions</p> <p>Normalized Ratio OSC Value Calculation Information and Definitions =</p> <ol style="list-style-type: none"> Raw OSC Calculation = (post cat O2 Resp time - pre cat O2 Resp time) BestFailing OSC value from a calibration table (based on temp and exhaust gas flow) WorstPassing OSC value (based on temp and exhaust gas flow) <p>Normalized Ratio Calculation = (1-2) / (3-2)</p> <p>A Normalized Ratio of 1 essentially represents a good part and a ratio of 0 essentially represents a very bad part.</p> <p>The Catalyst Monitoring Test is done during idle. Several conditions must be met in order to execute this test. These conditions and their related values are listed in the secondary parameters area of this document.</p>			<p>Throttle Position < 2.00 % Vehicle Speed < 2.00 Kph Engine speed > 1200 RPM for a minimum of 25 seconds since end of last idle period. Engine run time ≥ MinimumEngineRunTime, This is a function of Coolant Temperature, please see Supporting Tables</p> <p>Tests attempted this trip < 255 The catalyst diagnostic has not yet completed for the Catalyst Idle Conditions Met Criteria General Enable met and the Green Converter Delay Not Active Induction Air -20 < ° C < 250 Intrusive test(s): Not Active Fueltrim Post O2 EVAP EGR RunCrank Voltage > 10.90 Volts Ethanol Estimation NOT in Progress ECT 50 < ° C < 130 Barometric Pressure > 70 KPA</p>			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Idle Time before going intrusive is Idle time is incremented if Vehicle speed Short Term Fuel Trim Predicted catalyst temp > MinCatTemp table (degC) (refer Closed loop fueling Enabled PRNDL Idle Stable Criteria :: Must hold true from after MAF Predicted catalyst temperature Engine Fueling Criteria at Beginning of Idle Period The following fueling related must also be met from Number of pre-O2 switches Short Term Fuel Trim Avg Rapid Step Response (RSR) feature will initiate If the difference between current EWMA value and the Maximum of 24 RSR tests to detect failure when RSR is Green Converter Delay Criteria This is part of the check for the Catalyst Idle Conditions The diagnostic will not be enabled until the following has Predicted catalyst temperature > 550 ° C for 3600 PTO Not Active General Enable DTC's Not Set MAF_SensorFA AmbientAirDefault_SC IAT_SensorCircuitFA ECT_Sensor_FA O2S_Bank_1_Sensor_1_FA O2S_Bank_1_Sensor_2_FA O2S_Bank_2_Sensor_1_FA O2S_Bank_2_Sensor_2_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EvapPurgeSolenoidCircuit_FA IAC_SystemRPM_FA EGRValvePerformance_FA EGRValveCircuit_FA CamSensor_FA CrankSensorFaultActive TPS_Performance_FA EnginePowerLimited VehicleSpeedSensor_FA	< 50 Seconds < 2 Kph and the throttle position < 2.00 % as identified in the Valid Idle Period Criteria section. 0.90 < ST FT < 1.10 (refer to table) < 850 degC > 2 0.960 < ST FT Avg < 1.040		
Evaporative Emission (EVAP) System Small Leak	P0442	This DTC will detect a small leak (≥ 0.020") in the EVAP system	The total delta from peak pressure to peak vacuum during		Fuel Level Drive Time	10 % ≤ Percent ≤ 90 % ≥ 600 seconds	Once per trip, during hot soak	1 trip Type A

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Detected		<p>between the fuel fill cap and the purge solenoid. The engine off natural vacuum method (EONV) is used. EONV is an evaporative system leak detection diagnostic that runs when the vehicle is shut off when enable conditions are met. Prior to sealing the system and performing the diagnostic, the fuel volatility is analyzed. In an open system (Canister Vent Solenoid [CVS] open) high volatility fuel creates enough flow to generate a measurable pressure differential relative to atmospheric.</p> <p>After the volatility check, the vent solenoid will close. After the vent is closed, typically a build up of pressure from the hot soak begins (phase-1). The pressure typically will peak and then begin to decrease as the fuel cools. When the pressure drops (-62.27) Pa from peak pressure, the vent is then opened for 60 seconds to normalize the system pressure. The vent is again closed to begin the vacuum portion of the test (phase-2). As the fuel temperature continues to fall, a vacuum will begin forming. The vacuum will continue until it reaches a vacuum peak. When the pressure rises 62.27 Pa from vacuum peak, the test then completes. If the key is turned on while the diagnostic test is in progress, the test will abort.</p>	<p>the test is normalized against a calibration pressure threshold table that is based upon fuel level and ambient temperature. (See P0442: EONV Pressure Threshold Table on Supporting Tables Tab). The normalized value is calculated by the following equation: 1 - (peak pressure - peak vacuum)/pressure threshold. The normalized value is entered into EWMA (with 0= perfect pass and 1= perfect fail).</p> <p>When EWMA is > 0.65 (EWMA Fail Threshold), the DTC light is illuminated. The DTC light can be turned off if the EWMA is ≤ 0.35 (EWMA Re-Pass Threshold) and stays below the EWMA fail threshold for 2 additional consecutive trips.</p>	<p>> 0.65 (EWMA Fail Threshold)</p> <p>≤ 0.35 (EWMA Re-Pass Threshold)</p>	<p>Drive length ≥ 3.1 miles ECT ≥ 70 °C Baro ≥ 70 kPa Odometer ≥ 10.0 miles Time since last complete test ≥ 17 hours if normalized result and EWMA is passing</p> <p>OR</p> <p>Time since last complete test ≥ 10 hours if normalized result or EWMA is failing</p> <p>Estimated ambient temperature at end of drive 0 °C ≤ Temperature ≤ 34 °C</p> <p>Estimate of Ambient Air Temperature Valid</p>	<p>≥ 3.1 miles ≥ 70 °C ≥ 70 kPa ≥ 10.0 miles ≥ 17 hours ≥ 10 hours</p> <p>0 °C ≤ Temperature ≤ 34 °C</p>	<p>(up to 2400 sec.).</p> <p>No more than 2 unsuccessful attempts between completed tests.</p>	<p>EWMA</p> <p>Average run length is 9 under normal conditions</p> <p>Run length is 5 trips after code clear or non-volatile reset MIL: YES</p>
						<p>Conditions for Estimate of Ambient Air Temperature</p> <p>1. Cold Start Startup delta deg C (ECT-IAT) ≤ 8 °C</p> <p>OR</p> <p>2. Short Soak and Previous EAT Valid Previous time since engine off ≤ 7200 seconds</p> <p>OR</p> <p>3. Not a Cold Start and Previous EAT Valid and Previous time since engine off 7200 seconds < Time < 25200 seconds</p> <p>AND</p> <p>Must expire Estimate of Ambient Temperature Valid Conditioning Time. Please see "P0442: Estimate of Ambient Temperature Valid Conditioning Time" in Supporting Tables Tab.</p> <p>4. Not a Cold Start and Previous EAT Not Valid and Previous time since engine off < 25200 seconds</p>		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					<p>AND Must expire maximum value in Estimate of Ambient Temperature Valid Conditioning Time. Please see "P0442: Estimate of Ambient Temperature Valid Conditioning Time" in Supporting Tables Tab.</p> <p>OR 5. Long Soak Previous time since engine off</p>	<p>Vehicle Speed \geq 19.9 mph AND Mass Air Flow \geq 0 g/sec</p>		
				<p>Abort Conditions:</p>	<p>1. High Fuel Volatility During the volatility phase, pressure in the fuel tank is integrated vs. time. If the integrated pressure is then test aborts and unsuccessful attempts is incremented.</p> <p>OR</p> <p>2. Vacuum Refueling Detected See P0454 Fault Code for information on vacuum refueling algorithm.</p> <p>OR</p> <p>3. Fuel Level Refueling Detected See P0464 Fault Code for information on fuel level refueling.</p> <p>OR</p> <p>4. Vacuum Out of Range and No Refueling See P0451 Fault Code for information on vacuum sensor out of range and P0464 Fault Code for information on fuel level refueling.</p> <p>OR</p> <p>5. Vacuum Out of Range and Refueling Detected See P0451 Fault Code for information on vacuum sensor out of range and P0464 Fault Code for information on fuel level refueling.</p> <p>OR</p> <p>6. Vent Valve Override Failed Device control using an off-board tool to control the vent solenoid, cannot exceed during the EONV test</p>	<p>> -5</p>	<p>\geq 25200 seconds</p>	
						<p>0.50 seconds</p>		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					OR 7. Key up during EONV test No active DTCs:	FuelLevelDataFault MAF_SensorFA ECT_Sensor_FA IAT_SensorFA VehicleSpeedSensor_F A IgnitionOffTimeValid AmbientAirDefault P0443 P0446 P0449 P0452 P0453 P0455 P0496		
Evaporative Emission (EVAP) Canister Purge Solenoid Valve Circuit (ODM)	P0443	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		Run/Crank Voltage	11 volts ≤ Voltage ≤ 18 volts	20 failures out of 25 samples 250 ms /sample Continuous with solenoid operation	2 trips Type B MIL: YES
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. This test runs with normal purge and vent valve is open.	Vent Restriction Prep Test: Vented Vacuum < -623 Pa or Vented Vacuum > 1245 Pa for 60 seconds Vent Restriction Test: Tank Vacuum for 5 seconds > 2989 Pa BEFORE Purge Volume ≥ 10 liters 2 liters of fuel must be consumed after setting the DTC active the first time to set the DTC active the second time.		Fuel Level System Voltage Startup IAT Startup ECT BARO No active DTCs:	10% ≤ Percent ≤ 90% 11 volts ≤ Voltage ≤ 18 volts 4 °C ≤ Temperature ≤ 30 °C ≤ 35 °C ≥ 70 kPa MAP_SensorFA TPS_FA VehicleSpeedSensor_F A IAT_SensorCircuitFA ECT_Sensor_FA AmbientAirDefault EnginePowerLimited P0443 P0449 P0452 P0453	Once per Cold Start Time is dependent on driving conditions Maximum time before test abort is 1000 seconds	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
						P0454		
Evaporative Emission (EVAP) Vent Solenoid Control Circuit (ODM)	P0449	This DTC checks the circuit for electrical integrity during operation. If the P0449 is active, an intrusive test is performed with the vent solenoid commanded closed for 15 seconds.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		Run/Crank Voltage	11 volts ≤ Voltage ≤ 18 volts	20 failures out of 25 samples 250 ms / sample Continuous with solenoid operation	2 trips Type B MIL: YES
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) Lower voltage threshold (voltage subtraction below the nominal voltage) 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). When EWMA is > 0.73 (EWMA Fail Threshold), the DTC light is illuminated. The DTC light can be turned off if the EWMA is ≤ 0.40 (EWMA Re-Pass Threshold) and stays below the EWMA fail threshold for 2 additional consecutive trips.	0.2 volts 0.2 volts	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.	1 trip Type A EWMA Average run length: 6 Run length is 2 trips after code clear or non-volatile reset MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
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 The normal operating range of the fuel tank pressure sensor is 0.5 volts (~1245 Pa) to 4.5 volts (~3736 Pa).	< 0.15 volts (3 % of Vref or ~ 1681 Pa)	Time delay after sensor power up for sensor warm-up ECM State ≠ crank	is 0.10 seconds	80 failures out of 100 samples 100 ms / sample Continuous	2 trips Type B MIL: YES
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 The normal operating range of the fuel tank pressure sensor is 0.5 volts (~1245 Pa) to 4.5 volts (~3736 Pa).	> 4.85 volts (97% of Vref or ~ 4172 Pa)	Time delay after sensor power up for sensor warm-up ECM State ≠ crank	is 0.10 seconds	80 failures out of 100 samples 100 ms / sample Continuous	2 trips Type B MIL: YES
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 in vacuum: in the span of 1.0 seconds. A refueling event is confirmed if the fuel level has a persistent change of 10 % for 30 seconds.	112 Pa < Vacuum < 249 Pa	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 1 out of 3 samples are failures.	1 trip Type A MIL: YES
Evaporative Emission (EVAP) System Large Leak Detected	P0455	This DTC will detect a weak vacuum condition (large leak or purge blockage) in the EVAP	BEFORE Purge volume	> 12 liters	Fuel Level System Voltage	10% ≤ Percent ≤ 90% 11 volts ≤ Voltage ≤ 18 volts	Once per cold start	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			<p>refueling event occurred. If a refueling event is confirmed, then the test sample is considered passing. Otherwise, the sample is considered failing indicating an intermittent signal problem.</p> <p>An intermittent change in fuel level is defined as: The fuel level changes by 10 % and does not remain > 10 % for 30 seconds during a 600 second refueling rationality test.</p>				<p>on period.</p> <p>The length of the test is determined by the refueling rationality test, which can take up to 600 seconds to complete.</p> <p>The test will report a failure if 1 out of 3 samples are failures.</p>	
Cooling Fan 1 Relay Control Circuit (ODM)	P0480	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		Run/Crank Voltage Engine Speed	11 volts ≤ Voltage ≤ 18 volts ≥ 400 RPM	20 failures out of 25 samples 100 ms / sample Continuous with fan operation	2 trips Type B Not used on systems with Mechanical Fan) MIL: YES
Cooling Fan 2 Relay Control Circuit (ODM)	P0481	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.		Run/Crank Voltage Engine Speed	11 volts ≤ Voltage ≤ 18 volts ≥ 400 RPM	20 failures out of 25 samples 100 ms / sample Continuous with fan operation	2 trips Type B Not used on systems with Mechanical Fan) MIL: YES
Evaporative Emission (EVAP) System Flow During Non-Purge	P0496	This DTC will determine if the purge solenoid is leaking to engine manifold vacuum. This test will run with the purge valve closed and the vent valve closed.	BEFORE Test time	Tank Vacuum > 2491 Pa for 5 seconds Test time ≥ refer to "P0496: Purge Valve Leak Test Engine Vacuum Test Time (Cold Start) as a Function of Fuel Level table" in Supporting Tables Tab.	Fuel Level System Voltage BARO Startup IAT Temperature Startup ECT Engine Off Time	10% ≤ Percent ≤ 90% 11 volts ≤ Voltage ≤ 18 volts ≥ 70 kPa 4 °C ≤ Temperature ≤ 30 °C ≤ 35 °C ≥ 28800.0 seconds	Once per cold start Cold start: max time is 1000 seconds	2 trips Type B MIL: YES
					No active DTCs:	MAP_SensorFA		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
						TPS_FA VehicleSpeedSensor_FA IAT_SensorCircuitFA ECT_Sensor_FA AmbientAirDefault EnginePowerLimited P0443 P0449 P0452 P0453 P0454		
Transmission Output Speed Sensor (TOSS)	P0502	No activity in the TOSS circuit	TOSS Raw Speed	<= 60 RPM	Maximum Engine Torque Minimum Engine Torque Maximum Engine Torque in Park or Neutral Minimum Engine Torque in Park or Neutral Minimum Throttle opening Minimum Engine Speed when there is a Brake DTC Minimum Engine Speed when there is no Brake DTC Maximum Engine Speed Minimum Transmission Fluid Temperature Disable P0502 if PTO Active Maximum Engine Speed Minimum Engine Speed Time at Engine Speed Maximum Ignition Voltage Minimum Ignition Voltage	<= 8192 N-m >= 68 N-m <= 8192 N-m >= 90 N-m >= 8.0 % >= 1500 RPM >= 1500 RPM <= 6500 RPM >= -40 ° C. = 0 Boolean <= 7500 RPM >= 200 RPM >= 5 sec <= 18 volts >= 11 volts	>= 4.5 sec	2 trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.		
						ECM: P0068, P006E, P0101, P0102, P0103, P0104, P0107, P0108, P0120, P0122, P0123, P012C, P012D, P0171, P0172, P0174, P0175, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0209, P020A, P020B, P020C, P020D, P020E, P020F, P0220, P0222, P0223, P0300, P0400, P0401, P0402, P0403, P0404, P0405, P0406, P042E, P042F, P0489, P0490, P049D, P0716, P0717, P0851, P0852, P1106, P1107, P1120, P1122, P1123, P1220, P1221, P1183, P1184, P1185, P1186, P1400, P1404, P1407, P1512, P1514, P1515, P1516, P151A, P1523, P1524, P1681, P1791, P2100, P2101, P2119, P2135, P2176, P245A, P245B, P245C, P245D, U0101				
				Disable Conditions:	MIL not Illuminated for DTC's:	TCM: P0502, P0503				
Transmission Output Speed Sensor (TOSS)	P0503	TOSS Signal Intermittent	Loop-to-Loop change in TOSS	>= 350 RPM	Loop-to-Loop Input Speed Change Raw Output Speed Output Speed change Time for Input Speed Change Time since Range Change Time for Positive Output Speed Change Time above raw Output Speed Time since 4WD Range change	<= 500 RPM >= 300 RPM <= 150 RPM >= 2 sec >= 6 sec >= 2 sec >= 2 sec >= 6 sec	>= 4.5 sec	2 trips Type B MIL: YES		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					No active DTCs	PTO not active Transfer Case not in 4WD LowState Output control state normal Output control state instrumentation AmbientAirDefault ECT_Sensor_FA EngCoolHot EGRValveCircuit_FA EGRValvePerformance_FA IAT_SensorCircuitFA EvapFlowDuringNonPurge_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA FuelInjectorCircuit_FA MAF_SensorFA EngineMisfireDetected_FA IgnitionOutputDriver_FA EnginePowerLimited TPS_FA TPS_Performance_FA VehicleSpeedSensor_FA FuelLevelDataFault LowFuelConditionDiagnostic ClchPstnEmisFA ClchToT_TypedABC		
System Voltage Low	P0562	This DTC determines if the current system voltage is below the minimum required voltage for proper ECM operation.	System voltage	≤ 9 volts	Ignition is "ON" Engine Speed	≥ 400 RPM	5 failures out of 6 samples 1 second / sample Continuous	1 trip Special Type C MIL: NO
System Voltage High	P0563	This DTC determines if the current system voltage is above the maximum allowed voltage for proper ECM operation.	System voltage	≥ 18 volts	Ignition is "ON"		5 failures out of 6 samples 1 second / sample Continuous	1 trip Special Type C MIL: NO

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Cruise Control Input Circuit	P0575	Detects rolling count or protection value errors in Cruise Control Switch Status serial data signal	If x of y rolling count / protection value faults occur, disable cruise for duration of fault			Switch architecture CeCRZG_e_CAN is CAN, DTC enable cal 1 is TRUE	10/16 counts	1 trip Special Type C MIL: NO
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	Diagnostic runs continuously in the background Diagnostic reports a fault if 1 failure occurs on the first pass. Diagnostic reports a fault if 5 failures occur after the first pass is complete.	1 trip Type A MIL:YES
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	Diagnostic runs at powerup	1 trip Type A MIL:YES
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				Diagnostic runs at powerup Diagnostic reports a fault if 1 failure occurs	1 trip Type A MIL:YES
ECM RAM Failure	P0604	Indicates that the ECM is unable to correctly read data from or write data to RAM	1. Primary processor data pattern written doesn't match the pattern read for a count >	1 count if found on first memory scan. 5counts if found on subsequent scans.			1. Will finish first memory scan within 30 seconds at all engine conditions - diagnostic runs continuously	1 trip Type A MIL:YES
			2. Secondary processor battery backed RAM failed checksum twice for original values at power up and the defaulted values			2. Completion at initialization, <500 ms		
			3. Secondary processor copy of calibration area to RAM failed for a count >	2counts		3. Completion at initialization, <500 ms		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			4. Secondary Processor data pattern written doesn't match the pattern read consecutive times				4. Will finish within 30 seconds at all engine conditions.	
			5. Secondary Processor TPS or APPS minimum learned values fail compliment check continuously				5. 0.0625sec continuous	
ECM Processor	P0606	Indicates that the ECM has detected an internal processor integrity fault						1 trip Type A
1. Processor Performance Check - Throttle limiting Fault			When drag is active Secondary processor detects Primary's calculated throttle position is greater > than Secondary Processor calculated Throttle Position by Secondary processor detects Primary's calculated throttle position is greater > than Secondary's calculated Throttle Position when driver is commanding the throttle from APP by Secondary processor detects Primary's calculated throttle position is greater > than Secondary's calculated Throttle Position when reduce engine power is active by	0.00% 819.00% 4410.00%		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	1. 0.1875sec in the Secondary Processor	MIL: YES
2. Processor Performance Check - ETC software is not executed or it is not executed in proper order			Software tasks on the Primary Processor in the 12.5 ms loop were not executed or were not executed in the correct order. Software tasks on the Primary Processor in the 25 ms loop were not executed or were not executed in the correct order.	0.0625sec continuous 0.1250sec continuous		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	2. 0.0625sec continuous 0.1250sec continuous	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			Software tasks on the Primary Processor in the 50 ms loop were not executed or were not executed in the correct order.	0.2500sec continuous			0.2500sec continuous	
			Software tasks on the Primary Processor in the 100 ms loop were not executed or were not executed in the correct order.	0.5000sec continuous			0.5000sec continuous	
			Software tasks on the Primary Processor in the 250 ms loop were not executed or were not executed in the correct order.	1.2500sec continuous			1.2500sec continuous	
			The first completion of the RAM diagnostic on the Primary Processor was completed > the amount of time	360.0000sec continuous			360.0000sec continuous	
			The first completion of the ROM diagnostic on the Primary Processor was completed > the amount of time	360.0000sec continuous			360.0000sec continuous	
			Software tasks on the Secondary Processor were not executed or were not executed in the correct order.	Two Consecutive Loops (12.5ms * 2) 25ms			25 ms	
3. Processor Performance Check - SPI Failure			Loss or invalid message of SPI communication from the Secondary Processor at initialization detected by the Primary Processor or loss or invalid message of SPI communication from the Secondary Processor after a valid message was recieved by the Primary Processor			Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	In the primary processor, 159/400 counts intermittent or 15 counts continuous; 39 counts continuous @ initialization	
			Loss or invalid message of SPI communication from the Primary Processor at initialization detected by the Secondary Processor or loss or invalid message of SPI communication from the Primary Processor after a valid message was recieved by the Secondary Processor				In the secondary processor 0.4750sec at initialization, 0.1750sec continuous or 20/200 intermittent.	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
4. Processor Performance Check - Secondary Processor state of health (Main)			Primary processor check of the secondary processor by verifying the hardware line toggle between the two processors toggles within the threshold values	9.3750sec and 15.6250sec		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	9counts continuous at initialization or 9 counts continuous; 12.5 msec /count in the Primary processor	
5. Processor Performance Check - Primary Processor Learn Corruption Fault			Primary Processor TPS or APPS minimum learned values fail compliment check			Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	0.1000sec continuous	
6. Processor Performance Check - Primary Processor Clock Fault			The ocillator failed for the Primary processor where the clock is outside the threshold	27.85 kHz and 37.68 kHz		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	100ms continuous	
9. Processor Performance Check - Secondary Processor ALU Fault			The secondary check of the ALU failed to compute the expected result			Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	12.5ms continuous	
10. Processor Performance Check - Secondary Processor Register Configuration Fault			Secondary processor failed configuration check of the registers.			Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	12.5ms continuous	
11. Processor Performance Check - Secondary Processor StackFault			Secondary processor checks stack beginning and end point for pattern written at initialization .			Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	12.5ms continuous	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
12. Processor Performance Check - Secondary Processor MAIN Processor Fault			Secondary processor check that the Primary processor hasn't set a select combination of internal processor faults			Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	12.5ms continuous	
13. Processor Performance Check - Primary Processor ALU Fault			The primary processor check of the ALU failed to compute the expected result	Two Consecutive Times			12.5ms continuous	
14. Processor Performance Check - Primary Processor Register Configuration Fault			Primary processor failed configuration check of the registers.				12.5ms continuous	
Main & MHC state of health fault	P0607	Primary state of health (SOH) discrete line is not toggling between the two processors for a time >	0.4875sec			Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	0.4875sec continuous	1 Trips Special Type: C MIL:NO
Control Module Accelerator Pedal Position (APP) System Performance	P060D	Verify that the indicated accelerator pedal position calculation is correct	1. PPS sensor switch fault - When the APP sensor 2 is shorted to ground, the sensor value is >	41		1. Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions Engine Running TPS minimum learn is not active No Pedal related errors or diagnostic faults. Diagnostic is enabled (Only applicable for Legacy accelerator pedals)	Consecutive checks within 200ms or 2/2 counts; 175msec/count	1 Trip Type:A MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			2. Difference between primary processor indicated accelerator pedal position and secondary indicated accelerator pedal position is >	5		2. Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions MAIN Pedal Sync Error is FALSE	44/40 counts or 39 counts continuous; 12.5 msec/count in the Secondary processor	
						Engine Running TPS minimum learn is not active Diagnostic is enabled (Only applicable for Legacy accelerator pedals)		
Control Module EEPROM Error	P062F	Indicates that the NVM Error flag has not been cleared	Last EEPROM write did not complete		Ignition State	= unlock/accessory, run, or crank	1 test failure Diagnostic runs once at powerup	1 Trip Type:A MIL:YES
5 Volt Reference #1 Circuit	P0641	Detects a continuous or intermittent short on th 5 volt reference circuit #1	Primary Processor Vref1 <	4.432		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	19/39 counts or 0.1875sec continuous; 12.5 msec/count in Primary processor	1 Trip Type:A MIL:YES
			Primary Processor Vref1 >	4.659				
			Secondary Processor Vref1 < Secondary Processor Vref1 >	4.432 4.659				
Malfunction Indicator Lamp (MIL) Control Circuit (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.		Run/Crank Voltage Remote Vehicle Start is not active	11 volts ≤ Voltage ≤ 18 volts	20 failures out of 25 samples 250 ms / sample Continuous	2 trips Type B NO MIL

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
5 Volt Reference #2 Circuit	P0651	Detects a continuous or intermittent short on th 5 volt reference circuit #2	Primary Processor Vref2 <	4.432		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	19/39 counts or 0.1875sec continuous; 12.5 msec/count in main /Secondary processor	1 Trip Type:A MIL:YES
			or Primary Processor Vref2 >	4.659				
			Secondary Processor Vref1 < Secondary Processor Vref1 >	4.432 4.659				
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.		Run/Crank Voltage	11 volts ≤ Voltage ≤ 18 volts	8 failures out of 10 samples 250 ms / sample Continuous	2 trips Type B MIL:YES
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 Stuck Test: PT Relay feedback voltage is when commanded 'OFF'	≥ 18 volts > 2 volts	Powertrain relay commanded "ON" No active DTCs:	PowertrainRelayStateOn Error	5 failures out of 6 samples 1second / sample Stuck Test: 100 ms/ sample Continous failures ≥ 2 seconds	2 trips Type B MIL:YES
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	1 Trip Type A MIL: NO
Clutch Pedal Position Sensor Circuit Range / Performance	P0806	Detects if Clutch Pedal Position Sensor is Stuck in a range indicative of a vehicle NOT in gear, when the vehicle is determined to be in gear.	Filtered Clutch Pedal Position Error when the vehicle is determined to be in gear.	> 4 %	N/V Ratio must Match Actual Gear (i.e. vehicle in gear) Transfer Case not in 4WD Low range Engine Torque Clutch Pedal Position	> EngTorqueThreshold Table < ResidualErrEnableLow Table	25 ms loop Continuous	1 Trip Type A MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
						> ResidualErrEnableHigh Table		
				disable conditions:	No active DTCs:	ClutchPositionSensorCktLo FA ClutchPositionSensorCkitHi FA CrankSensorFA VehicleSpeedSensor_FA		
Clutch Pedal Position Sensor Circuit Low	P0807	Detects Continuous Circuit Short to Low or Open	Clutch Position Sensor Circuit	< 4 % of Vref disable conditions:	Engine Not Cranking System Voltage No active DTCs:	< 11.0 Volts 5VoltReferenceB_FA	200 failures out of 250 samples 25 ms loop Continuous	1 Trip Type A MIL:YES
Clutch Pedal Position Sensor Circuit High	P0808	Detects Continuous Circuit Short toHigh	Clutch Position Sensor Circuit	> 96 % of Vref disable conditions:	Engine Not Cranking System Voltage No active DTCs:	< 11.0 Volts 5VoltReferenceB_FA	200 failures out of 250 samples 25 ms loop Continuous	1 Trip Type:A MIL:YES
Clutch Pedal Position Not Learned	P080A	Monitor for Valid Clutch Pedal Fully Applied Learn Position values	Fully Applied Learn Position OBD Manufacturer Enable Counter	= 0 = 0	Clutch Pedal Position Not Learned		250 ms loop Continuous	2 trip(s) Type B MIL:YES
Traction Control Torque Request Circuit	P0856	Determines if torque request from the EBTCM is valid	Serial Communication 2's complement message - (\$140 for PPEI2 or \$1C9 for PPEI3) OR Serial Communication message (\$140 for PPEI2 or \$1C9 for PPEI3) rolling count value	Message <=> 2's complement of message Message rolling count value <=> previous message rolling count value plus one	All except Class2 with PWM: Serial communication to EBTCM (U0108) Power Mode Engine Running Status of traction in GMLAN message (\$380 for PPEI2 or \$4E9 for PPEI3)	No loss of communication = Run = True = Traction Present	All except Class2 PWM: Count of 2's complement values not equal >= 20 OR 10 rolling count failures out of 10 samples Performed every 25 msec	1 trip(s) "Special Type C" MIL:NO
Inlet Airflow System Performance	P1101	Determines if there are multiple air induction problems affecting airflow and/or manifold pressure.	Filtered Throttle Model AND	<= 250 kPa/(g/s)	Engine Speed Engine Speed Coolant Temp Coolant Temp	>= 400 RPM <= 6200 RPM > 70 Deg C < 125 Deg C	Continuous Calculation are performed every 12.5 msec	2 trip(s) Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			(ABS(Measured Flow – Modeled Air Flow) Filtered OR ABS(Measured MAP – MAP Model 1) Filtered AND ABS(Measured MAP – MAP Model 2) Filtered	> 15 grams/sec > 15.0 kPa) > 15.0 kPa	Intake Air Temp Intake Air Temp Minimum total weight factor (all factors multiplied together) No Active DTCs:	> -20 Deg C < 125 Deg C < 0.00 Filtered Throttle Model multiplied by TPS Residual Weight Factor Modeled Air Flow multiplied by MAF Residual Weight Factor based on RPM and MAF Residual Weight MAP Model 1 multiplied by MAP1 Residual Weight Factor based MAP Model 2 multiplied by MAP2 Residual Weight Factor based See table "IFRD Residual Weighting MAP_SensorCircuitFA EGRValve_FP EGRValvePerformance_FA MAF_SensorCircuitFA CrankSensorFA ECT_sensor_FA ECT_Sensor_FP IAT_SensorFA IAT_SensorCircuitFP CylDeacSystemTFTKO		
O2S Insufficient Switching Bank 1 Sensor 1	P1133	This DTC determines if the O2 sensor is no longer sufficiently switching.	Fault condition present if Half Cycle L/R or R/L Switches are below the threshold. OR If Slope Time L/R or R/L Switches	H/C L/R switches < Threshold, or H/C R/L switches < Threshold, (refer to table named "P1133 - O2S HC L to R Switches Limit Bank 1 Sensor 1" Pass/Fail Threshold table & "P1133 - O2S HC R to L Switches Limit Bank 1	No Active DTC's	TPS_ThrottleAuthority Defaulted MAP_SensorFA IAT_SensorFA ECT_Sensor_FA AmbientAirDefault MAF_SensorFA	Sample time is 60 seconds Frequency: Once per trip	2 trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.	
			are below the threshold.	Sensor 1" Pass/Fail Threshold table in Supporting tables tab) OR S/T L/R switches < 5, or S/T R/L switches < 5		EvapPurgeSolenoidCircuit_FA EvapFlowDuringNonPurge_FA EvapVentSolenoidCircuit_FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSnrCkt_FA FuelInjectorCircuit_FA AIR System FA EthanolCompositionSensor_FA EngineMisfireDetected_FA = P0131, P0132 or P0134 Bank 1 Sensor 1 DTC's not active System Voltage EGR Device Control Idle Device Control Fuel Device Control AIR Device Control Low Fuel Condition Diag Green O2S Condition O2 Heater on for Learned Htr resistance Engine Coolant IAT Engine Run Time Time since any AFM status change Time since Purge On to Off change Time since Purge Off to On change Purge duty cycle Engine airflow Engine speed Fuel Baro	The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than 22 gps for 120000 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	<u>Green Sensor Delay Criteria</u>	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Throttle Position Low Fuel Condition Diag Fuel Control State Closed Loop Active LTM fuel cell Transient Fuel Mass Baro Fuel Control State Fuel State Commanded Proportional Gain All of the above met for Time	>= 4 % = False = Closed Loop = TRUE = Enabled <= 100.0 mgrams = Not Defaulted not = Power Enrichment DFCO not active >= 0.0 % > 3.0 seconds		
Air Fuel Imbalance Bank 1	P1174	Determines if the air-fuel delivery system is imbalanced by monitoring the pre-catalyst O2 sensor voltage characteristics	The Bank 1 AFIM Filtered Length Ratio variable exceeds a value of	> 0.465	System Voltage Engine Run Time ECT Engine speed Mass Airflow PerCent Ethanol Delta O2 voltage during previous 12.5ms O2 sensor switches Quality Factor For DoD equipped vehicles only The AFIM Filtered Length Ratio is determined by The first report is delayed for 90 seconds to allow time for Closed Loop fueling enabled	10 < V < 18 for > 4 seconds > 10 seconds > -20 oC 500 < rpm < 4000 5 < g/s < 600 < 100 % > 5 and -5 > 0 times during current 3 second sample period > 0 in the current operating region No DoD state change during current 3 second sample period.	Frequency: Continuous Monitoring of O2 voltage signal in 12.5ms loop AFIM Filtered Length Ratio variable is updated after every 3 seconds of valid data.	Type B 2 Trip(s) MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					<p>A change in throttle position (tip-in/tip-out) will initiate a delay in the calculation of the average qualified residual value. When the delay timer > 5.00 seconds the diagnostic will continue the calculation.</p> <p>For Manual Transmission vehicles, the clutch must be fully engaged. Clutch Pedal Position < 20.00</p> <p>OR</p> <p>The clutch must be fully disengaged. Clutch Pedal Position > 92.00</p> <p>General Enable DTC's Not Set MAF_SensorFA MAP_SensorFA IAT_SensorCircuitFA IAT2_SensorCircuitFA ECT_Sensor_FA CrankSensorFaultActive IAC_SystemRPM_FA TPS_FA VehicleSpeedSensor_FA EngineMisfireDetected_FA IgnitionOutputDriver_FA ControllerProcessorPerf_FA 5VoltReferenceA_FA 5VoltReferenceB_FA FuelInjectorCircuit_FA Clutch Sensor FA</p>			
Transmission Engine Speed Request Circuit	P150C	Determines if engine speed request from the TCM is valid	Serial Communication rolling count value	+ 1 from previous \$19D message (PTEI3)	Diagnostic enable bit	1	Diagnostic runs in 25 ms loop	2 trips Type B
			Transmission engine speed protection	not equal to 2's complement of transmission engine speed request + Transmission alive rolling count	Engine run time # of Protect Errors # of Alive Rolling Errors No idle diagnostic 506/507 code No Serial communication loss to TCM Engine Running Power mode	0.5 10 3 IAC_SystemRPM_FA (U0101) = TRUE Run Crank Active		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Throttle Actuator Control - Position Performance	P1516	1) Detect a throttle positioning error	The throttle model and actual Throttle position differ by > or The throttle model and actual Throttle position differ by <	819.40% 819.40%	Engine Running or Ignition Voltage > and Ignition Voltage > and Throttle is being Controlled and Communication Fault (SPI is not set) and TPS minimum learn is not active Ignition voltage failure is false (P1682)	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions 11 5.4	0.1875sec in the Secondary processor	1 Trip Type: A MIL: YES
		2) Detect throttle control is driving the throttle in the incorrect direction	Thottle Position >	4459.80%	(Throttle is being Controlled and TPS minimum learn is active) or Reduce Engine Power is Active	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	0.1375sec continuous	
		3) Degraded Motor	Desired throttle position is stable within 0.25% for 4.0000sec and the delta between Indicated throttle position and desired throttle position in greater than 2.00%		Engine Running or Ignition Voltage > and Ignition Voltage > and Throttle is being Controlled and Communication Fault (SPI is not set) and TPS minimum learn is not active	11 5.4	0.4875sec continuous on secondary processor	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Ignition voltage failure is false (P1682)			
Ignition Voltage Correlation	P1682	Detect a continuous or intermittent out of correlation between the Run/Crank Ignition Voltage & the Powertrain Relay Ignition Voltage	Run/Crank – ETC Run/Crank >	3.00Volts	Powertrain commanded on and Run/crank voltage > and Run/crank voltage >	Table, f(IAT). See supporting tables 5.5	240/480 counts or 0.1750sec continuous; 12.5 msec/count in main processor	1 Trip Type: A MIL:YES
Control Module Throttle Actuator Position Performance	P2101	1) Detect a throttle positioning error	Difference between measured throttle position and modeled throttle position >	819.00%	TPS minimum learn is not active and Throttle is being Controlled and (Engine Running or Ignition Voltage > or Ignition Voltage >) Ignition voltage failure is false (P1682)	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	1. 15/15 counts; 12.5 msec/count in the primary processor	1 Trip Type: A MIL:YES
			Difference between measured throttle position and modeled throttle position <	819.00%		11		
		2) Detect throttle control is driving the throttle in the incorrect direction or exceed the reduced power limit	Thottle Position >	4410.00%	TPS minimum learn is active	5.5	2. 11counts; 12.5 msec/count in the primary processor	
			Thottle Position >	4390.00%	Reduced Power is True			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Accelerator Pedal Position (APP) Sensor #1	P2120	Detects a continuous or intermittent short or open in APP1 circuit on the secondary processor but sensor is in range on the primary processor	Secondary APP1 Voltage < or Secondary APP1 Voltage >	0.463 4.75	No 5 V reference error No 5 V reference DTCs	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	19/39counts or 14counts continuous; 12.5 msec/count in the secondary processor	1 Trip Type: A MIL:YES
Accelerator Pedal Position (APP) Sensor 1 Lo	P2122	Detects a continuous or intermittent short or open in APP1 circuit on both processors or just the primary processor	1. Primary APP1 Voltage <	0.463	No 5 V reference error No 5 V reference DTCs	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	1. 19/39counts or 14counts continuous; 12.5 msec/count in the primary processor	1 Trip Type: A MIL:YES
			2. Secondary APP1 Voltage <	0.463	No 5 V reference DTCs		2. 19/39counts or 14counts continuous; 12.5 msec/count in the secondary processor	
Accelerator Pedal Position (APP) Sensor 1 Hi	P2123	Detect a continuous or intermittent short in the APP1 sensor on both processors or just the primary processor	1. Primary APP1 Voltage >	4.75	No 5 V reference error No 5 V reference DTCs	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	1. 19/39counts or 14counts continuous; 12.5 msec/count in the primary processor	1 Trip Type: A MIL:YES
			2. Secondary APP1 Voltage >	4.75			2. 19/39counts or 14counts continuous; 12.5 msec/count in the secondary processor	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Accelerator Pedal Position (APP) Sensor 2	P2125	Detects a continuous or intermittent short or open in APP2 circuit on the secondary processor but sensor is in range on the primary processor	Secondary APP2 Voltage < or Secondary APP2 Voltage >	0.325 2.6	No 5 V reference error No 5 V reference DTCs	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	19/39counts or 14counts continuous; 12.5 msec/count in the secondary processor	1 Trip Type: A MIL:YES
Accelerator Pedal Position (APP) Sensor 2 Lo	P2127	Detects a continuous or intermittent short or open in APP2 circuit on both processors or just the primary processor	1. Primary APP2 Voltage <	0.325		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	1. 19/39counts or 14counts continuous; 12.5 msec/count in the primary processor	1 Trip Type: A MIL:YES
			2. Secondary APP2 Voltage <	0.325	No 5 V reference error No 5 V reference DTCs	2. 19/39counts or 14counts continuous; 12.5 msec/count in the secondary processor		
Accelerator Pedal Position (APP) Sensor 2 Hi	P2128	Detect a continuous or intermittent short in the APP2 sensor on on both processors or just the primary processor	1. Primary APP2 Voltage >	2.6		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	1. 19/39 counts or 14counts continuous; 12.5 msec/count in the primary processor	1 Trip Type: A MIL:YES
			2. Secondary APP2 Voltage >	2.6	No 5 V reference error No 5 V reference DTCs	2. 19/39counts or 14counts continuous; 12.5 msec/count in the secondary processor		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Throttle Position (TP) Sensor 1-2 Correlation	P2135	Detects a continuous or intermittent correlation fault between TP sensors #1 and #2 on either processor	1. On the Primary processor, the difference between TPS1 displaced and TPS2 displaced >	7.022% offset at min. throttle position with it linearly increasing to 10% at max. throttle position	No TPS Sensor Faults No 5 V reference DTCs	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	79/159 counts or 58 counts continuous; 3.125 msec/count in the primary processor	1 Trip Type: A MIL: YES
			On the Secondary processor, the difference between TPS1 displaced and TPS2 displaced >	7.02% offset at min. throttle position with it linearly increasing to 10% at max. throttle position				
			2. On the primary processor, the difference between (raw min TPS1) and (raw_min TPS2) >	499.90%	No TPS Sensor Faults No 5 V reference DTCs	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions		
On the secondary processor, the difference between (raw min TPS1) and (raw_min TPS2) >	500.00%							
Accelerator Pedal Position (APP) Sensor 1-2 Correlation	P2138	Detects a continuous or intermittent correlation fault between APP sensors #1 and #2 on either processor	1. On the primary processor, the difference between APP 1 displaced and APP 2 displaced is >	9.729% offset at min. throttle position with it linearly increasing to 10% at max pedal position	No APP Sensor Faults No 5 V reference DTCs	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	1. 19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the primary processor	1 Trip Type: A MIL: YES
On the secondary processor, the difference between APP 1 displaced and APP 2 displaced is >	10.00% offset at min. throttle position with it linearly increasing to 10% at max pedal position							

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			2. On the primary processor, the difference between the learned PPS1 min and PPS2 min >	500.00%		Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	2. 19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the secondary processor	
			On the primary processor, the difference between the learned PPS1 min and PPS2 min >	500.00%				
Minimum Throttle Position Not Learned	P2176	TP sensors were not in the minnum learn window after multiple attempts to learn the minimum.	During TPS min learn on the Primary processor, TPS Voltage > or During TPS min learn on the Secondary processor, TPS Voltage > and Number of learn attempts >	1759.90% 1759.90% 10counts	No TPS circuit errors No TPS circuit faults Ignition voltage failure is false (P1682) Minimum TPS learn active	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions	2.0secs continuous	1 Trip Type: A MIL:YES
Throttle return to default	P2119	Throttle unable to return to default throttle position after de-energizing ETC motor.	TPS1 Voltage > AND TPS2 Voltage > On the Primary processor OR TPS1 Voltage > AND TPS2 Voltage > On the Secondary processor	2.022 2.022 2.022 2.022	Throttle de-energized No TPS circuit faults PT Relay Voltage >	Run/crank voltage or Powertrain relay voltage > 6.00 and reduced power is false, else the failure will be reported for all conditions 5.5	0.4969sec continuous	Special Type:C MIL:NO

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	P2270	This DTC determines if the post catalyst O2 sensor is stuck in a normal lean 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 (during coast) which increases the delivered fuel to achieve the required rich threshold.	Post O2 sensor cannot achieve the rich threshold voltage. AND The Accumulated mass air flow monitored during the Stuck Lean Voltage Test is greater than the threshold before the above voltage threshold is met.	1) Post O2S signal < 775 mvolts AND 2) Accumulated air flow during stuck lean test > 55 grams.	No Active DTC's B1S2 Failed this key cycle System Voltage Learned heater resistance ICAT MAT Burnoff delay Green O2S Condition Low Fuel Condition Diag Engine Speed to enable test Engine Speed to disable test Engine Airflow Vehicle Speed to enable test Vehicle Speed to disable test Closed loop integral Closed Loop Active Evap Ethanol Post fuel cell Power Take Off EGR Intrusive diagnostic All post sensor heater delays	TPS_ThrottleAuthority Defaulted ECT_Sensor_FA IAT_SensorFA MAF_SensorFA MAP_SensorFA AIR System FA FuelInjectorCircuit_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EthanolCompositionSensor_FA P013A, P013B, P013E, P013F, P2270 or 10.0 volts < system voltage< 18.0 volts = Valid = Not Valid = Not Valid = False 1250 <= RPM <= 1950 1100 <= RPM <= 2100 3 gps <= Airflow <= 12 gps 34.2 mph <= Veh 31.7 mph <= Veh Speed <= 79.5 mph 0.90 <= C/L Int <= 1.07 = TRUE not in control of purge not in estimate mode = enabled = not active = not active = not active	Frequency: Once per trip Note: if NaPOPD_b_Reset FastRespFunc= FALSE for the given Fuel Bank OR NaPOPD_b_Rapid ResponseActive = TRUE, multiple tests per trip are allowed. Green Sensor Delay Criteria The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than 22 gps for 120000 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	2 trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					O2S Heater on Time Predicted Catalyst temp Fuel State	>= 120.0 sec 650 °C <= Cat Temp <= 900 °C = DFCO possible		
					All of the above met for at least 1.0 seconds, and then the Force Cat Rich intrusive stage is requested.			
O2 Sensor Signal Stuck Rich Bank 1 Sensor 2	P2271	This DTC determines if the post catalyst O2 sensor is stuck in a normal rich 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 requests the DFCO mode to achieve the required lean threshold.	Post O2 sensor cannot achieve the lean threshold voltage. AND The Accumulated mass air flow monitored during the Stuck Rich Voltage Test is greater than the threshold before the above voltage threshold is met.	1) Post O2S signal > 100 mvolts AND 2) Accumulated air flow during stuck rich test > 40 grams.	No Active DTC's B1S2 Failed this key cycle System Voltage Learned heater resistance ICAT MAT Burnoff delay Green O2S Condition Low Fuel Condition Diag Engine Speed Engine Airflow Vehicle Speed Closed loop integral Closed Loop Active Evap Ethanol Post fuel cell Power Take Off	TPS_ThrottleAuthority Defaulted ECT_Sensor_FA IAT_SensorFA MAF_SensorFA MAP_SensorFA AIR System FA FuelInjectorCircuit_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EthanolCompositionSensor_FA P013A, P013B, P013E, P013F or P2270 10.0 volts < system voltage< 18.0 volts = Valid = Not Valid = Not Valid = False 1250 <= RPM <= 1950 3 gps <= Airflow <= 12 gps 34.2 mph <= Veh Speed <= 74.6 mph 0.90 <= C/L Int <= 1.07 = TRUE not in control of purge not in estimate mode = enabled = not active	Frequency: Once per trip Note: if NaPOPD_b_Reset FastRespFunc= FALSE for the given Fuel Bank OR NaPOPD_b_Rapid ResponseActive = TRUE, multiple tests per trip are allowed. <u>Green Sensor Delay Criteria</u> The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than 22 gps for 120000 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).	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					EGR Intrusive diagnostic = not active All post sensor heater delays = not active O2S Heater on Time >= 120.0 sec 650 °C <= Cat Temp Predicted Catalyst temp <= 900 °C Fuel State = DFCO possible DTC's Passed = P2270 (and P2272 (if applicable)) DTC's Passed = P013E (and P014A (if applicable)) DTC's Passed = P013A (and P013C (if applicable))	= not active = not active >= 120.0 sec 650 °C <= Cat Temp <= 900 °C = DFCO possible = P2270 (and P2272 (if applicable)) = P013E (and P014A (if applicable)) = P013A (and P013C (if applicable))	Note: This feature is only enabled when the vehicle is new and cannot be enabled in service	
					After above conditions are met: DFCO mode is continued (wo driver initiated pedal input).			
Secondary AIR System Pressure Sensor Circuit Bank 1	P2430	This DTC detects a stuck in range pressure sensor signal when the AIR pump is commanded on.	Average Error and Signal Variation	< 0.50 kPa < 1.00 kPa	BARO > 60 kPa Inlet Air Temp > -11.0 deg C. Coolant Temp > -11.0 deg C. Engine off time < 60.0 deg C. System Voltage > 3600.0 seconds > 10.0 OR < 18.0 Volts	> 60 kPa > -11.0 deg C. > -11.0 deg C. < 60.0 deg C. > 3600.0 seconds > 10.0 OR < 18.0 Volts	Stuck in range cumulative time > 5.0 seconds	2 trip(s) Type B MIL: YES
				disable conditions: No active DTCs:	MAP < 20 kPa for 2 seconds Engine Speed > 5000 RPM MAF > 50 gm/s for 3 seconds AIRValveControlCircuit FA AIRPumpControlCircuit FA AIRSysPressSnsrB1Ck tLoFA AIRSysPressSnsrB1Ck tHiFA ControllerProcessorPerf_FA 5VoltReferenceA_FA 5VoltReferenceB_FA	< 20 kPa for 2 seconds > 5000 RPM > 50 gm/s for 3 seconds AIRValveControlCircuit FA AIRPumpControlCircuit FA AIRSysPressSnsrB1Ck tLoFA AIRSysPressSnsrB1Ck tHiFA ControllerProcessorPerf_FA 5VoltReferenceA_FA 5VoltReferenceB_FA	Frequency: Once per trip when SAI pump commanded On	
Secondary AIR System Pressure Sensor Performance Bank 1	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	Difference between AIR pressure sensor and BARO (Pump Commanded Off) OR	> 14.0 kPa < -10.0 kPa	BARO > 60 kPa Inlet Air Temp > -11.0 deg C. Coolant Temp > -11.0 deg C. Engine off time < 60.0 deg C. > 3600.0 seconds	> 60 kPa > -11.0 deg C. > -11.0 deg C. < 60.0 deg C. > 3600.0 seconds	Skewed sensor cumulative test weight > 5.0 seconds	2 trip(s) Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		the quality of the comparison.	Difference between AIR pressure sensor and BARO (Pump Commanded On)	> 50.0 kPa	System Voltage	> 10.0 OR < 18.0 Volts	Continuous 6.25ms loop	
						Skewed sensor cumulative test weight is based on distance from the last Baro update Baro Skewed Sensor Weight Factor		
				disable conditions:	MAP	< 20 kPa for 2 seconds		
					Engine Speed	> 5000 RPM		
					MAF	> 50 gm/s for 3 seconds		
					No active DTCs:	Transfer Case not in 4WD Low AIRValveControlCircuit FA AIRPumpControlCircuit FA AIRSysPressSnsrB1Ck tLoFA AIRSysPressSnsrB1Ck tHiFA MAF_SensorFA ControllerProcessorPerf_FA 5VoltReferenceA_FA 5VoltReferenceB_FA		
Secondary AIR System Pressure Sensor Circuit Low Voltage Bank 1	P2432	This DTC detects an out of range low AIR pressure sensor signal	AIR Pressure Sensor signal	< 5 % of 5Vref			800 failures out of 1000 samples	2 Trips Type:B MIL:YES
				disable conditions:	No active DTCs:	ControllerProcessorPerf_FA 5VoltReferenceA_FA 5VoltReferenceB_FA	6.25 ms loop Continuous	
Secondary AIR System Pressure Sensor Circuit Hi Voltage Bank 1	P2433	This DTC detects an out of range high AIR pressure sensor signal	AIR Pressure Sensor signal	> 94 % of 5Vref			800 failures out of 1000 samples	2 Trips Type:B MIL:YES
				disable conditions:	No active DTCs:	ControllerProcessorPerf_FA 5VoltReferenceA_FA 5VoltReferenceB_FA	6.25 ms loop Continuous	
Secondary AIR System Shut-off Valve Stuck Open Single Bank System	P2440	This DTC detects if one or both of the AIR system control valves is stuck open	AIR pressure error	< Bank 1 Valve Pressure Error table or > 32.0 kPa	BARO Inlet Air Temp Coolant Temp Engine off time	> 60 kPa > -11.0 deg C. > -11.0 deg C. < 60.0 deg C. > 3600.0 seconds	Phase 2 Conditional test weight > 1.5 seconds	2 Trips Type:B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		This test is run during Phase 2 (Pump commanded On, valve commanded closed)			System Voltage > 10.0 OR < 18.0 Volts Stability Time > 0.5 seconds AIR diagnostic Phase 1 passed Conditional test weight is calculated by multiplying the following Factors Phase 2 Baro Test Weight Factor Phase 2 MAF Test Weight Factor Phase 2 System Volt Test Weight Factor Phase 2 Ambient Temp Test Weight Factor		Frequency: Once per trip when AIR pump commanded On	
				disable conditions:	MAP < 20 kPa for 2 seconds Engine Speed > 5000 RPM MAF > 50 gm/s for 3 seconds No active DTCs:	AIRSystemPressureSensor FA AIRValveControlCircuit FA AIRPumpControlCircuit FA MAF_SensorFA MAP_SensorFA IAT_SensorFA ECT_Sensor_FA EngineMisfireDetected_FA CatalystSysEfficiencyLoB1_FA CatalystSysEfficiencyLoB2_FA ControllerProcessorPerf_FA 5VoltReferenceA_FA 5VoltReferenceB_FA IgnitionOutputDriver_FA FuelInjectorCircuit_FA		
Secondary AIR System Pump Stuck On Single Bank System	P2444	This DTC detects if the SAI pump is stuck On This test is run during Phase 3 (Pump commanded Off, valve	AIR pressure error	> Bank 1 Pump Pressure Error table or < -32 kPa	BARO > 60 kPa Inlet Air Temp > -11.0 deg C. Coolant Temp > -11.0 deg C. < 60.0 deg C. Engine off time > 3600.0 seconds System Voltage > 10.0 OR < 18.0 Volts		Phase 3 Cumulative test weight > 2.0 seconds	1 trip Type A MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		commanded closed)			Stability Time	> 2.0 seconds AIR diagnostic Phase 1 passed AIR diagnostic Phase 2 passed	Frequency: Once per trip when AIR pump commanded On	
					Phase 3 cumulative test weight is based on distance from the last Baro update Baro Skewed Sensor Weight Factor			
			disable conditions:	MAP < 20 kPa for 2 seconds Engine Speed > 5000 RPM MAF > 50 gm/s for 3 seconds No active DTCs: AIRSystemPressureSensor FA AIRValveControlCircuit FA AIRPumpControlCircuit FA MAF_SensorFA MAP_SensorFA IAT_SensorFA ECT_Sensor_FA EngineMisfireDetected_FA CatalystSysEfficiencyLoB1_FA CatalystSysEfficiencyLoB2_FA ControllerProcessorPerf_FA 5VoltReferenceA_FA 5VoltReferenceB_FA IgnitionOutputDriver_FA FuelInjectorCircuit_FA				
Transmission Control Torque Request Circuit	P2544	Determines if the torque request from the TCM is valid	Protect error - Serial Communication message - (\$150 - PTEI2, \$199 - PTEI3) Rolling count error - Serial Communication message (\$150 - PPEI2, \$199 - PPEI3) rolling count value	Message <-> two's complement of message OR Message <-> previous message rolling count value + one	Diagnostic enabled/disabled	Enabled	>= 16 Protect errors during key cycle >= 6 Rolling count errors out of ten samples	2 trip(s) Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			<p>RAM Error - Serial Communication message (\$150 - PPEI2, \$199 - PPEI3)</p> <p>TCM Requested Torque Increase message \$199</p> <p>Multi-transition - Trans torque intervention type request change</p> <p>Serial communication from TCM</p>	<p>OR</p> <p>Trans torque reduction or type request portion of message 2's complement values <></p> <p>OR</p> <p>> 8192 Nm</p> <p>OR</p> <p>Request change from not min limit to min limit</p> <p>OR</p> <p>Loss of communication</p>	<p>Power Mode</p> <p>Engine Running</p> <p>Run/Crank Active</p>	<p>= Run</p> <p>= True</p> <p>> 0.50 Sec</p>	<p>>= 3 RAM errors during key cycle</p> <p>>= 3 range out of 10 samples</p> <p>>= 3 multi-transitions out of 5 samples</p> <p>> 0.40 seconds</p> <p>Performed every 12.5 msec</p>	
ECM/PCM Internal Engine Off Timer Performance	P2610	<p>This DTC determines if the engine off timer does not initialize or count properly.</p> <p>Clock rate test: Checks the accuracy of the 1 second timer by comparing it with the 12.5 ms timer</p>	<p>Initial value test: Initial ignition off timer value</p> <p>OR</p> <p>Initial ignition off timer value</p> <p>Clock rate test: Time between ignition off timer increments</p> <p>Time between ignition off timer increments</p> <p>Time since last ignition off timer increment</p> <p>Current ignition off time < old ignition off time</p> <p>Current ignition off timer minus old ignition off timer</p>	<p>< 0 seconds</p> <p>> 10 seconds</p> <p>< 1 seconds</p> <p>> 1 seconds</p> <p>≥ 1 seconds</p> <p>≠ 1</p>	<p>ECM is powered down</p> <p>IAT Temperature</p>	<p>-40 °C ≤ Temperature ≤ 125 °C</p>	<p>Initial value test: 3 failures</p> <p>1.375 sec / sample</p> <p>Clock rate test: 8 failures out of 10 samples</p> <p>1second / sample</p> <p>test runs once each key-off</p>	<p>2 trips Type B</p> <p>DTC sets on next key cycle if failure detected MIL:YES</p>
O2Sensor 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.	<p>Closed Loop O2S ready flag</p> <p>A) O2S signal must be 1) O2S signal</p> <p>OR 2) O2S signal To set Closed Loop ready flag</p>	<p>= False</p> <p>> 550 mvolts</p> <p>< 350 mvolts</p> <p>= True</p>	<p>No Active DTC's</p> <p>FuelInjectorCircuit_FA P0131, P0151 P0132, P0152</p> <p>System Voltage</p>	<p>TPS_ThrottleAuthority Defaulted MAP_SensorFA ECT_Sensor_FA</p> <p>10.0 volts < system voltage < 18.0 volts</p>	<p>200 failures out of 250 samples.</p> <p>Frequency: Continuous 100msec loop</p>	<p>2 trips Type B MIL:YES</p>

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			Closed Loop O2S ready flag = True B) Once set to ready O2S cannot be 1) O2S signal > 350 mvolts AND 2) O2S signal < 550 mvolts for time > 5.0 seconds Then set Closed Loop ready flag = False		Engine Speed Engine Airflow Engine Coolant Engine Metal Overtemp Active Converter Overtemp Active Fuel State AFM Status Predicted Exhaust Temp (B1S1) Engine run time Fuel Enrichment <u>All of the above met for</u> Time	500 RPM <= Engine speed <= 3400 RPM 3.2 gps <= Engine Airflow <= 30.0 gps >= 70.0 °C = False = False DFCO not active All Cylinders active >= 0.0 °C > 100 seconds = Not Active > 5 seconds		
Control Module Communication Bus A Off	U0073	This DTC monitors for a BUS A off condition	Bus off failures out of these samples ≥ 5 counts ≥ 5 counts	≥ 5 counts	CAN hardware is bus OFF for	≥ 0.0375 seconds	Diagnostic runs in 1000 ms loop	2 Trips Type B MIL: YES
Lost Communication With TCM	U0101	This DTC monitors for a loss of communication with the transmission control module	Message is not received from controller for this many counts out of these samples 12 counts 12 counts	12 counts	Run/Crank Voltage Power mode is RUN Communication bus is not OFF or is typed as a C code Normal Communication is enabled Normal Transmit capability is TRUE The diagnostic system is not disabled The bus has been on for A message has been selected to monitor.	11 volts ≤ Voltage ≤ 18 volts > 3.0000 seconds	The diagnostic runs in the 1000 ms loop	2 Trips Type B MIL: YES
The following diagnostics are specific to the GMX020 LE5.								
O2 Sensor Signal Stuck Lean Bank 1 Sensor 2 <NOTE: This is a POVDT DTC description>	P2270	This DTC determines if the post catalyst O2 sensor is stuck in a normal lean 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 (durina coast) which increases the	Post O2 sensor cannot achieve the rich threshold voltage. AND The Accumulated mass air flow monitored during the Stuck Lean Voltage Test is greater than the	1) Post O2S signal >= 740 mvolts AND 2) Accumulated air flow during stuck lean test > 600 grams.	No Active DTC's	TPS_ThrottleAuthority Defaulted P0131, P0137, P0151, P0157 P0132, P0138, P0152, P0158 P0134, P0140, P0154, P0160	Frequency: Once per trip Green Sensor Delay Criteria	2 Trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		delivered fuel to achieve the required rich threshold.	threshold before the above voltage threshold is met.		DTC passed System Voltage Learned heater resistance ICAT MAT Burnoff delay Green O2S Condition Low Fuel Condition Diag Engine Speed Engine Airflow Vehicle Speed Closed loop integral Closed Loop Active Evap Ethanol	P0053, P0054, P0059, P0060 P0135, P0141, P0155, P0161 P1133, P1153, P0133, P0153 EvapPurgeSolenoidCircuit_FA EvapFlowDuringNonPurge_FA EvapVentSolenoidCircuit_FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSensorCircuit_FA MAF_SensorFA MAP_SensorFA AIR System FA FuelInjectorCircuit_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EthanolCompositionSensor_FA = P2271 10.0 volts < system voltage < 18.0 volts = Valid = Not Valid = Not Valid = False 400 <= RPM <= 1900 3 gps <= Airflow <= 12 gps 24.9 mph <= Veh Speed <= 80.8 mph 0.95 <= C/L Int <= 1.05 = TRUE not in control of purge not in estimate mode	The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than 22 gps for 120000 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	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Post fuel cell = enabled Power Take Off = not active EGR Intrusive diagnostic = not active All post sensor heater delays = not active All above met and then fuel is commanded Rich Fuel State = Refer to "P2270/P2272 - O2 Sensor Signal Stuck Lean Bank 1/2 Sensor 2" Rich Equiv Ratio table in the Supporting Tables tab. During Stuck Lean test the following can cause the test to abort Fuel State = DFCO Fuel State = PE Purge duty cycle > 0 %			
O2 Sensor Signal Stuck Rich Bank 1 Sensor 2 <NOTE: This is a POVD DTC description>	P2271	This DTC determines if the post catalyst O2 sensor is stuck in a normal rich 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 O2 sensor cannot achieve the lean threshold voltage. AND The Accumulated mass air flow monitored during the Stuck Rich Voltage Test is greater than the threshold before the above voltage threshold is met.	1) Post O2S signal <= 250 mvolts AND 2) Accumulated air flow during stuck rich test > 400 grams.	No Active DTC's TPS_ThrottleAuthority Defaulted P0131, P0137, P0151, P0157 P0132, P0138, P0152, P0158 P0134, P0140, P0154, P0160 P0053, P0054, P0059, P0060 P0135, P0141, P0155, P0161 P1133, P1153, P0133, P0153 EvapPurgeSolenoidCircuit_FA EvapFlowDuringNonPurge_FA EvapVentSolenoidCircuit_FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSensorCircuit_FA MAF_SensorFA MAP_SensorFA AIR System FA	TPS_ThrottleAuthority Defaulted P0131, P0137, P0151, P0157 P0132, P0138, P0152, P0158 P0134, P0140, P0154, P0160 P0053, P0054, P0059, P0060 P0135, P0141, P0155, P0161 P1133, P1153, P0133, P0153 EvapPurgeSolenoidCircuit_FA EvapFlowDuringNonPurge_FA EvapVentSolenoidCircuit_FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSensorCircuit_FA MAF_SensorFA MAP_SensorFA AIR System FA	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 22 gps for 120000 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	2 Trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.	
						FuelInjectorCircuit_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EthanolCompositionSensor_FA System Voltage Learned heater resistance ICAT MAT Burnoff delay Green O2S Condition Low Fuel Condition Diag Engine Speed Engine Airflow Vehicle Speed Closed loop integral Closed Loop Active Evap Ethanol Post fuel cell Power Take Off EGR Intrusive diagnostic All post sensor heater delays	Note: This feature is only enabled when the vehicle is new and cannot be enabled in service 10.0 volts < system voltage < 18.0 volts = Valid = Not Valid = Not Valid = False 400 <= RPM <= 1900 3 gps <= Airflow <= 12 gps 24.9 mph <= Veh Speed <= 80.8 mph 0.95 <= C/L Int <= 1.05 = TRUE not in control of purge not in estimate mode = enabled = not active = not active = not active		
						All of the above met for at least 2.0 seconds, Purge is commanded off, and then wait 4.0 seconds before a commanding lean ratio.			
						Fuel State = Refer to "P2271/P2273 - O2 Sensor Signal Stuck Rich Bank 1/2 Sensor 2" Lean Equiv Ratio table in the Supporting Tables tab.			
						During Stuck Lean test the following can cause the test to			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					abort	Piston Protection = Active Converter Mode = Over Temperature Hot Coolant Enrichment = Active Fuel State = PE Purge duty cycle > 0 %		
The following diagnostics are specific to the GMT319 LE5 and LAT applications								
Fuel Pump Control Module (FPCM) Requested MIL Illumination	P069E	Monitors the FPCM MIL request line to determine when the FPCM has detected a MIL illuminating fault.	Fuel Pump Control Module Emissions-Related DTC set			Time since power-up > 3 seconds	Continuous	1 Trip Type A MIL: NO
Remote Vehicle Speed Limiting Signal Circuit	P162B	Determines if the speed request from OnStar is valid	Password Protect error - Serial Communication message - (\$3ED) Rolling count error - Serial Communication message (\$3ED) rolling count value	Message <> two's complement of message OR Message <> previous message rolling count value + one	Vehicle Requested Speed Limit	< 174 Kph	>= 10 Password Protect errors out of 10 samples >= 10 Rolling count errors out of 10 samples Performed every 25 msec	1 trip(s) "Special Type C" MIL:NO
Fuel Level Sensor 2 Performance	P2066	This DTC will detect a fuel sender stuck in range in the secondary fuel tank.			Engine Running No active DTCs:	VehicleSpeedSensor_F A	250 ms / sample Continuous	2 trips Type B MIL:YES
			Fuel Level in Secondary Tank Remains in an Unreadable Range too Long					
			If fuel volume in primary tank is >= 1024.0 liters AND Fuel volume in secondary tank < 1.0 liters and remains in this condition for 124 miles					

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			OR Fuel Level is in a Readable Range for both Primary and Secondary Tanks too Long Volume in Primary Tank < 1024 liters AND Volume in Secondary Tank > 1 liters and remains in this condition for 2430 seconds OR Distance Traveled without a Secondary Fuel Level Change If the vehicle is driven a distance of 186 miles without the secondary fuel level changing by 3 liters, then the sender must be stuck.					
Fuel Level Sensor 2 Circuit Low Voltage (For use on vehicles with	P2067	This DTC will detect a fuel sender stuck out of range low in the secondary fuel tank.	Fuel level Sender % of 5V range	< 10 %	Run/Crank Voltage	11 volts ≤ Voltage ≤ 18 volts	180 failures out of 225 samples 100 ms / sample Continuous	2 trips Type B MIL: YES
Fuel Level Sensor 2 Circuit High Voltage (For use on vehicles with	P2068	This DTC will detect a fuel sender stuck out of range low in the secondary fuel tank.	Fuel level Sender % of 5V range	> 60 %	Run/Crank Voltage	11 volts ≤ Voltage ≤ 18 volts	180 failures out of 225 samples 100 ms / sample Continuous	2 trips Type B MIL: YES
Lost Communication With Fuel Pump Control Module	U0109	This DTC monitors for a loss of communication with the fuel pump control module	Message is not received from controller for this many counts out of these samples	12 counts 12 counts	Run/Crank Voltage Power mode is RUN Communication bus is not OFF or is typed as a C code Normal Communication is enabled Normal Transmit capability is TRUE The diagnostic system is not disabled The bus has been on for A message has been selected to monitor.	11 volts ≤ Voltage ≤ 18 volts > 3.0000 seconds	The diagnostic runs in the 1000 ms loop	2 trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
The following diagnostics are specific to the GMX384 and GMT319 LAT hybrid applications								
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 or All Cylinder's Actual Signals	> 4.50 Volts ≤ 0.20 Volts	Engine Speed Engine Air Flow No Active DTC's Engine Speed Engine Air Flow No Active DTC's	≥ 600 RPM > 165 mg/cylinder KS_Ckt_Perf_B1B2_F A ≥ 600 RPM > 165 mg/cylinder KS_Ckt_Perf_B1B2_F A	50 Failures out of 63 Samples 100 msec rate	1 Trip Type: A MIL: YES
Catalyst System Low Efficiency Bank 1	P0420	Oxygen Storage (Stored Oxygen Release Monitor or STORM) The catalyst washcoat contains Cerium Oxide. Cerium Oxide reacts with NO and O2 during lean A/F excursions to store the excess oxygen (i.e. Cerium Oxidation). During rich A/F excursions, Cerium Oxide reacts with CO and H2 to release this stored oxygen (i.e. Cerium Reduction). This is referred to as the Oxygen Storage Capacity, or OSC. The catalyst diagnostic's strategy is to essentially measure this through a forced Rich A/F excursion following a decel fuel cutoff event. OSC Period = HO2S2 Resp Time – HO2S1 Resp Time – Inert Catalyst Transport Delay. OSC Mass = Integrate{ MAF(Bank,t) * [EquivalenceRatio(t)/FuelTrim LT – 1]} @ t, t=0 to OSC Period. Normalized OSC Mass = OSC Mass *Catalyst Temperature Compensation Factor. (Compensation table to the OSC Mass based on Cat Temp. Refer to "Supporting Tables")	OSC Mass EWMA (EWMA filtered)	≤ 0.980 grams air Test Completion: HO2S1 ≥ 600 mV and HO2S2 ≥ 200 mV OR HO2S2 Response Time - HO2S1 Response Time > 1.52 seconds	<u>Diagnostic Enable Conditions</u> This diagnostic has the ability to run as a stand alone diagnostic or following the Post O2 Performance Diagnostic (POPD) depending on the calibration value below: Stand Alone Diagnostic: 1 (a value of 1 means the diagnostic is running in the stand alone state and a value of 0 means the diagnostic is running following POPD's completion of the rich to lean portion of the diagnostic). If calibrated to run stand alone then the catalyst diagnostic must not have completed for trip. If calibrated to run following POPD's completion of the rich to lean portion of the diagnostic (i.e. Stand Alone Diagnostic = 0) then POPD must make the request for decel fuel cutoff through the catalyst diagnostic. Predicted Catalyst Temperature ≥ 550 degC for > 30 seconds Engine speed and Vehicle Speed ≥ 1200 RPM and > 29 KPH respectively for a minimum of 30 seconds Predicted Catalyst Temperature ≥ 550 degC and ≤ 900 degC Tests attempted this trip < 255 The catalyst diagnostic has not yet completed for the	Minimum of 1 test per trip Maximum of 7 tests per trip Frequency: 12.5 ms continuous	1 Trip Type: A MIL: YES	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
		<p>The Catalyst Monitoring Test is done during a deceleration. Several conditions must be met in order to execute this test. These conditions and their related values are listed in the secondary parameters area of this document.</p>			<p>Device control is Disabled Green Converter Delay Not Active Induction Air $-20 \leq ^\circ\text{C} \leq 250$ Fuel Level ≥ 2 percent (if there is no fuel level fault present) or ≥ 0 percent if there is a fuel level fault active RunCrank Voltage ≥ 11.00 Volts Minimum Learn Enable Time to ensure stable BLM and PLM values ≥ 100 seconds or ≥ 100 seconds if the fuel tank level increases by ≥ 10 percent or following a code clearing event ECT $71 \leq ^\circ\text{C} \leq 125$ Barometric Pressure ≥ 70 KPA</p> <hr/> <p>Rapid Step Response (RSR) feature will initiate If the difference between current EWMA value and the Maximum of 18 RSR tests to detect failure when RSR is</p> <hr/> <p>Green Converter Delay Criteria This is part of the check for the Diagnostic Enable The diagnostic will not be enabled until the following has Predicted catalyst temperature > 500 ° C for 3600</p> <hr/> <p>To allow a DFCO Event This is checked once a decel fuel cutoff event is detected Torque Request ≤ 5.00 NM's Valid DFCO Period Criteria Prior Enable Criteria Met Decel Fuel Cutoff Time ≥ 1.50 seconds HO2S1 (pre-O2 sensor) ≤ 325.000 mV prior to DFCO exit HO2S2 (post-O2 sensor) ≤ 100 mV for 1.25 seconds prior to DFCO exit</p> <hr/> <p>Valid DFCO Exit Criteria Cumulative Throttle Movement < 30.00 percent Equivalence Ratio ≥ 1.00</p> <hr/> <p>General Enable DTC's Not Set MAF_SensorFA MAF_SensorTFTKO GetAAPR_e_AmbPresDfItDStatus IAT_SensorCircuitFA IAT_SensorCircuitTFTKO ECT_Sensor_FA O2S_Bank_1_Sensor_1_FA</p>			

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					O2S_Bank_1_Sensor_2_FA O2S_Bank_2_Sensor_1_FA O2S_Bank_2_Sensor_2_FA FuelTrimSystemB1_FA GetFADR_b_FuelTrimSysB1_TFTKO FuelTrimSystemB2_FA GetFADR_b_FuelTrimSysB2_TFTKO EngineMisfireDetected_FA EvapPurgeSolenoidCircuit_FA GetSPDR_b_IAC_SysRPM_FA EGRValvePerformance_FA EGRValveCircuit_FA CamSensorAnyLocationFA CrankSensor_FA TPS_Performance_FA GetSRAR_b_EnginePowerLimited VehicleSpeedSensor_FA GetPTOR_b_PTO_Active AmbientAirDefault_NoSnrsr			
Lost Communication With Battery Energy Control Module A	U0111	This DTC monitors for a loss of communication with the Starter/ Generator Control Module	Message is not received from controller for this many counts out of these samples	12 counts 12 counts	Run/Crank Voltage Power mode is RUN Communication bus is not OFF or is typed as a C code Normal Communication is enabled Normal Transmit capability is TRUE The diagnostic system is not disabled The bus has been on for A message has been selected to monitor.	11 volts ≤ Voltage ≤ 18 volts > 3.0000 seconds	The diagnostic runs in the 1000 ms loop	2 Trips Type B MIL: YES
Lost Communication with Starter/ Generator Control Module	U0120	This DTC monitors for a loss of communication with Starter/ Generator Control Module	Message is not received from controller for this many counts out of these samples	12 counts 12 counts	Run/Crank Voltage Power mode is RUN Communication bus is not OFF or is typed as a C code Normal Communication is enabled Normal Transmit capability is TRUE The diagnostic system is not disabled The bus has been on for	11 volts ≤ Voltage ≤ 18 volts > 3.0000 seconds	The diagnostic runs in the 1000 ms loop	2 Trips Type B MIL: YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					A message has been selected to monitor.			
Lost Communication With Anti-Lock Brake System (ABS) Control Module	U0121	This DTC monitors for a loss of communication with the ABS control module.	Message is not received from controller for this many counts out of these samples	12 counts 12 counts	Run/Crank Voltage Power mode is RUN Communication bus is not OFF or is typed as a C code Normal Communication is enabled Normal Transmit capability is TRUE The diagnostic system is not disabled The bus has been on for A message has been selected to monitor.	11 volts ≤ Voltage ≤ 18 volts > 3.0000 seconds	The diagnostic runs in the 1000 ms loop	2 Trips Type B MIL:YES
The following diagnostics are specific to the GMT319 LAT application.								
O2S Circuit High Voltage Bank 1 Sensor 2	P0138	This DTC determines if the O2 sensor circuit is shorted to high.	Measure Oxygen Sensor Signal.	> 175 mvolts	System Voltage Engine Run Time All Fuel Injectors for active Cylinders Fuel State <u>All of the above met for</u> Time	10.0 volts < system voltage < 18.0 volts ≥ 200 sec Disabled (Off) DFCO active	80 failures out of 100 samples Frequency: Continuous in 100 milli - second loop	2 Trips Type B MIL:YES
O2 Sensor Circuit Range/Performance Bank 1 Sensor 2	P2A01	This DTC determines if the post catalyst O2 sensor is stuck in a normal voltage range and thereby can no longer be used for post oxygen sensor fuel control or for catalyst monitoring. The diagnostic is an intrusive test which increases or reduces delivered fuel to achieve the required rich or lean threshold.	Post O2 sensor cannot achieve the rich threshold voltage. AND The Accumulated mass air flow monitored during the Stuck Lean Voltage Test is greater than the threshold before the above voltage threshold is met. OR Post O2 sensor cannot achieve the lean threshold voltage. AND	1) Post O2S signal ≥ 730 mvolts AND Accumulated air flow > 500 grams for the stuck lean test. OR 2) Post O2S signal ≤ 250 mvolts AND Accumulated air flow during > 300 grams for the stuck rich test.	No Active DTC's	TPS_ThrottleAuthority Defaulted P0131, P0137, P0151, P0157 P0132, P0138, P0152, P0158 P0134, P0140, P0154, P0160 P0053, P0054, P0059, P0060 P0135, P0141, P0155, P0161 P1133, P1153, P0133, P0153 EvapPurgeSolenoidCircuit_FA EvapFlowDuringNonPurge_FA	Frequency: Once per trip <u>Green Sensor Delay Criteria</u> The diagnostic will not be enabled until the next ignition cycle after the following has been met: Airflow greater than 22 grams for 120000	2 Trips Type B MIL:YES

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			<p>The Accumulated mass air flow monitored during the Stuck Rich Voltage Test is greater than the threshold before the above voltage threshold is met.</p>		<p>EvapVentSolenoidCircuit_FA EvapSmallLeak_FA EvapEmissionSystem_FA FuelTankPressureSensorCircuit_FA MAP_SensorFA MAP_SensorFA AIR System FA FuelInjectorCircuit_FA FuelTrimSystemB1_FA FuelTrimSystemB2_FA EngineMisfireDetected_FA EthanolCompositionSensor_FA System Voltage Learned heater resistance ICAT MAT Burnoff delay Green O2S Condition Low Fuel Condition Diag Engine Speed Engine Airflow Vehicle Speed Closed loop integral Closed Loop Active Evap Ethanol Post fuel cell Power Take Off EGR Intrusive diagnostic All post sensor heater delays</p>	<p>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 10.0 volts < system voltage < 18.0 volts = Valid = Not Valid = Not Valid = False 1000 <= RPM <= 3500 5 gps <= Airflow <= 50 gps 40 mph <= Veh Speed <= 132 mph 0.929 <= C/L Int <= 1.07 = TRUE not in control of purge not in estimate mode = enabled = not active = not active = not active</p>		
<p>All above met and then fuel is commanded Rich</p>								

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Fuel State = Refer to P2A01-02 Sensor Signal Stuck Lean Bank 1 Sensor 2" Rich Equiv Ratio table in the Supporting			
					During Stuck Lean test the following can cause the test to abort			
					Fuel State = DFCO Fuel State = PE Purge duty cycle > 0 %			
					All of the above met for at least 1.0 seconds, Purge is commanded off, and then wait 3.0 seconds before a commanding lean ratio.			
					Fuel State = Refer to P2A01-02 Sensor Signal Stuck Rich Bank 1 Sensor 2" Lean Equiv Ratio table in the Supporting			
					During Stuck Lean test the following can cause the test to abort			
					Piston Protection = Active Converter Mode = Over Temperature Hot Coolant Enrichment = Active Fuel State = PE Purge duty cycle > 0 %			

LOOK-UP TABLES

P0442: EONV Pressure Threshold Table (in Pascals)

		X axis is fuel level in %																
		Y axis is temperature in deg C																
		0.0000	6.2485	12.4969	18.7454	24.9939	31.2424	37.4908	43.7393	49.9878	56.2363	62.4847	68.7332	74.9817	81.2302	87.4786	93.7271	99.9756
-10.0000	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
-4.3750	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
1.2500	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
6.8750	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
12.5000	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
18.1250	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
23.7500	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
29.3750	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
35.0000	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
40.6250	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
46.2500	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
51.8750	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
57.5000	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
63.1250	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
68.7500	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
74.3750	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632
80.0000	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632	-311.3632

P0442: Estimate of Ambient Temperature Valid Conditioning Time

EAT Valid Conditioning Time (in seconds)	
Axis is Ignition Off Time (in seconds)	
Axis	Curve
0	78
600	245
1200	245
1800	245
2400	245
3000	245
3600	185
4200	183
4800	181
5400	179
6000	176
6600	174
7200	172
7800	170
8400	168
9000	166
9600	163
10200	161
10800	159
11700	156
12600	153
13500	149
14400	146
15300	144
16200	143
17100	141
18000	140
19200	137
20400	135
21600	133
22800	129
24000	124
25200	120

P0496: Purge Valve Leak Test Engine Vacuum Test Time (Cold Start) as a Function of Fuel Level

Purge Valve Leak Test Engine Vacuum Test Time (in seconds)	
Axis is Fuel Level in %	
Axis	Curve
0	58
6	56
12	54
19	52
25	50
31	48
37	47
44	46
50	44
56	43
62	42
69	41
75	40
81	40
87	39
94	38
100	37
53	4
56	4
59	4

LOOK-UP TABLES

LOOK-UP TABLES																	
P0325/P0330 OpenCircuitThresh																	
Engine Speed (RPM):	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000	
OpenCircuitThresh:	0	25	50	50	50	50	50	63	75	77	80	82	85	85	85	85	
P0326 Knock Detection Enabled Factors:																	
FastRtdMax:	X - axis = Engine Speed (RPM) Y - axis = Manifold Pressure (kPa)																
	0	512	1024	1536	2048	2560	3072	3584	4096	4608	5120	5632	6144	6656	7168	7680	8192
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
50	0.0	5.0	6.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
60	0.0	2.0	2.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
70	0.0	2.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
80	0.0	4.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
90	0.0	6.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
100	0.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
110	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
120	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
130	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
140	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
150	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
160	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
170	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
180	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Knock Detection Enabled Factors:																	
Knock Detection Enable = FastAttackRate * FastAttackCoolGain * FastAttackBaroGain																	
RPM:	0	512	1024	1536	2048	2560	3072	3584	4096	4608	5120	5632	6144	6656	7168	7680	8192
FastAttackRate:	0.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
ECT (deg. C):	-40	-30	-20	-10	0	10	20	30	40	50	60	70	80	90	100	110	120
FastAttackCoolGain:	0.15	0.15	0.15	0.15	0.15	0.15	0.20	0.30	0.40	0.50	0.75	1.00	1.00	1.00	1.00	1.23	1.50
Baro:	55.00	61.25	67.50	73.75	80.00	86.25	92.50	98.75	105.00								
FastAttackBaroGain:	0.55	0.60	0.67	0.74	0.80	0.86	1.00	1.00	1.00								
P0327/P0332 ShortLowThresh																	
Engine Oil Temperature (deg C)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160		
ShortLowThresh:	34000	34000	34000	34000	34000	34000	34000	34000	34000	33500	33400	33400	33400	31100	31100		
P0328/P0333 ShortHiThresh																	
Engine Oil Temperature (deg C)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160		
ShortHiThresh:	63000	63000	63000	63000	63000	63000	63000	63000	63000	63000	63000	63000	63000	63000	63000		
AFIM Section																	
KIOXYD cmp AFIM LngthThrsH1																	
AvgFlow / AvgRPM	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000	4500	5000	6000
40	14752	14752	14752	16640	20624	26224	27984	31424	33024	35152	36064	36864	34976	32304	32304	32304	32304
80	14752	14752	14752	16640	20624	26224	27984	31424	33024	35152	36064	36864	34976	32304	32304	32304	32304
120	16672	16672	16672	18688	23440	27472	29456	32768	34640	37600	37200	38816	44320	46800	46800	46800	46800
200	16864	16864	16864	19040	23936	28240	30864	33568	37024	38848	40832	44848	48144	47536	47536	47536	47536
240	16864	16864	16864	19040	25744	28352	31232	32848	36992	39472	41136	42800	47616	48944	48944	48944	48944
280	19040	19040	19040	19040	25744	28368	31152	35872	38224	41904	43936	45568	49632	52512	52512	52512	52512
320	19040	19040	19040	19040	28880	28880	32032	35888	39392	42992	45024	46304	51360	52336	52336	52336	52336
360	28384	28384	28384	28384	28384	28384	32352	34864	37536	42256	43696	46752	50080	52336	52336	52336	52336
400	28304	28304	28304	28304	28304	28304	32416	34400	37104	40704	41376	44400	48656	52336	52336	52336	52336
440	28800	28800	28800	28800	28800	28800	31200	33616	37152	38720	40128	42480	46856	52336	52336	52336	52336
480	28800	28800	28800	28800	28800	28800	30032	32416	36848	37824	38464	38464	41216	52336	52336	52336	52336
520	30032	30032	30032	30032	30032	30032	30032	35840	35840	37264	38464	38464	41216	52336	52336	52336	52336
560	30032	30032	30032	30032	30032	30032	30032	35840	35840	37264	38464	38464	41216	52336	52336	52336	52336
640	30032	30032	30032	30032	30032	30032	30032	35840	35840	37264	38464	38464	41216	52336	52336	52336	52336
720	30032	30032	30032	30032	30032	30032	30032	35840	35840	37264	38464	38464	41216	52336	52336	52336	52336
800	30032	30032	30032	30032	30032	30032	30032	35840	35840	37264	38464	38464	41216	52336	52336	52336	52336
KIOXYD cmp AFIM LngthThrsH1 DoD																	
AvgFlow / AvgRPM	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000	4500	5000	6000
40	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
80	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
120	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
160	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
200	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
240	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
280	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
320	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000

LOOK-UP TABLES																		
AvgFlow / AvgRPM	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000	4500	5000	6000	
40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
80	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
120	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
160	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
200	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
240	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
280	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
320	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
360	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
400	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
440	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
480	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
520	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
560	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
640	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
720	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
800	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
KIOXYD K AFIM QualFactor2 DoD																		
AvgFlow / AvgRPM	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	3500	4000	4500	5000	6000	
40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
80	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
120	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
160	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
200	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
240	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
280	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
320	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
360	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
400	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
440	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
480	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
520	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
560	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
640	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
720	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
800	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Define Close Loop																		
KiFSTA_T_ClosedLoopTemp	Start-Up Coolant	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
Close Loop Enable Temp	50	45	30	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40
KiFSTA_t_ClosedLoopTime	Start-Up Coolant	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
Close Loop Enable Time	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tables supporting Clutch Diagnostics																		
P0806	EngTorqueThreshold Table																	
Axis	0	6.2485	12.497	18.7455	24.994	31.2425	37.491	43.7395	49.988	56.2365	62.485	68.7335	74.982	81.2305	87.479	93.7275	99.976	
Curve	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
P0806	ResidualErrorEnableLow Table																	
Axis	1st	2nd	3rd	4th	5th	6th	rev	neutral										
Curve	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
P0806	ResidualErrorEnableHigh Table																	
Axis	1st	2nd	3rd	4th	5th	6th	rev	neutral										
Curve	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
Tables supporting AIR Diagnostics																		
P0411	SL Threshold Bank 1 Table																	
Axis	0.0	3.0	6.0	9.0	12.0	15.0	18.0	21.0	24.0	27.0	30.0	33.0	36.0	39.0	42.0	45.0	48.0	
Curve	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	
P0411	Phase 1 Baro Test Weight Factor																	
Axis	40	50	60	70	80	90	100	110	120									
Curve	0.0	0.0	0.5	1.0	1.0	1.0	1.0	1.0	0.0									
P0411	Phase 1 MAF Test Weight Factor																	
Axis	0.0	3.0	6.0	9.0	12.0	15.0	18.0	21.0	24.0	27.0	30.0	33.0	36.0	39.0	42.0	45.0	48.0	
Curve	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	
P0411	Phase 1 System Volt Test Weight Factor																	
Axis	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	
Curve	0.0	0.0	0.0	0.0	0.0	0.5	0.8	1.0	1.0	1.0	1.0	1.0	0.8	0.5	0.0	0.0	0.0	
P0411																		

LOOK-UP TABLES

Phase 1 Amb Temp Test Weight Factor		axis is Deg C																			
Axis	-30	-20	-10	0	10	20	30	40	50												
Curve	0.0	0.0	0.0	0.5	1.0	1.0	1.0	1.0	1.0												
P02431																					
Baro Skewed Sensor Weight Factor		axis is distance traveled from last Baro update in Km																			
Axis	0.0	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	28.0	30.0	32.0				
Curve	1.0	0.8	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
P02440																					
Bank 1 Valve Pressure Error		axis weighted time in seconds																			
Axis	0	1	2	3	4	5	6	7	8												
Curve	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0												
P02440																					
Phase 2 Baro Test Weight Factor		axis is Baro in Kpa																			
Axis	40	50	60	70	80	90	100	110	120												
Curve	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0												
P02440																					
Phase 2 MAF Test Weight Factor		axis is engine airflow in gm/sec																			
Axis	0.0	3.0	6.0	9.0	12.0	15.0	18.0	21.0	24.0	27.0	30.0	33.0	36.0	39.0	42.0	45.0	48.0				
Curve	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0				
P02440																					
Phase 2 System Volt Test Weight Factor		axis is engine airflow in gm/sec																			
Axis	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0				
Curve	0.0	0.0	0.0	0.0	0.0	0.5	0.8	1.0	1.0	1.0	1.0	1.0	0.8	0.5	0.0	0.0	0.0				
P02440																					
Phase 2 Amb Temp Test Weight Factor		axis is Deg C																			
Axis	-30	-20	-10	0	10	20	30	40	50												
Curve	0.0	0.0	0.0	0.5	1.0	1.0	1.0	1.0	1.0												
P02444																					
Bank 1 Pump Pressure Error		axis weighted time in seconds																			
Axis	0	1	2	3	4	5	6	7	8												
Curve	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5												
FASD Section																					
P0171 & P0174 (LONG TERM ONL)		Long Term Trim Lean																			
% Ethanol	0.00	6.25	12.50	18.75	24.99	31.24	37.49	43.74	49.99	56.24	62.48	68.73	74.98	81.23	87.48	93.73	99.98				
Long Term Fuel Trim Lean Threshold	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29				
P0172 & P0175 (LONG TERM ONL)		Non Purge Rich Limit																			
% Ethanol	0.00	6.25	12.50	18.75	24.99	31.24	37.49	43.74	49.99	56.24	62.48	68.73	74.98	81.23	87.48	93.73	99.98				
Long Term Fuel Non-Purge Rich Thr	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81				
P0172 & P0175 (LONG TERM ONL)		Purge Rich Limit																			
% Ethanol	0.00	6.25	12.50	18.75	24.99	31.24	37.49	43.74	49.99	56.24	62.48	68.73	74.98	81.23	87.48	93.73	99.98				
Long Term Fuel Purge Rich Thresho	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82				
The following tables define when the engine goes closed loop																					
P0171, P0172, P0174 & P0175		Closed Loop Enable Temp vs Coolant Temp																			
Start-Up Coolant	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152				
Close Loop Enable Temp	50	45	30	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40				
P0171, P0172, P0174 & P0175		Closed Loop Enable Time vs Coolant Temp																			
Start-Up Coolant	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152				
Close Loop Enable Time	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
P0101, P0106, P0121, P012B, P1101: IFRD Residual Weighting Factors																					
		TPS Residual Weight Factor based on RPM																			
RPM	0	250	750	1250	1750	2250	2750	3250	3750	4250	4750	5250	5750	6250	6750	7250	9000				
	1.000	1.000	0.992	0.984	0.992	0.962	0.933	0.871	0.992	0.763	0.776	0.864	0.756	0.694	1.000	1.000	1.000				
		MAF Residual Weight Factor based on RPM																			
RPM	0	250	750	1250	1750	2250	2750	3250	3750	4250	4750	5250	5750	6250	6750	7250	9000				
	1.000	1.000	1.000	1.000	1.000	0.962	0.855	0.896	0.896	0.584	0.689	0.751	0.739	0.722	1.000	1.000	1.000				
		MAF Residual Weight Factor Based on MAF Estimate																			
gm/sec	0.0	40.0	47.0	56.0	67.0	79.0	93.0	111.0	131.0	156.0	184.0	218.0	259.0	307.0	363.0	431.0	510.0				
	1.000	1.000	0.909	0.836	0.773	0.719	0.660	0.584	0.501	0.408	0.336	0.294	0.268	0.243	0.219	0.191	0.159				
		MAP1 Residual Weight Factor based on RPM																			
RPM	0	250	750	1250	1750	2250	2750	3250	3750	4250	4750	5250	5750	6250	6750	7250	9000				
	1.000	0.893	0.693	0.693	0.693	0.736	0.778	0.749	0.627	0.584	0.659	0.683	0.673	0.632	1.000	1.000	1.000				
		MAP2 Residual Weight Factor based on RPM																			
RPM	0	250	750	1250	1750	2250	2750	3250	3750	4250	4750	5250	5750	6250	6750	7250	9000				
	1.000	0.967	0.921	0.894	0.870	0.839	0.870	0.769	0.716	0.786	0.870	1.000	0.958	0.921	0.822	1.000	1.000				
		SCIAP1 Residual Weight Factor based on RPM																			
RPM	0	1500	2200	2500	2800	3100	3200	3300	3500	3700	4000	4200	4500	5000	5500	6500	8000				
	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000				
		SCIAP2 Residual Weight Factor based on RPM																			
RPM	0	1500	2200	2500	2800	3100	3200	3300	3500	3700	4000	4200	4500	5000	5500	6500	8000				
	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000				
		Boost Residual Weight Factor based on % of Boost																			
% Boost	0.00	0.06	0.13	0.19	0.25	0.31	0.38	0.44	0.50	0.56	0.63	0.69	0.75	0.81	0.88	0.94	1.00				
	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000				

LOOK-UP TABLES

P0108, P012D: MAP/SCIAP Cold Run Time Threshold

		Z axis is Engine Coolant Temperature in Deg C				
Temp	-30	-15	0	15	30	
	242.0	188.0	134.0	80.0	0.0	

P0116: Fail if power up ECT exceeds IAT by these values

		Z axis is the Fast Failure temp difference (°C)															
		X axis is IAT Temperature at Power up (°C)															
	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
	80	80	80	60	60	40	40	30	30	30	30	30	30	30	30	30	30

P0128: Maximum Accumulated Airflow for IAT and Start-up ECT conditions

		Z axis is the accumulated airflow failure threshold (grams)												
		X axis is ECT Temperature at Power up (°C)												
		Y axis is IAT min during test (°C)												
		IAT Range												
		Low	Hi	-40	-28	-16	-4	8	20	32	44	56	68	80
Primary		10.0 °C	54.5 °C	5672	5672	5672	5672	5672	4868	4064	3260	2456	1652	848
Alternate		-7.0 °C	10.0 °C	7583	7583	7583	6719	5855	5011	4231	3451	2671	1891	1111

P0300-P0308: Idle SCD

		(decal index > Idle SCD AND > Idle SCD ddt Tables)												
		400	500	600	700	800	900	1000	1100	1200				
load	0	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
Load	6	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	13	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	19	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	25	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	31	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	38	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	44	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	50	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	56	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	63	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	69	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	75	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	81	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	88	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	94	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	100	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767

P0300-P0308: Idle SCD ddt

		400	500	600	700	800	900	1000	1100	1200				
load	0	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	6	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	13	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	19	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	25	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	31	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	38	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	44	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	50	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	56	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	63	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	69	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	75	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	81	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	88	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	94	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	100	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767

P0300-P0308: SCD Delta

		OR (decal index > SCD Delta AND > SCD Delta ddt Tables)												
		400	500	600	700	800	900	1000	1100	1200	1400	1600	1800	2000
load	0	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
Load	6	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	13	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	19	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	25	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	31	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	38	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	44	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	50	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	56	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	63	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	69	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	75	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	81	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	88	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	94	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	100	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767

P0300-P0308: SCD Delta ddt

		400	500	600	700	800	900	1000	1100	1200	1400	1600	1800	2000
load	0	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	6	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767
	13	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767	32767

09 OBDG08 Engine Diagnostics

LOOK-UP TABLES

Table with 13 columns and 13 rows of numerical data, likely representing engine parameters.

P0300-P0308: Idle Cyl Mode. Table with 10 columns (400-1200) and 13 rows of numerical data.

P0300-P0308: Idle Cyl Mode ddt. Table with 10 columns (400-1200) and 13 rows of numerical data.

P0300-P0308: Cyl Mode. Table with 20 columns (400-7000) and 13 rows of numerical data.

P0300-P0308: Cyl Mode ddt. Table with 20 columns (400-7000) and 13 rows of numerical data.

LOOK-UP TABLES

40	23	23	21	21	19	5	5	5
50	21	21	21	20	15	5	5	5
60	21	21	20	18	5	5	5	5
70	20	20	19	18	5	5	5	5
80	19	19	10	5	5	5	5	5
90	15	15	6	5	5	5	5	5
100	15	15	5	5	5	5	5	5

P0133 - O2S Slow Response Bank 1 Sensor 1* Pass/Fail Threshold table

Z axis is the pass/fail result (see note below)
X axis is Lean to Rich response time (msec)
Y axis is Rich to Lean response time (msec)
Note: If the cell contains a "0" then the fault is not indicated, if it contains a "1" a fault is indicated

	0.000	0.025	0.040	0.055	0.070	0.085	0.100	0.115	0.130	0.145	0.160	0.175	0.190	0.205	0.220	0.235	1.000
0.000	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.025	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.040	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.055	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.070	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.085	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.100	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.115	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.130	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.145	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.160	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.175	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.190	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.205	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0
0.220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

P0153 - O2S Slow Response Bank 2 Sensor 1* Pass/Fail Threshold table

Z axis is the pass/fail result (see note below)
X axis is Lean to Rich response time (msec)
Y axis is Rich to Lean response time (msec)
Note: If the cell contains a "0" then the fault is not indicated, if it contains a "1" a fault is indicated

	0.000	0.025	0.040	0.055	0.070	0.085	0.100	0.115	0.130	0.145	0.160	0.175	0.190	0.205	0.220	0.235	1.000
0.000	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.025	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.040	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.055	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.070	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.085	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.100	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.115	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.130	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.145	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.160	1	1	1	1	1	1	1	0.115	1	1	1	0	0	0	0	0	0
0.175	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.190	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0
0.205	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0
0.220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

P1133 - O2S HC L to R Switches Limit Bank 1 Sensor 1* Pass/Fail Threshold table

Z axis is Limit for L/R HC switches
Y axis is Average flow during the response test (gps)
X axis is estimated Ethanol percentage
Note: The cell contains the minimum switches

	0.0	10.0	20.0	50.0	80.0
0.0	30	30	30	30	30
6.3	30	30	30	30	30
12.5	30	30	30	30	30
18.8	30	30	30	30	30
25.0	30	30	30	30	30
31.3	30	30	30	30	30
37.5	30	30	30	30	30
43.8	30	30	30	30	30
50.0	30	30	30	30	30
56.3	30	30	30	30	30
62.5	30	30	30	30	30
68.8	30	30	30	30	30
75.0	30	30	30	30	30
81.3	30	30	30	30	30
87.5	30	30	30	30	30
93.8	30	30	30	30	30
100.0	30	30	30	30	30

P1133 - O2S HC R to L Switches Limit Bank 1 Sensor 1* Pass/Fail Threshold table

LOOK-UP TABLES

P1153 - O2S HC L to R Switches Limit Bank 2 Sensor 1* Pass/Fail Threshold table					
Z axis is Limit for R/L HC switches					
Y axis is Average flow during the response test (gps)					
X axis is estimated Ethanol percentage					
Note: The cell contains the minimum switches					
	0.0	10.0	20.0	50.0	80.0
0.0	30	30	30	30	30
6.3	30	30	30	30	30
12.5	30	30	30	30	30
18.8	30	30	30	30	30
25.0	30	30	30	30	30
31.3	30	30	30	30	30
37.5	30	30	30	30	30
43.8	30	30	30	30	30
50.0	30	30	30	30	30
56.3	30	30	30	30	30
62.5	30	30	30	30	30
68.8	30	30	30	30	30
75.0	30	30	30	30	30
81.3	30	30	30	30	30
87.5	30	30	30	30	30
93.8	30	30	30	30	30
100.0	30	30	30	30	30

P1153 - O2S HC R to L Switches Limit Bank 2 Sensor 1* Pass/Fail Threshold table					
Z axis is Limit for L/R HC switches					
Y axis is Average flow during the response test (gps)					
X axis is estimated Ethanol percentage					
Note: The cell contains the minimum switches					
	0.0	10.0	20.0	50.0	80.0
0.0	30	30	30	30	30
6.3	30	30	30	30	30
12.5	30	30	30	30	30
18.8	30	30	30	30	30
25.0	30	30	30	30	30
31.3	30	30	30	30	30
37.5	30	30	30	30	30
43.8	30	30	30	30	30
50.0	30	30	30	30	30
56.3	30	30	30	30	30
62.5	30	30	30	30	30
68.8	30	30	30	30	30
75.0	30	30	30	30	30
81.3	30	30	30	30	30
87.5	30	30	30	30	30
93.8	30	30	30	30	30
100.0	30	30	30	30	30

P2270/P2272 - O2 Sensor Signal Stuck Lean Bank 1/2 Sensor Rich Equiv Ratio					
	0.0	500.0	1000.0	1500.0	2000.0
0.0	1.180176	1.180176	1.180176	1.180176	1.180176
25.0	1.180176	1.180176	1.165039	1.160156	1.149902
50.0	1.180176	1.180176	1.160156	1.149902	1.140137
75.0	1.180176	1.169922	1.160156	1.149902	1.140137
100.0	1.180176	1.169922	1.149902	1.140137	1.140137

Z axis is Equiv ratio during the test					
Y axis is MAP (kpa)					
X axis RPM					

LOOK-UP TABLES

P2271/P2273 - O2 Sensor Signal Stuck Rich Bank 1/2 Sensor 2 Lean Equiv Ratio																	
	0.0	500.0	1000.0	1500.0	2000.0												
0.0	0.919922	0.919922	0.919922	0.919922	0.919922												
25.0	0.919922	0.910156	0.907227	0.904785	0.899902												
50.0	0.919922	0.908203	0.904785	0.899902	0.895020												
75.0	0.919922	0.904785	0.899902	0.895020	0.890137												
100.0	0.919922	0.899902	0.895020	0.890137	0.879883												
	Z axis is Equiv ratio during the test																
	Y axis is MAP (kpa)																
	X axis RPM																
P2A01 - O2 Sensor Signal Stuck Lean Bank 1 Sensor 2 Rich Equiv Ratio																	
	0.0	500.0	1000.0	1500.0	2000.0												
0.0	1.110352	1.110352	1.110352	1.120117	1.150391												
25.0	1.110352	1.110352	1.110352	1.120117	1.150391												
50.0	1.110352	1.110352	1.110352	1.120117	1.150391												
75.0	1.110352	1.110352	1.110352	1.120117	1.150391												
100.0	1.110352	1.110352	1.110352	1.120117	1.150391												
	Z axis is Equiv ratio during the test																
	Y axis is MAP (kpa)																
	X axis RPM																
P2A01- O2 Sensor Signal Stuck Rich Bank 1 Sensor 2 Lean Equiv Ratio																	
	0.0	500.0	1000.0	1500.0	2000.0												
0.0	0.919922	0.919922	0.919922	0.919922	0.919922												
25.0	0.919922	0.919922	0.919922	0.919922	0.919922												
50.0	0.919922	0.919922	0.919922	0.919922	0.919922												
75.0	0.919922	0.919922	0.919922	0.919922	0.919922												
100.0	0.919922	0.919922	0.919922	0.919922	0.919922												
	Z axis is Equiv ratio during the test																
	Y axis is MAP (kpa)																
	X axis RPM																
CSED Section																	
KtIDLC_n_CLO_ThrshOfst																	
Coolant Temperature	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
Offset to be considered Cat Light Off	1000	1000	250	125	125	125	125	125	125	500	1000	1000	1000	1000	1000	1000	1000
KaIDLC_n_EngDsrBase[CiIDLR_PN]																	
Coolant Temperature	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
Base RPM	950	950	950	950	950	950	950	900	850	800	775	775	775	775	775	775	775
KaIDLC_n_EngDsrBase[CiIDLR_DR]																	
Coolant Temperature	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
Base RPM	950	950	950	950	950	950	950	900	850	800	775	775	775	775	775	775	775
Phaser Section																	
KtPHSD_phi_CamPosErrorLimct1																	
	X axis is Deg C																
	Y axis is RPM																
	-40.0000	-28.0000	-16.0000	-4.0000	8.0000	20.0000	32.0000	44.0000	56.0000	68.0000	80.0000	92.0000	104.0000	116.0000	128.0000	140.0000	152.0000
400	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
800	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
1200	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
1600	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
2000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
2400	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
2800	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
3200	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
3600	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
4000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
4400	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
4800	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
5200	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
5600	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
6000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
6400	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
6800	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000
KtPHSD_phi_CamPosErrorLimEct																	
	X axis is Deg C																
	Y axis is RPM																

FAULT BUNDLE DEFINITIONS									
Cert Doc Bundle Name	Pcodes								
CatalystSysEfficiencyLoB1_FA	P0420								
CatalystSysEfficiencyLoB2_FA	P0430								
EvapPurgeSolenoidCircuit_FA	P0443								
EvapFlowDuringNonPurge_FA	P0496								
EvapVentSolenoidCircuit_FA	P0449								
EvapSmallLeak_FA	P0442								
EvapEmissionSystem_FA	P0455	P0446							
FuelTankPressureSnsrCkt_FA	P0452	P0453							
CoolingFanSpeedTooHigh_FA	P0495								
FuelLevelDataFault	P0461	P0462	P0463	P2066	P2067	P2068			
PowertrainRelayFault	P1682								
PowertrainRelayStateOn_FA	P0685								
PowertrainRelayStateOn_Error	P0685								
IgnitionOffTimer_FA	P2610								
IgnitionOffTimeValid	P2610								
TimeSinceEngineRunningValid	P2610								
VehicleSpeedSensor_FA	P0502	P0503	P0722	P0723					
VehicleSpeedSensorError	P0502	P0503	P0722	P0723					
FuelTrimSystemB1_FA	P0171	P0172							
FuelTrimSystemB2_FA	P0174	P0175							
A/F Imbalance Bank1	P1174								
A/F Imbalance Bank2	P1175								
AIRSystemPressureSensor FA	P2430	P2431	P2432	P2433	P2435	P2436	P2437	P2438	
AIR System FA	P0411	P2440	P2444						
AIRValveControlCircuit FA	P0412								
AIRPumpControlCircuit FA	P0418								
Clutch Sensor FA	P0806	P0807	P0808						
ClutchPositionSensorCktLo FA	P0807								
ClutchPositionSensorCktHi FA	P0808								

FAULT BUNDLE DEFINITIONS												
Cert Doc Bundle Name	Pcodes											
EthanolCompositionSensor_FA	P0178	P0179										
EngineMisfireDetected_TFTKO	P0300	P0301	P0302	P0303	P0304	P0305	P0306	P0307	P0308			
EngineMisfireDetected_FA	P0300	P0301	P0302	P0303	P0304	P0305	P0306	P0307	P0308			
KS_Ckt_Perf_B1B2_FA	P0324	P0325	P0326	P0327	P0328	P0330	P0332	P0333				
IgnitionOutputDriver_FA	P0351	P0352	P0353	P0354	P0355	P0356	P0357	P0358				
O2S_Bank_1_TFTKO	P0131	P0132	P0134	P2A00								
O2S_Bank_2_TFTKO	P0151	P0152	P0154	P2A03								
O2S_Bank_1_Sensor_1_FA	P2A00	P0131	P0132	P0133	P0134	P0135	P0053	P1133				
O2S_Bank_1_Sensor_2_FA	P013A	P013B	P013E	P013F	P2270	P2271	P0137	P0138	P0140	P0141	P0054	
O2S_Bank_2_Sensor_1_FA	P2A03	P0151	P0152	P0153	P0154	P0155	P0059	P1153				
O2S_Bank_2_Sensor_2_FA	P013C	P013D	P014A	P014B	P2272	P2273	P0157	P0158	P0160	P0161	P0060	
ECT_Sensor_Ckt_FA	P0117	P0118										
ECT_Sensor_Ckt_TPTKO	P0117	P0118										
ECT_Sensor_Ckt_TFTKO	P0117	P0118										
ECT_Sensor_DefaultDetected	P0117	P0118	P0116	P0125								
ECT_Sensor_FA	P0117	P0118	P0116	P0125	P0128							
ECT_Sensor_TFTKO	P0117	P0118	P0116	P0125								
ECT_Sensor_Perf_FA	P0116											
ECT_Sensor_Ckt_FP	P0117	P0118										
ECT_Sensor_Ckt_High_FP	P0118											
ECT_Sensor_Ckt_Low_FP	P0117											
AmbientAirPressCktFA	P2228	P2229										
AmbientAirPressCktFA_NoSnsr	P0106	P0107	P0108									
AmbientAirDefault_NA	P0106	P0107	P0108	P2227	P2228	P2229						
AmbientAirDefault_SC	P012B	P012C	P012D	P2227	P2228	P2229						
AmbientAirDefault_NoSnsr	P0106	P0107	P0108									
AmbientAirDefault	NA is has Baro Sensor and Normally Aspirated, SC if suprecharged, NoSnsr is Normally Aspirated with no Baro Sensor											
IAT_SensorCircuitTFTKO	P0112	P0113										
IAT_SensorCircuitFA	P0112	P0113										
IAT_SensorCircuitFP	P0112	P0113										
IAT_SensorTFTKO	P0111	P0112	P0113									
IAT_SensorFA	P0111	P0112	P0113									
IAT2_SensorCktTFTKO	P0097	P0098										

FAULT BUNDLE DEFINITIONS			
Cert Doc Bundle Name	Pcodes		
IAT2_SensorCktTFTKO_NoSnsr	P0112	P0113	
IAT2_SensorCircuitFA	P0097	P0098	
IAT2_SensorCircuitFA_NoSnsr	P0112	P0113	
IAT2_SensorcircuitFP	P0097	P0098	
IAT2_SensorcircuitFP_NoSnsr	P0112	P0113	
IAT2_SensorTFTKO	P0096	P0097	P0098
IAT2_SensorTFTKO_NoSnsr	P0111	P0112	P0113
IAT2_SensorFA	P0096	P0097	P0098
IAT2_SensorFA_NoSnsr	P0111	P0112	P0113
SuperchargerBypassValveFA	P2261		
CylDeacSystemTFTKO	P3400		
MAF_SensorPerfFA	P0101		
MAF_SensorPerfTFTKO	P0101		
MAP_SensorPerfFA	P0106		
MAP_SensorPerfTFTKO	P0106		
SCIAP_SensorPerfFA	P012B		
SCIAP_SensorPerfTFTKO	P012B		
ThrottlePositionSnsrPerfFA	P0121		
ThrottlePositionSnsrPerfTFTKO	P0121		
MAF_SensorFA	P0101	P0102	P0103
MAF_SensorTFTKO	P0101	P0102	P0103
MAF_SensorFP	P0102	P0103	
MAF_SensorCircuitFA	P0102	P0103	
MAF_SensorCircuitTFTKO	P0102	P0103	
MAP_SensorTFTKO	P0106	P0107	P0108
MAP_SensorFA	P0106	P0107	P0108
SCIAP_SensorFA	P012B	P012C	P012D
SCIAP_SensorTFTKO	P012B	P012C	P012D
SCIAP_SensorCircuitFP	P012C	P012D	
AfterThrottlePressureFA_NA	P0106	P0107	P0108
AfterThrottlePressureFA_SC	P012B	P012C	P012D
AfterThrottleVacuumTFTKO_NA	P0106	P0107	P0108
AfterThrottleVacuumTFTKO_SC	P012B	P012C	P012D
SCIAP_SensorCircuitFA	P012C	P012D	
AfterThrottlePressTFTKO_NA	P0106	P0107	P0108
AfterThrottlePressTFTKO_SC	P012B	P012C	P012D
MAP_SensorCircuitFA	P0107	P0108	
MAP_EngineVacuumStatus	MAP_SensorFA OR P0107, P0108 Pending		

FAULT BUNDLE DEFINITIONS												
Cert Doc Bundle Name	Pcodes											
CrankCamCorrelationTFTKO	P0016	P0017	P0018	P0019								
CrankSensorFA	P0335	P0336										
CrankSensorTFTKO	P0335	P0336										
CamSensorFA	P0016	P0017	P0018	P0019	P0340	P0341	P0345	P0346	P0365	P0366	P0390	P0391
CamSensorTFTKO	P0016	P0017	P0018	P0019	P0340	P0341	P0345	P0346	P0365	P0366	P0390	P0391
CrankIntakeCamCorrelationFA	P0016	P0018										
CrankExhaustCamCorrelationFA	P0017	P0019										
IntakeCamSensorTFTKO	P0016	P0018	P0340	P0341	P0345	P0346						
IntakeCamSensorFA	P0016	P0018	P0340	P0341	P0345	P0346						
ExhaustCamSensorTFTKO	P0017	P0019	P0365	P0366	P0390	P0391						
ExhaustCamSensorFA	P0017	P0019	P0365	P0366	P0390	P0391						
IntakeCamSensor_FA	P0016	P0018	P0340	P0341	P0345	P0346						
IntakeCamSensor_TFTKO	P0016	P0018	P0340	P0341	P0345	P0346						
ExhaustCamSensor_FA	P0017	P0019	P0365	P0366	P0390	P0391						
ExhaustCamSensor_TFTKO	P0017	P0019	P0365	P0366	P0390	P0391						
CrankIntakeCamCorrFA	P0016	P0018										
CrankExhaustCamCorrFA	P0017	P0019										
CrankSensorFaultActive	P0335	P0336										
CrankSensor_FA	P0335	P0336										
CrankSensorTestFailedTKO	P0335	P0336										
CrankSensor_TFTKO	P0335	P0336										
CamSensor_FA	P0016	P0017	P0018	P0019	P0340	P0341	P0345	P0346	P0365	P0366	P0390	P0391
CamSensorAnyLocationFA	P0016	P0017	P0018	P0019	P0340	P0341	P0345	P0346	P0365	P0366	P0390	P0391
CamSensor_TFTKO	P0016	P0017	P0018	P0019	P0340	P0341	P0345	P0346	P0365	P0366	P0390	P0391
AnyCamPhaser_FA	P0010	P0011	P0013	P0014	P0020	P0021	P0023	P0024				
AnyCamPhaser_TFTKO	P0010	P0011	P0013	P0014	P0020	P0021	P0023	P0024				
IntkCamPhaser_FA	P0010	P0011	P0020	P0021								
EGRValvePerformance_FA	P0401	P042E										
EGRValveCircuit_FA	P0403	P0404	P0405	P0406								
EGRValve_FP	P0405	P0406	P042E									
EGRValveCircuit_TFTKO	P0403	P0404	P0405	P0406								
EGRValvePerformance_TFTKO	P0401	P042E										
EngineMetalOvertempActive	P1258											
	no codes?											
A/C_FailedOn	P0645											
EngOilTempSensorCircuitFA	P0197	P0198										

FAULT BUNDLE DEFINITIONS											
Cert Doc Bundle Name	Pcodes										
EngOilModeledTempValid	ECT_Sensor_FA or IAT_SensorCircuitFA										
EngOilPressureSensorCktFA	P0522	P0523									
EngOilPressureSensorFA	P0521	P0522	P0523								
see Trans Summary Tables											
CylinderDeacDriverTFTKO	P3401	P3409	P3417	P3425	P3433	P3441	P3449				
BrakeBoosterSensorFA	P0556	P0557	P0558								
BrakeBoosterVacuumValid	P0556	P0557	P0558								
BrakeBoosterVacuumValid	VehicleSpeedSensorError or MAP_SensorFA										
FuelInjectorCircuit_FA	P0201	P0202	P0203	P0204	P0205	P0206	P0207	P0208			
FuelInjectorCircuit_TFTKO	P0201	P0202	P0203	P0204	P0205	P0206	P0207	P0208			
ControllerProcessorPerf_FA	P0606										
ControllerRAM_Error_FA	P0604										
TPS_Performance_FA	P0068	P0121	P1516	P2101							
EnginePowerLimited	P0068	P0606	P0120	P0122	P0123	P0220	P0222	P0223	P0641	P0651	
	P1516	P2101	P2120	P2122	P2123	P2125	P2127	P2128	P2135	P2138	P2176
TPS1_OutOfRange_Composite	P0120	P0122	P0123								
TPS2_OutOfRange_Composite	P0220	P0222	P0223								
TPS_FA	P2135	(TPS1_OutOfRange_Composite and TPS2_OutOfRange_Composite)									
TPS_FaultPending	Always set to FALSE, As ETC diagnostics are set within 200 msec there is no real need for a pending flag										
TPS_ThrottleAuthorityDefaulted	P0068	P0606	P1516	P2101	P2135	P2176	V5B_OutOfRange_Composite				
	(TPS1_OutOfRange_Composite and TPS2_OutOfRange_Composite)										
	(MAP_OutOfRange_Composite and MAF_OutOfRange_Composite)										
AcceleratorEffectivePstnValid	Always set to TRUE, no P codes will set to FALSE										
5VoltReferenceA_FA	P0641										
5VoltReferenceB_FA	P0651										
IAC_SystemRPM_FA	P0506	P0507									

FAULT BUNDLE DEFINITIONS													
Cert Doc Bundle Name		Pcodes											
TransmissionGearDefaulted	P182E	P1915											
TransmissionEngagedState_FA	P182E	P1915											
FourWheelDriveLowStateValid	P2771												
EngineTorqueInaccurate	EngineMisfireDetected_FA or FuelInjectorCircuit_FA or FuelInjectorCircuit_TFTKO or FuelTrimSystemB1_FA or FuelTrimSystemB2_FA or MAF_SensorTFTKO or MAP_SensorTFTKO or EGRValvePerformance_FA												
Long Name	Short Name												
Bank	B												
Brake	Brk												
Circuit	Ckt												
Engine	Eng												
Fault Active	FA												
Intake	Intk												
Naturally Aspirated	NA												
Performance	Perf												
Position	Pstn												
Pressure	Press												
Sensor	Snsr												
Supercharged	SC												
System	Sys												
Test Failed This Key On	TFTKO												
LowFuelConditionDiagnostic	Flag set to TRUE if the fuel level < 10 % AND No Active DTCs: FuelLevelDataFault P0462 P0463 for at least 30 seconds.												

FAULT BUNDLE DEFINITIONS																																																																																																																																																																																																																	
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Transfer Pump is Commanded On	Fuel Volume in Primary Fuel Tank < 0.0 liters														AND														Fuel Volume in Secondary Fuel Tank ≥ 0.0 liters														AND														Transfer Pump on Time < TransferPumpOnTimeLimit Table														AND														Transfer Pump had been Off for at least 0.0 seconds														AND														Evap Diagnostic (Purge Valve Leak Test, Large Leak Test, and Waiting for Purge) is not running														AND														Engine Running																																																																				
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COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Fuel System Control Module:								
Fuel Rail Pressure (FRP) Sensor Performance (Rationality)	P0191	This DTC detects if the fuel pressure sensor is stuck within the normal operating range	Absolute value of change in fuel pressure as sensed during intrusive test.	<= 30 kPa	1. FRP Circuit Low DTC (P0192) 2. FRP Circuit High DTC (P0193) 3. FuelPump Circuit Low DTC (P0231) 4. FuelPump Circuit High DTC (P0232) 5. FuelPump Circuit Open DTC (P023F) 6. Reference Voltage DTC (P0641) 7. Reference Voltage DTC (P0641) 8. Reference Voltage DTC (P0642) 9. Fuel Pump Control Module Driver Over-temperature DTC's (P064A, P1255) 10. Control Module Internal Performance DTC (P0606) 11. Engine run time 12. Emissions fuel level (PPEI \$3FB) 13. Fuel pump control 14. Fuel pump control state 15. Engine fuel flow 16. ECM fuel control system failure (PPEI \$1ED)	not active not active not active not active not active not active not failed this trip not active not active not active >=5 seconds not low enabled normal or FRP Rationality control Valid failure has not occurred	Frequency: Continuous; 12.5 ms loop. 60 seconds between intrusive tests that pass Intrusive test requested if fuel system is clamped or fuel pressure error variance <= 0.6 for >= 5 seconds; otherwise report Duration of intrusive test is fueling related (5 to 12 seconds).	DTC Type A

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Fuel Rail Pressure (FRP) Sensor Circuit Low Voltage	P0192	This DTC detects if the fuel pressure sensor circuit is shorted to low	FRP sensor voltage	< 0.1 V	Ignition OR HS Comm OR Fuel Pump Control AND Reference Voltage DTC P0641	Run or Crank enabled enabled not active	72 test failures in 80 test samples 1 sample/12.5 ms	DTC Type A
Fuel Rail Pressure (FRP) Sensor Circuit High Voltage	P0193	This DTC detects if the fuel pressure sensor circuit is shorted to high	FRP sensor voltage	> 4.9 V	Ignition OR HS Comm OR Fuel Pump Control AND Reference Voltage DTC P0641	Run or Crank enabled enabled not active	72 test failures in 80 test samples 1 sample/12.5 ms	DTC Type A
Fuel Pump Control Circuit Low Voltage	P0231	This DTC detects if the fuel pump control circuit is shorted to low	Fuel Pump Current	> 14.48A	Ignition OR HS Comm OR Fuel Pump Control AND Ignition Run/Crank Voltage	Run or Crank enabled enabled 9V < voltage < 18V	72 test failures in 80 test samples if Fuel Pump Current <100A 3 test failures in 15 test samples if Fuel Pump Current >=100A 1 sample/12.5 ms	DTC Type A
Fuel Pump Control Circuit High Voltage	P0232	This DTC detects if the fuel pump control circuit is shorted to high	Voltage measured at fuel pump circuit	> 3.86 V	Commanded fuel pump output Fuel pump control enable	0% duty cycle (off) False	36 test failures in 40 test samples 1 sample/12.5 ms Pass/Fail determination made only once per trip on non-hybrid applications.	DTC Type A

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					Time that above conditions are met	>=4.0 seconds	1 sample/12.5 ms continuous during auto-stop after enable conditions are met on hybrid applications.	
Fuel Pump Control Circuit (Open)	P023F	This DTC detects if the fuel pump control circuit is open	Fuel Pump Current AND Fuel Pump Duty Cycle	<=0.5A □ >20%	Ignition OR HS Comm OR Fuel Pump Control AND Ignition Run/Crank Voltage	Run or Crank enabled enabled 9V < voltage < 18V	72 test failures in 80 test samples 1 sample/12.5 ms	DTC Type A
Fuel System Control Module Enable Control Circuit	P025A	This DTC detects if there is a fault in the fuel pump control enable circuit	PPEI (PPEI (Powertrain Platform Electrical Interface) Fuel System Request (\$1ED)	≠ Fuel Pump Control Module Enable Control Circuit	Ignition OR HS Comm OR Fuel Pump Control AND PPEI Fuel System Request (\$1ED)	Run or Crank enabled enabled valid	72 test failures in 80 test samples 1 sample/12.5 ms	DTC Type A
Control Module Read Only Memory (ROM)	P0601	This DTC will be stored if any software or calibration check sum is incorrect	Calculated Checksum (CRC16)	≠ stored checksum for any of the parts (boot, software, application calibration, system calibration)	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 failure if it occurs during the first ROM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background	DTC Type A
Control Module Not Programmed	P0602	Indicates that the FSCM needs to be programmed	This DTC is set via calibration, when KeMEMD b NoStartCal	TRUE	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	Runs once at power up	DTC Type A

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Control Module Long Term Memory Reset	P0603	Non-volatile memory checksum error at controller power-up	Checksum at power-up	≠ checksum at power-down	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 failure Frequency: Once at power-up	DTC Type A
Control Module Random Access Memory (RAM)	P0604	Indicates that control module is unable to correctly write and read data to and from RAM	Data read	≠ Data written	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 failure if it occurs during the first RAM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background.	DTC Type A
Control Module Internal Performance 1. Main Processor Configuration Register Test 2. Processor clock test 3. External watchdog test	P0606	This DTC indicates the FSCM has detected an internal processor fault or external watchdog fault (PID 2032 can tell what causes the fault.)	1. For all I/O configuration register faults: •Register contents 2. For Processor Clock Fault: •EE latch flag in EEPROM. OR • RAM latch flag. 3. For External Watchdog Fault: • Software control of viper chip.	Incorrect value. 0x5A5A 0x5A Control Lost	Ignition OR HS Comm OR Fuel Pump Control 1. For all I/O configuration register faults: •KeMEMD_b_ProcFitCfgRegEnbl 2. For Processor Clock Fault: •KeMEMD_b_ProcFitCLKDiagEnbl 3. For External Watchdog Fault: •KeFRPD_b_FPExtWDogDiagEnbl	Run or Crank enabled enabled TRUE TRUE TRUE	Tests 1 and 2 1 test failure Frequency: Continuously (12.5ms) Test 3 3 test failures in 15 test samples Frequency: 1 sample/12.5 ms	DTC Type A

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Control Module Long Term Memory (EEPROM) Performance	P062F	Indicates that the NVM Error flag has not been cleared	Last EEPROM write	Did not complete	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	1 test failure Once on controller power-up	DTC Type A
5 Volt Reference Circuit (Short High/Low)	P0641	Detects a continuous short on the #1 5V sensor reference circuit	Reference voltage Output OR Reference voltage Output OR Reference voltage Output	>= 0.5V inactive >= 5.5V active <= 4.5V active	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	15 test failures in 20 test samples 1 sample/12.5 ms	DTC Type A
Fuel Pump Control Module Performance - Driver Over Temperature 1	P064A	This DTC detects if an internal fuel pump driver overtemperature condition exists under normal operating conditions. (Motorola's responsibility)	Module Range of Operation AND Viper Temp	Normal (- FSCM is in normal operating range for module voltage versus PWM duty cycle. Linear range from 100% @ 12.5V to 70% @ 18V.) >190C	Ignition OR HS Comm OR Fuel Pump Control KeFRPD_b_FPOverTempDiagEn bl Ignition Run/Crank	Run or Crank enabled enabled TRUE 9V<voltage<18V	3 test failures in 15 test samples 1 sample/12.5 ms	DTC Type B
5 Volt Reference Circuit (Out of Range)	P06A6	Detects that the #1 5 V sensor reference circuit is out of range	Reference voltage □	> 102.5% nominal (i.e. 5.125V) OR < 97.5% nominal (i.e. 4.875V)	Ignition OR HS Comm OR Fuel Pump Control	Run or Crank enabled enabled	72 test failures in 80 test samples 1 sample/12.5 ms	DTC Type A
Fuel Pump Control Module - Driver Over-temperature 2	P1255	This DTC detects if an internal fuel pump driver overtemperature condition exists under extreme operating conditions (GM's responsibility)	Module Range of Operation AND	Outside normal range (FSCM is NOT in normal operating range for module voltage versus PWM duty cycle. Linear range from 100% @ 12.5V to 70% @ 18V.)	Ignition OR HS Comm OR	Run or Crank enabled	3 test failures in 15 test samples 1 sample/12.5 ms	DTC Type B

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
			Viper Temp	> 190C	Fuel Pump Control KeFRPD_b_FPOverTempDiagEn bl Ignition Run/Crank	enabled TRUE 9V<voltage<18V		
Ignition 1 Switch Circuit Low Voltage	P2534	This DTC detects if the Ignition1 Switch circuit is shorted to low or open	Ignition 1 voltage	<= 6 V	Engine	Running	144 test failures in 160 test samples 1 sample/12.5 ms	DTC Type A
Fuel Pump Flow Performance	P2635	This DTC detects degradation in the performance of the electronic return-less fuel system	Filtered fuel rail pressure error	<= Low Threshold (function of desired fuel rail pressure and fuel flow rate. Typical values in the range of -30.0 to -90.0 kPa.) OR > High Threshold (function of desired fuel rail pressure and fuel flow rate. Typical values in the range of 30.0 to 90.0 kPa.)	1. FRP Circuit Low DTC (P0192) 2. FRP Circuit High DTC (P0193) 3. Fuel Rail Pressure Sensor Performance DTC (P0191) 4. FuelPump Circuit Low DTC (P0231) 5. FuelPump Circuit High DTC (P0232) 6. FuelPump Circuit Open DTC (P023F) 7. Reference Voltage DTC (P0641) 8. Reference Voltage DTC (P0641) 9. Reference Voltage DTC (P0642) 10. Fuel Pump Control Module Driver Over-temperature DTC's (P064A, P1255) 11. Control Module Internal Performance DTC (P0606) 12. An ECM fuel control system failure (PPEI \$1ED) 13. The Barometric pressure (PPEI \$4C1) signal	not active not active not active not active not failed this trip not active not active has not occurred valid (for absolute fuel pressure sensor)	Filtered fuel rail pressure error Time Constant = 12.5 seconds Frequency: Continuous 100 ms loop	DTC Type B

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					14. Engine run time 15. Emissions fuel level (PPEI \$3FB) 16. Fuel pump control 17. Fuel pump control state 18. Battery Voltage 19. Fuel flow rate 20. Fuel Pressure Control System	>= 30 seconds not low enabled normal 11V<=voltage<=18V > 0.05 g/s AND <= Max allowed fuel flow rate as a function of desired rail pressure (Typical values in the range of 13 to 20 g/s) Is not responding to an over-pressurization due to pressure build during DFCO or a decreasing desired pressure command.		
Control Module Communication Bus "A" Off	U0073	Detects that a CAN serial data bus shorted condition has occurred to force the CAN device driver to enter a bus-off state	Bus Status	Off	HS Communication OR Ignition Run/Crank	Enabled on	5 test failures in 5 samples (5 seconds)	DTC Type B
Lost Communication With ECM/PCM "A"	U0100	Detects that CAN serial data communication has been lost with the ECM	Message \$0C9	Undetected	1. Power mode 2. Ignition Run/Crank Voltage 3. U0073	Run/Crank (11 – 18 V) not active	12 test failures in 12 samples (12 seconds)	DTC Type B

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
SGCM 3 Phase current sensor:								
Starter/Generator Phase U-V-W Correlation (rationality)	P1AAE	To detect electrical failure of phase current sensor.	Sum of 3 phase current	> 200A	Main Relay	Closed	20ms	two trips
			Sum of 3 phase current	< - 200A	Wakeup Signal	On		
Starter/Generator Phase U-V-W Current Sensor Overcurrent	P1AB1	To detect 3 Phase over current and to protect MOSFET.	Over current signal	> 1000 A	Wakeup Signal	On	20ms	two trips
Starter/Generator Phase U Current Sensor Circuit Low Voltage	P1AB3	Circuit Low monitor to detect the failure of U-phase current sensor circuit below valid range	U Phase current sensor output voltage at highside	< 0.5 V	Wakeup Signal	On.	0.5ms	two trips
Starter/Generator Phase U Current Sensor Circuit High Voltage	P1AB4	Circuit High monitor to detect the failure of U-phase current sensor circuit above valid range	U Phase current sensor output voltage at highside	> 4.50 V	Wakeup Signal	On.	0.5ms	two trips
Starter/Generator Phase V Current Sensor Circuit Low Voltage	P1AB5	Circuit Low monitor to detect the failure of V-phase current sensor circuit below valid range	V Phase current sensor output voltage at highside	< 0.5V	Wakeup Signal	On.	0.5ms	two trips
Starter/Generator Phase V Current Sensor Circuit High Voltage	P1AB6	Circuit High monitor to detect the failure of V-phase current sensor circuit above valid range	V Phase current sensor output voltage at highside	> 4.5V	Wakeup Signal	On.	0.5ms	two trips
Starter/Generator Phase W Current Sensor Circuit Low Voltage	P1AB7	Circuit Low monitor to detect the failure of W-phase current sensor circuit below valid range	W Phase current sensor output voltage at highside	< 0.5V	Wakeup Signal	On.	0.5ms	two trips
Starter/Generator Phase W Current Sensor Circuit High Voltage	P1AB8	Circuit High monitor to detect the failure of W-phase current sensor circuit above valid range	W Phase current sensor output voltage at highside	> 4.5V	Wakeup Signal	On.	0.5ms	two trips
SGCM 36V battery voltage sensor:								
Hybrid Battery System Voltage High	P0AFB	To detect over voltage and to protect MOSFET.(Load dump)	In the hardware, Over voltage signal from protection circuit	> 56V	WakeUp signal	On	5sec	two trips
			In the software, 36V output voltage	> 50V	Control module voltage	> 10V		
			Main relay	Closed				
			WakeUp signal	On				
Starter/Generator Control Module Hybrid Battery Voltage Sense Circuit Low Voltage	P1A97	Circuit Low monitor to detect the failure of 36V output voltage sensor circuit below valid range	Sensor signal	< 0.2V	36V voltage from BDU (42VIN)	> 0V.	20ms	two trips
			absolute value (36V Battery Voltage - 36V output Voltage)	> 5V	Main relay	Closed		
					V42IN invalid Flag	OFF		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Starter/Generator Control Module Hybrid Battery Voltage Sense Circuit High Voltage	P1A98	Circuit High monitor to detect the failure of 36V output voltage sensor circuit above valid range	Sensor signal	> 4.0V	36V voltage from BDU (42VIN)	> 0V.	20ms	two trips
			absolute value (36V Battery Voltage - 36V output Voltage)	> 5V	Main relay	Closed		
					V42IN invalid Flag	OFF		
Hybrid System Voltage	P0AF8	To correlation of ESCM Battery Voltage and SGCM output Voltage to detect 3 phase cable open, or fuse/relay 's failure.	absolute value (36V Battery Voltage - 36V output Voltage)	> 5V	36V voltage from BDU (42VIN)	> 0V.	4sec	two trips
					Main relay	Closed		
					V42IN invalid Flag	OFF		
					Pre-Fux Current	0		
Hybrid Battery System Voltage Low	P0AFA	To detect the 36V output is less than 22V	36V output voltage sensor reads less than 22V	< 22V	Wakeup Signal	On	2 Sec.	two trips
Starter/Generator Phase U-V-W ACR Circuit	P1AAF	To detect phase wire open/short.	ACR output	> 200A	Main relay	Closed	200ms	two trips
			ACR output	> -200A				
14 Volt Power Module Voltage Sensor								
14 Volt Power Module Voltage Sensor Circuit Low Voltage	P1A8D	Circuit Low monitor to detect the failure of APM 12V voltage sensor circuit below valid range	Sensor output voltage	< 0.2V	Wakeup Signal	On	0.5ms	two trips
			absolute value (12V Power supply Voltage - 12V APM output Voltage)	> 5V			1.0ms	
14 Volt Power Module Voltage Sensor Circuit High Voltage	P1A8E	Circuit High monitor to detect the failure of APM 12V voltage sensor circuit above a valid range	Sensor output voltage	> 3.84V	Wakeup Signal	On	0.5ms	two trips
			absolute value (12V Power supply Voltage - 12V APM output Voltage)	> 5V			1.0ms	
14 Volt Power Module System Voltage High	P0A8E	APM output voltage is greater than a acceptable value for a calibrated period of time	In Hardware: 12V over voltage signal	> 20.9V			20ms.	two trips
			In software: 12V output voltage	> 18 V			2 sec.	
					Wakeup Signal	On		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
SGCM system voltage:								
Starter/Generator Control Module System Voltage Performance	P1A70	Performance monitor to detect 12V DC wire electrical failure by comparing the 12v input to the 12v output values	ABS 12V power supply voltage - 12V APM output voltage	> 5V			2ms	two trips
			Wait 15 seconds to see if fault occurs again during this time.				15sec	
					Wakeup Signal	On		
					No APM voltage sensor faults	P1A8D		
					No APM voltage sensor faults	P1A8E		
APM current Sensor:								
14 Volt Power Module Current Sensor Circuit Range/Performance	P0A87	Performance Monitor to detect the failure of APM current sensor circuit.	ABS APM current - APM High (+130A)	>39A	APM Output voltage	> 7V	25ms	two trips
					42V Output voltage	> 28V		
					APM Status	Current limit		
14 Volt Power Module Current Sensor Circuit Low Current	P0A88	Circuit Low Monitor to detect the failure of APM current sensor circuit.	Sensor signal for APM	<0.5V	Wakeup Signal	On	1.0ms	two trips
14 Volt Power Module Current Sensor Circuit High Current	P0A89	Circuit High Monitor to detect the failure of APM Current sensor circuit.	Sensor signal for APM	>4.5V	Wakeup Signal	On	1.0ms	two trips
14 Volt Power Module Current Sensor Overcurrent	P1A8F	To detect over current and to protect MOSFET. In the hardware an over current protection circuit is used to limit the current, and software monitors for an over current reading in the sensor	If either hardware signal 1. 36V Over current hardware signal	250 A	Wakeup Signal	On	20ms	two trips
			2. 12V Over current hardware signal	> =250 A			20ms	
			In the software, ABS Current sensor	> +/- 150A			2sec	
APM Performance								
14 Volt Power Module Stuck Off	P1A93	To check APM On/Off, DC - DC direction is commanded ON but converter is OFF	DC to DC direction is ON, abs 14V Output V - APM Commanded V	> 0.2V	Wakeup Signal	On	1 sec	two trips
14 Volt Power Module Stuck On	P1A94	To detect APM on when it is not commanded on causing a large current output.	DC-DC direction is OFF, converter remains ON, ABS APM current	> +/- 20A	Wakeup Signal	On	1 sec	two trips
DC/DC Converter Stuck in 42-14 Volt Direction	P1A96	To detect APM fault when the APM is commanded in the Buck moded but is set to Boost mode causing an over current	When DCDC direction indicates 14-42 direction, but the converter stays in the 42-14 direction, Boost mode current	> 20A	APM Mode	Buck	1 sec	two trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.	
APM temp sensor									
14 Volt Power Module Temperature Sensor Performance	P1A90	To detect the failure of APM temperature sensor circuit by taking the average of the 2 PIM sensors and subtracting the Module temperature and looking for a large difference. This can be done because the sensors are on the same board close together.	ABS APM temp - (PIMTemp1 + PIMTemp2)/2	> 55 deg C	no APM over temp fault	P0A7F	2 sec	two trips	
					no APM temp sensor circuit (High/Low) faults	P1A91 P1A92			
14 Volt Power Module Temperature Sensor Circuit Low Voltage	P1A91	FET temperature sensor signal for APM is less than 0.2V for 50 times of 20ms(1s).	Sensor output voltage	< 0.2V	no APM over temp fault	P0A7F	1 sec.	two trips	
14 Volt Power Module Temperature Sensor Circuit High Voltage	P1A92	Sensor output voltage greater than 4.6 V(-14.3degC) && DDTEMP - (PIMTEMP1+PIMTEMP2)/2 > 55degC for 50 times of 20ms(1s)	Sensor output voltage	> 4.6V	no APM over temp fault	P0A7F	1 sec	two trips	
			and ABS DDTEMP - (PIMTEMP1 + PIMTEMP2)/2	> 55 deg C					
14 Volt Power Module Internal Temperature Too High	P0AF7	Continuously monitor the APM temperature if it rises above an acceptable operating range set a fault	APM Temp	> 175deg C			20ms	two trips	
					Wakeup Signal	On			
AUX Pump Control									
Auxiliary Transmission Fluid Pump Motor Pump Supply Voltage Circuit/Open	P0B09	To detect the Auxiliary Transmission Fluid Pump supply relay circuit is faulted by an error feedback line.	Eco-back signal (Low) does not match to the LSD output signal (CVTP1_D)		0	WakeUp signal	On	320ms	two trips
			Eco-back signal (High) does not match to the LSD output signal (CVTP1_D)		1				
Auxiliary Transmission Fluid Pump Control Circuit/Open	P2796	To detect the Auxillary Transmission Fluid Pump control PWM circuit is faulted using error feedback line.	Eco-back signal (PWM output duty) is out of range, CVTPERR or CVTPERR	> 2.06V or < 0.68V	WakeUp signal	On	1 sec	two trips	

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.			
Board temp sensor											
Starter/Generator Control Module Temperature Sensor Performance	P1A7B	To determine if the sensor is reading correctly, by comparing it to average of 3 other sensors after 480min soak.	Ave(PIMTEMP1,PIMTEMP2,APMTEMP) - BOARDTEMP	> 30deg C	No Board Over Temp fault	P0A7C	n/a	two trips			
					No Board temp sensor circuit fault	P1A7C or P1A7D					
					Engine Off Timer	> 480min					
Starter/Generator Control Module Temperature Sensor Circuit Low Voltage	P1A7C	To detect failure of temperature sensor shorted high.	Sensor output voltage	< 0.2V	No Board Over Temp fault	P0A7C	1 sec	two trips			
Starter/Generator Control Module Temperature Sensor Circuit High Voltage	P1A7D	To detect failure of temperature sensor shorted Low	Sensor output voltage	> 4.6V	No Board Over Temp fault	P0A7C	1 sec	two trips			
			PIMTEMP1 greater than 80degC && PIMTEMP2 greater than 80degC && APMTEMP greater than 80degC								
Motor Electronics Over Temperature	P0A7C	Continuously monitor the Circuit board temperature if it rises above an acceptable operating range set a fault.	BOARDTEMP is greater than 120 degC	> 120 Deg C			1 sec.	two trips			
					Wakeup Signal	On					
CAN											
Starter / Generator Control Module Lost Communication With Battery Energy Control Module	U1897	To detect loss of communication on the CAN bus with the ESCM module base on messages \$220, \$484, \$486	10 out of 10 timeouts based on the "GensigTimeoutTime" for each message from BDU. Each message timeout is measured seperately. (Reception error), sum error or rolling counter error.		WakeUp	On		two trips			
									MSG \$220	10 out of 10 timeouts	500ms
									MSG \$484	10 out of 10 timeouts	2000ms
									MSG \$486	10 out of 10 timeouts	2000ms

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Starter/Generator Control Module Lost Communication With Engine Control Module (ECM)	U1899	To detect the loss of communication on the CAN bus with the ECM module base on messages \$260, \$350, \$440	10 out of 10 timeouts based on the "GensigTimeoutTime" for each from ECM. Each message timeout is measured separately. (Reception error), sum error or rolling counter error.		WakeUp	On		two trips
				MSG \$260	10 out of 10 timeouts		625	
				MSG \$350	10 out of 10 timeouts		625	
				MSG \$440	10 out of 10 timeouts		2000	
Field Coil Current Control								
Starter/Generator Field Coil Circuit	P1AA8	To detect a field coil circuit fault in the Motor Generator from the error feedback line	ABS Field coil current - Command current)	> 0.5A	WakeUp	On	1 sec	two trips
Starter/Generator Field Coil Current Sensor Circuit Low Voltage	P1AB9	Starter/Generator Field Coil Current Sensor Circuit Low Voltage	Sensor output voltage	< 1.8V	WakeUp	On	20ms	two trips
Generator Field Coil Current Sensor Circuit High Voltage	P1ABA	Generator Field Coil Current Sensor Circuit High Voltage	Sensor output voltage	> 4.1V	WakeUp	On	20ms	two trips
Starter/Generator Field Coil Current Sensor Overcurrent	P1ABB	Starter/Generator Field Coil Current Sensor Overcurrent	Field coil current	> 6A	WakeUp	On	20ms	two trips
Hood Switch								
Engine Hood Switch Circuit	P254F	To detect a fault in the vehicle hood switch	Hood Switch1 signal = Hood Switch2 signal (ex.Hood Switch1 is high and Hood Switch2 is high or Hood Switch1 is low and Hood Switch2 is low)	Switch 1 = Switch 2	WakeUp	On	1000ms	two trips
System Voltage								
Starter/Generator Control Module System Voltage Low	P1A6D	To detect the system voltage sensor is shorted low	Sensor output voltage is less than 0.2 V (1.56V) && 12V power supply - 12V output voltage greater than 5V for 4 times of 119us (0.5ms)		WakeUp	On	0.5 ms	two trips
			Sensor output voltage	< 0.2V				
			ABS 12V power supply - 12V output voltage	> 5V				

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Starter/Generator Control Module System Voltage High	P1A6E	To detect the system voltage sensor is shorted high	Sensor output voltage is greater than 3.84 V (30.0V) && 12V power supply - 12V output voltage greater than 5V for 4 times of 119us (0.5ms).	> 3.84V	WakeUp	On	0.5 ms	two trips
			Sensor output voltage > 3.84V ABS 12V power supply - 12V output voltage	> 5V				
Infrastructure								
Starter/Generator Control Module Internal Performance	P0A1E	CPU calculation error, ACR task check error, dual path error, sub CPU error, clock monitor check	CPU calculation error, ACR task check error, dual path error, sub CPU error, clock monitor check		WakeUp	On	1 fail	two trips
Starter/Generator Control Module Internal Driver Error	P1A63	To detect a fault in the internal drive error.Gate driver error flag from driver IC is low. (Gate driver voltage error, PWM output logic error)	"Gate driver voltage fault signal is low" OR "PWM logic error fault signal is low".		WakeUp	On	1 fail	two trips
Starter/Generator Control Module Random Access Memory (RAM)	P1A69	To detect an error in the SGCM RAM write area.	RAM check error		WakeUp	On	1 fail	two trips
Starter/Generator Control Module Read Only Memory (ROM)	P1A6A	To detect an error in the SGCM ROM using a checksum calculation	ROM check error Cuaculated ROMSUM value does not match with defined value.		WakeUp	On	1 fail	two trips
Starter/Generator Control Module 5 Volt Reference Circuit	P1A6B	To detect a fault in the 5 volt reference circuit	5V reference fault 5V input AD value(2 byte) is out of following range for 10 times of 10ms (100ms). ave_vbb_chk (497 to 575) ave_vcc_chk (496 to 528) ave_vn_chk (499 to 453) ave_vref_chk (482 to 542)		WakeUp	On	100ms	two trips
SGCM not programmed								
Starter/Generator Control Module Not Programmed	P1A6C	Starter/Generator Control Module Not Programmed	This diagnostic will be set in service parts. SGCM will not function			Always		One trip

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
MGU Performance								
Motor Torque Delivered Performance	P1A62	To detect the delivered Torque value is not within tolerance meaning that the MGU is not able to deliver the requested torque.	Compare the PEB "internal torque" - PEB "Delivered Torque" greater than 10Nm for 1 second and the MGU is in normal charge mode.	> 10 Nm difference	WakeUp	On	1 sec	two trips
					Motor Mode	Normal charge mode with external set point		
MGU temp. sensor								
Generator Temperature Sensor Circuit Range/Performance	P0A37	To detect the performance of the motor generator temperature sensor to validate is within range of the other temperature sensors, by comparing it to the other sensors it controls.	ABS [Average(PIMTEMP1,PIMTEMP2, APMTEMP,BOARDTEMP) - MGUTEMP]	> 30 deg C				two trips
					No Motor Over Temp fault	P0A3B		
					No Motor temp sensor circuit (High/Low) faults	P0A38 or P0A39		
Generator Temperature Sensor Circuit Low	P0A38	To detect the Motor Generator temperature sensor is shorted low	Sensor output voltage less than 0.2V (280degC)	< 0.2V	No Motor Over Temp fault	P0A3B	1 sec	two trips
Generator Temperature Sensor Circuit High	P0A39	To detect the Motor Generator temperature sensor is shorted high	Sensor output voltage greater than 3.95V&& PIMTEMP1 greater than 80degC && PIMTEMP2 greater than 80degC && APMTEMP greater than 80degC	> 3.95V	No Motor Over Temp fault	P0A3B	1 sec	two trips
Generator Over Temperature	P0A3B	Continuously monitor the Motor Generator temperature if it rises above an acceptable operating range set a fault.	MGU temperature	> 205 degC	Wakeup Signal	On	1 sec.	two trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Inverter temp sensor								
Starter/Generator Inverter Phase U Temperature Sensor Performance	P1A9B	To detect the failure of inverter temp sensor circuit usin rationality of other temperature sensors to determine if it is out of range	PIMTEMP1 - (DDTEMP+PIMTEMP2)/2 > 55degC or PIMTEMP2 - (DDTEMP+PIMTEMP1)/2 > 55degC for 50 times of 20ms(2.0s)	> 55 deg C			2 sec	two trips
					No V Phase or W Phase Over Temp fault	P1A9E or P1AA2		
					No V Phase or W Phase temp sensor circuit (High/Low)	P1A9C or P1A9D or P1AA0 or P1AA1		
Starter/Generator Inverter Phase U Temperature Sensor Circuit Low Voltage	P1A9C	To detect the inverter phase u temperature sensor is shoted low	Sensor output voltage is less than 0.2 V(200degC) 50 times of 20ms (1.0 s)	< 0.2 V	No V Phase or W Phase Over Temp fault	P1A9E or P1AA2	1 sec	two trips
Starter/Generator Inverter Phase U Temperature Sensor Circuit High Voltage	P1A9D	To detect the inverter phase u temperature sensor is shoted lhigh	Sensor output voltage greater than 4.6 V(-14.3degC) && PIMTEMP1 - (DDTEMP+PIMTEMP2)/2 > 55degC for 50 times of 20ms(1s)	> 4.6 V	No V Phase or W Phase Over Temp fault	P1A9E or P1AA2	1 sec	two trips
Starter/Generator Inverter Phase V Temperature Sensor Circuit Low Voltage	P1AA0	To detect the inverter phase v temperature sensor circuit is shorted low	Sensor output voltage is less than 0.2 V(200degC) for 50 times of 20ms (1.0 s)	< 0.2V	No V Phase or W Phase Over Temp fault	P1A9E or P1AA2	1 sec	two trips
Starter/Generator Inverter Phase V Temperature Sensor Circuit High Voltage	P1AA1	To detect the inverter phase v temperature sensor circuit is shorted high	Sensor output voltage greater than 4.6 V(-14.3degC) && PIMTEMP2 - (DDTEMP+PIMTEMP1)/2 > 55degC for 50 times of 20ms(1s)	> 4.6 V	No V Phase or W Phase Over Temp fault	P1A9E or P1AA2	1 sec	two trips
Starter/Generator Inverter Phase U Overtemperature	P1A9E	Continuously monitor the Starter Generator Phase U Inverter temperature, if it rises above an acceptable operating range set a fault.	Phase U Inverter Temperature.	>175 degC	Wakeup Signal	On	20 ms	two trips
Starter/Generator Inverter Phase V Overtemperature	P1AA2	Continuously monitor the Starter Generator Phase V Inverter temperature, if it rises above an acceptable operating range set a fault.	Phase V Inverter Temperature.	> 175 degC	Wakeup Signal	On	20 ms	two trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Motor R/D Sensor								
Generator Position Sensor Circuit	P0A4B	To detect Loss of speed signal or converter error (line open, short) in the Motor Generator position sensor circuit	R/D converter error (loss of signal or tracking)	100ms	WakeUp	On	100ms	two trips
Generator Position Sensor Circuit Range/Performance	P0A4C	To detect a fault in the angle data read by the motor generator position sensor circuit.	(data error) R/D IC angle data does not match with micro computer angle data. (initialization error)self check fault when initial sequence		WakeUp	On	init	two trips
Generator Position Sensor Circuit Overspeed	P0A50	To detect an over speed condition in the motor generator position sensor circuit	absolute motor speed	> 21000 rpm	WakeUp	On	10ms	two trips
PEB Elec. Coolant Pump								
Motor Electronics Coolant Pump Control Circuit Low High	P0A06	To detect control voltage relay circuit open or short to ground fault for the SGCM coolant pump	Eco-back signal (High) does not match to the LSD output signal (COOIP_D) for 4 times of 80ms.		0 WakeUp Pump	On On	320ms	two trips
Motor Electronics Coolant Pump Control Circuit High Low	P0A07	To detect the PWM circuit open or short to ground fault of the SGCM coolant pump	Eco-back signal (Low) does not match to the LSD output signal (COOIP_D) for 4 times of 80ms.		1 WakeUp Pump	On OFF	320ms	two trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.																
Auxiliary Transmission Fluid Pump																								
(Passive test)	P2797	To detect the Auxiliary Transmission Fluid Pump is not creating enough pressure in the Transmission to keep the PRND4 PSM pressure switch closed. Diagnostic is run continuously during hybrid engine off event.	PRND4 PSM Switch is OPEN during AutoStop	4 seconds out of 8 seconds	<table border="1"> <tr><td>The diagnostic system</td><td>Not disabled</td></tr> <tr><td>The Diagnostic</td><td>Enabled</td></tr> <tr><td>hybrid engine off</td><td>TRUE</td></tr> <tr><td>Transmission temperature</td><td>> 10C and < 100C</td></tr> <tr><td>The run/crank ignition voltage</td><td>>9V and <18V</td></tr> <tr><td>The PSM input PRND4</td><td>= valid</td></tr> <tr><td>On board prime</td><td>Not Active</td></tr> <tr><td>Enough time has passed to allow the pump pressure to stabilize</td><td>1 sec</td></tr> </table>	The diagnostic system	Not disabled	The Diagnostic	Enabled	hybrid engine off	TRUE	Transmission temperature	> 10C and < 100C	The run/crank ignition voltage	>9V and <18V	The PSM input PRND4	= valid	On board prime	Not Active	Enough time has passed to allow the pump pressure to stabilize	1 sec		8 sec	two trips
The diagnostic system	Not disabled																							
The Diagnostic	Enabled																							
hybrid engine off	TRUE																							
Transmission temperature	> 10C and < 100C																							
The run/crank ignition voltage	>9V and <18V																							
The PSM input PRND4	= valid																							
On board prime	Not Active																							
Enough time has passed to allow the pump pressure to stabilize	1 sec																							
(Onboard prime)	P2797	To detect the Auxiliary Transmission Fluid Pump is not creating enough pressure in the Transmission to keep the pressure switches closed.	On Board Prime The three PSM switches are read during a hybrid engine off event while the aux pump is commanded on if all of switches do not read on then the voltage to the pump is increased for a calibrated amount of time (30 seconds) if the three switches are still off (0)then a fault is set.	switch reads 0	<table border="1"> <tr><td>Hybrid Engine Off</td><td>TRUE</td></tr> <tr><td>SbHYBC_PumpPrimeNeeded</td><td>TRUE</td></tr> <tr><td>SeHYBC_b_EngineRunningPrev</td><td>FALSE</td></tr> <tr><td>LeHYBC_b_EngineRunning</td><td>TRUE</td></tr> </table>	Hybrid Engine Off	TRUE	SbHYBC_PumpPrimeNeeded	TRUE	SeHYBC_b_EngineRunningPrev	FALSE	LeHYBC_b_EngineRunning	TRUE		30 sec	two trips								
Hybrid Engine Off	TRUE																							
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LeHYBC_b_EngineRunning	TRUE																							

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Transmission Fluid Pressure (TFP) Position								
Stuck Off	P1808	To determine if the PRND4 PSM switch circuit is open or stuck off. This monitor checks the PRND4 PSM switch to see if it is Off when it should be on. If fail counts >= calibration Then Report test Fail If sample count >= Calibration Then report test pass	PRND4 PSM Switch	Switch is off for 3 seconds out of 4			4 sec	two trips
					And GetEPSR_b_CrankSnsr_FA() and VeHYBI_b_DRI_D_R_StateVld and VeEPSR_b_EngineRunning	FALSE TRUE TRUE		
					and Engine RPM And VeHYBI_b_DRI_D_Raw	> 500 FALSE (not in Drive)		
Stuck On	P1809	To determine if the PRND4 PSM switch circuit is short to ground or stuck on. This monitor checks the PRND4 PSM switch to see if it is On when it should be off (after key off).	PRND4 PSM Switch	ON for 2 seconds			8.5 sec	two trips
					VePMDR_b_RunCrankActive VePMDR_b_AccessoryOn And If (VeHYBD_t_EnblPressIndDepress	!= TRUE != TRUE >= 5.5 seconds (wait 5.5 seconds after key off to let pressure settle)		
					And Vehicle Speed And Engine movement detected TransOil temp Failsofted And VeHYBD_b_PRND4_ShutdownE nblid	== 0.0 == FALSE > 10 deg. C == CbFALSE		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Hybrid Generator Performance								
Hybrid Generator Performance	P0A92	The monitor is used to determine if the mechanical drive belt connection between the Engine and the Motor Generator has faulted.	If difference between the filtered, weighted predicted MGU speed and the actual filtered MGU speed)	> 25 or < -25			N/A	two trips
					VeDRER_DiagSystemDsbl	is equal to FALSE (the diagnostic system has not been disabled), and		
					VePMDR_b_RunCrankActive	is equal to TRUE (ignition position is run or crank)		
					VeEPSR_b_CKP_SnsrFaultActive	is equal to FALSE (there are no crank sensor faults)		
					VeECTR_b_ECT_SnsrFA	is equal to FALSE (there are no engine coolant temperature sensor faults)		
VeMAPR_b_MAP_SnsrFA	is equal to FALSE (there are no mass air flow sensor faults)							

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					VeEITR_b_IAT_SnsrCktFA	is equal to FALSE (there are no intake air temperature sensor faults)		
					VeENER_b_MG_TempVldty	is equal to TRUE (there are no motor/generator temperature faults)		
					VeENER_b_MG_AnglrPstnVldty	is equal to TRUE (there are no motor/generator position sensor faults)		
					VeENER_b_MG_SpdVldty	is equal to TRUE (there are no motor/generator speed faults)		
					VeENER_b_MG_DlvdTorqVldty	is equal to TRUE (there are no motor/generator torque delivered faults)		
Starter/Generator System No Crank at Restart	P1A6F	To determine performance failure of the Hybrid Motor Generator	This function performs the motor generator restart failed diagnostic. During a 36v motor generator start. If (VeENED_Cnt_MG_RestartFailed Cntr >= 1 fails) Then Report Test Failed using CeDFIR_e_SGCM_NoCrankAtRestart	1 fail			N/A	two trips
					VeDRER_DiagSystemDsbl (the diagnostic system has not been disabled)	is equal to FALSE ,		
					And The calibrations: And VeENED_b_HB_GenrPerf_FA	is equal to FALSE (there are no belt slip faults),		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					And VePMDR_b_RunCrankActive	does not equal False (the ignition switch is in the run/crank position),		
					And VeHYBR_b_MtrTorqDivdPerf_FA	is equal to FALSE (there are no MGU torque delivered faults)		
					And VeEONV_Pct_FuelLevel	> KeENED_Pct_MinFuel Restart (10%)		
Park Neutral Position Switch								
Circuit Low	P0851	The monitor is used to determine if the Park Neutral Position Switch is stuck in the P/N Position (low). The secondary parameters are used to determine that the transmission is in gear and not neutral or park, then the switch is read and a pass fail decision is made.	Park Neutral Switch	0 V (Short to Ground)			3.125 sec	two trips
					Engine Torque	> 50Nm		
					Engine Speed	> 1000rpm		
					Transmission Torque Converter Slip	> -10Nm and < 20Nm		
					Throttle Position	> 10%		
					Vehicle Speed	> 10 kph		

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
CAN Communications								
Lost Comm - ECM	U1886	This DTC indicates that ECM communication signal has been lost	Number of consecutive missed ECM messages	> 3	ESCM State System Voltage	RUN or SERVICE > 9V	1 test failure in 1 test sample Frequency: 1 sample/100ms	Two Trips
Pack/Link Voltage Circuits								
Pack Voltage Low	P0ABC	This DTC indicates that the Pack Voltage is low.	Pack Voltage Raw A/D Pack Voltage	< 0.5V < 5V	ESCM State System Voltage	RUN or SERVICE or POWERDOWN > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Pack Voltage High	P0ABD	This DTC indicates that the Pack Voltage is high.	Pack Voltage Raw A/D Pack Voltage	> 4.85 Volts > 49.3V	ESCM State System Voltage	RUN or SERVICE or POWERDOWN > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Link Voltage Low	P1A0E	This DTC indicates that the Link Voltage is low.	Link Voltage Raw A/D Link Voltage	< 0.5V < 5V	ESCM State Contactor State Contactor Status PASSED DTCs NOT FAILED DTCs System Voltage	RUN or SERVICE or POWERDOWN CLOSED != OPEN SERVICE DISCONNECT P0ADB P0ADC P0AA1 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Link Voltage High	P1A0F	This DTC indicates that the Link Voltage is high.	Link Voltage Raw A/D Link Voltage	> 4.85 Volts > 49.3V	ESCM State Contactor State PASSED DTCs NOT FAILED DTCs Contactor Status System Voltage	RUN or SERVICE or POWERDOWN CLOSED P0ADB P0ADC P0AA1 != OPEN SERVICE DISCONNECT > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Link Voltage Performance	P1A47	This DTC indicates the Link Voltage Performance.	Absolute Value (Link Voltage - Sum of all Module voltages)	> 5V	ESCM State Contactor State Contactor Status PASSED DTCs	RUN or SERVICE or POWERDOWN CLOSED != OPEN SERVICE DISCONNECT P1A0E P1A0F P1A22 P1A23 P1A29	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					NOT FAILED DTCs Module Voltages Link Voltage System Voltage	P1A2A P1A30 P1A31 P0ADB P0ADC P0AA1 VALID VALID > 9V		
Module Voltage Circuits								
Module 1 Voltage Low	P1A22	This DTC indicates that Module 1 Voltage is low.	Module 1 Voltage Raw A/D Module 1 Voltage	< 0.25 V < 2.5V	ESCM State System Voltage	RUN or SERVICE > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Module 1 Voltage High	P1A23	This DTC indicates that Module 1 Voltage is high.	Module 1 Voltage Raw A/D Module 1 Voltage	> 4.85 Volts > 49.3V	ESCM State System Voltage	RUN or SERVICE > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Module 2 Voltage Low	P1A29	This DTC indicates that Module 2 Voltage is low.	Module 2 Voltage Raw A/D Module 2 Voltage	< 0.25 V < 2.5V	ESCM State System Voltage	RUN or SERVICE > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Module 2 Voltage High	P1A2A	This DTC indicates that Module 2 Voltage is high.	Module 2 Voltage Raw A/D Module 2 Voltage	> 4.85 Volts > 49.3V	ESCM State System Voltage	RUN or SERVICE > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Module 3 Voltage Low	P1A30	This DTC indicates that Module 3 Voltage is low.	Module 3 Voltage Raw A/D Module 3 Voltage	< 0.25 V < 2.5V	ESCM State System Voltage	RUN or SERVICE > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Module 3 Voltage High	P1A31	This DTC indicates that Module 3 Voltage is high.	Module 3 Voltage Raw A/D Module 3 Voltage	> 4.85 Volts > 49.3V	ESCM State System Voltage	RUN or SERVICE > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature								
Temperature Sensor 1A Circuit Low	P0A9D	This DTC indicates that Temperature Sensor 1A is low.	Temperature Sensor 1A Raw A/D Temperature 1A	< 0.5 Volts > 87degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 1A Circuit High	P0A9E	This DTC indicates that Temperature Sensor 1A is high.	Temperature Sensor 1A Raw A/D Temperature 1A	> 4.5 Volts < -37.5degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Temperature Sensor 1B Circuit Low	P0AC7	This DTC indicates that Temperature Sensor 1B is low.	Temperature Sensor 1B Raw A/D Temperature 1B	< 0.5 Volts > 87degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 1B Circuit High	P0AC8	This DTC indicates that Temperature Sensor 1B is high.	Temperature Sensor 1B Raw A/D Temperature 1B	> 4.5 Volts < -37.5degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 2A Circuit Low	P0ACC	This DTC indicates that Temperature Sensor 2A is low.	Temperature Sensor 2A Raw A/D Temperature 2A	< 0.5 Volts > 87degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 2A Circuit High	P0ACD	This DTC indicates that Temperature Sensor 2A is high.	Temperature Sensor 2A Raw A/D Temperature 2A	> 4.5 Volts < -37.5degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 2B Circuit Low	P0AEA	This DTC indicates that Temperature Sensor 2B is low.	Temperature Sensor 2B Raw A/D Temperature 2B	< 0.5 Volts > 87degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 2B Circuit High	P0AEB	This DTC indicates that Temperature Sensor 2B is high.	Temperature Sensor 2B Raw A/D Temperature 2B	> 4.5 Volts < -37.5degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 3A Circuit Low	P1A1A	This DTC indicates that Temperature Sensor 3A is low.	Temperature Sensor 3A Raw A/D Temperature 3A	< 0.5 Volts > 87degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 3A Circuit High	P1A1B	This DTC indicates that Temperature Sensor 3A is high.	Temperature Sensor 3A Raw A/D Temperature 3A	> 4.5 Volts < -37.5degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 3B Circuit Low	P1A1D	This DTC indicates that Temperature Sensor 3B is low.	Temperature Sensor 3B Raw A/D Temperature 3B	< 0.5 Volts > 87degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Temperature Sensor 3B Circuit High	P1A1E	This DTC indicates that Temperature Sensor 3B is high.	Temperature Sensor 3B Raw A/D Temperature 3B	> 4.5 Volts < -37.5degC	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Current								
Current Sensor 1 (-30A to 30A) Circuit Low	P0AC1	This DTC indicates that Current Sensor 1 is low.	Current Sensor 1 Raw A/D Current Sensor 1* (saturation 0.25V/-33.75A)	< 0.2V < -34.5A	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Current Sensor 1 (-30A to 30A) Circuit High	P0AC2	This DTC indicates that Current Sensor 1 is high.	Current Sensor 1 Raw A/D Current Sensor 1* (saturation 4.75V/33.75A)	> 4.8V > 34.5A	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Current Sensor 2 Circuit Low	P1A48	This DTC indicates that Current Sensor 2 is low.	Current Sensor 2 Raw A/D Current Sensor 2* (saturation 0.25V/-381A)	< 0.2V < -388A	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Current Sensor 2 Circuit High	P1A49	This DTC indicates that Current Sensor 2 is high.	Current Sensor 2 Raw A/D Current Sensor 2* (saturation 4.75V/-181.5A)	> 4.8V > 187.8A	ESCM State NOT FAILED DTCs System Voltage	RUN or SERVICE P1A07 > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Fan								
Fan Control Low	P0A84	This DTC indicates that the Fan speed is low.	Fan Control Feedback	< 5%	ESCM State Fan State System Voltage System Voltage	RUN or SERVICE ON > 9V < 18V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Fan Control High	P0A85	This DTC indicates that the fan control speed is high.	Fan Control Feedback	> 95%	ESCM State Fan State Fan Command System Voltage System Voltage	RUN or SERVICE ON < 80% > 9V < 18V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Fan Stuck Off	P0A82	This DTC indicates that the Fan is stuck off.	Fan Speed Feedback	< 5%	ESCM State Fan State System Voltage System Voltage	RUN or SERVICE ON > 9V < 18V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Fan Stuck On	P0A83	This DTC indicates that the Fan is stuck on.	Fan Speed Feedback	> 5%	ESCM State Fan State System Voltage System Voltage	RUN or SERVICE OFF > 9V < 18V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Controller								
Controller Stack Overrun	P1A08	This DTC indicates that the Controller has encountered a stack over run.	# of Over Runs	> 0	ESCM State	RUN or SERVICE or POWERDOWN or POWERUP or FAILURE LOOP	1 test failure in 1 test sample Frequency: 1 sample/20ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Controller RAM error	P1A05	This DTC indicates that the Controller has encountered a RAM error.	Errors during write to a location in RAM	> 0	ESCM State	RUN or SERVICE or POWERDOWN or POWERUP or FAILURE LOOP	1 test failure in 1 test sample Frequency: 1 sample/20ms	Two Trips
Controller ROM error	P1A06	This DTC indicates that the Controller has encountered a ROM error.	Application checksum corrupted		ESCM State	RUN or SERVICE or POWERDOWN or POWERUP or FAILURE LOOP	1 test failure in 1 test sample Frequency: 1 sample/20ms	One Trip
Controller EEPROM error	P1A04	This DTC indicates that the Controller has encountered an EEPROM error	Critical EEPROM data corrupted		ESCM State	RUN or SERVICE or POWERDOWN or POWERUP or FAILURE LOOP	1 test failure in 1 test sample Frequency: 1 sample/100ms	Two Trips
Contactor								
Contactor Shorted Low	P0ADB	This DTC indicates that the Contactor is shorted low.	Contactor Control Feedback	> 98%	ESCM State Contactor State NOT FAILED DTCs Contactor Status System Voltage	RUN or SERVICE or POWERDOWN CLOSED P0ADB P0ADC P0AA1 != OPEN SERVICE DISCONNECT > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Contactor Shorted High	P0ADC	This DTC indicates that the Contactor is shorted high.	Contactor Control Feedback	< 5%	ESCM State Contactor State NOT FAILED DTCs Contactor Status System Voltage	RUN or SERVICE or POWERDOWN CLOSED P0ADB P0ADC P0AA1 != OPEN SERVICE DISCONNECT > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Contactor Stuck Closed	P0AA1	This DTC indicates that the Contactor is stuck closed.	Link Voltage after contactor open	> Link V before contactor open-500mV	System Power Mode Pack Current Contactor State Contactor Status PASSED DTCs	OFF or ACCESSORY < -0.3Amps (seen w/in 250msec of contactor open command) OPEN != OPEN SERVICE DISCONNECT P0ABC P0ABD P1A0E P1A0F P1A47	20 test failures in 20 test samples Frequency: 1 sample/20ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
					System Voltage	P0AC1 P0AC2 P1A48 P1A49 P0AC0 > 9V		
Current Sensor Performance								
Current Performance Golden Range Check	P0AC0	This DTC ensures the zero point for both current sensors is set within a good range.	Low Range Zero Point Raw A/D Low Range Zero Current High Range Zero Point Raw A/D High Range Zero Current	>2.5V+0.7% <2.5V-0.7% > 0.525A < -0.525A >3.3V+1% <3.3V-1% >4.375A <-4.375A	ESCM State PASSED DTCs NOT FAILED DTCs Contactor Command Contactor Status System Voltage	RUN or SERVICE P0AC1 P0AC2 P1A48 P1A49 P1A07 Commanded to CLOSED OPEN > 9V	15 test failure in 15 test sample Frequency: 1 sample/10ms	Two Trips
Current Performance Correlation Check	P0AC0	This DTC ensures that the difference between the two current sensors is within acceptable range.	Absolute Value (Current Sensor 1 - Current Sensor 2)	>5A	ESCM State PASSED DTCs NOT FAILED DTCs Current Sensor 1 & 2 Current Sensor 1 Current Sensor 2 System Voltage	RUN or SERVICE P0AC1 P0AC2 P1A48 P1A49 P1A07 VALID >-30A and <30A > -350A and < 150A > 9V	188 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips
Buffered 5V Circuit								
Buffered +5V out of range	P1A07	This DTC ensures that the buffered +5V used by the electronics has not fallen below a good value.	Buffered 5V Pack Voltage	< 4.7V	ESCM State System Voltage	POWERUP or RUN or SERVICE > 9V	93 test failures in 250 test samples Frequency: 1 sample/20ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Battery System Performance Diagnostics								
Replace Hybrid Battery Pack	P0A80	This DTC indicates the Battery Pack resistance has increased such that it affects the hybrid vehicle performance.	Pack_Resistance	> Resistance_ Criteria Where Resistance_ Criteria = TempFactorLookup TempFactorLookup(T) = -40 .214 -30 .214 -20 .214 -10 .214 0 .11 10 .068 20 .043 30 .036 40 .031 50 .031 60 .031 70 .031 80 .031 90 .031 100 .031 110 .031 120 .031	Run/Crank Contactor Status Battery Voltage Battery Current Battery Temp Battery State of Charge Battery Resistance Low Battery Resistance Severe Low Battery Resistance Calc. Regression No active DTCs Battery Temp Battery State of Charge	active closed valid valid valid valid valid valid valid active P0AC0 P0AC1 P0AC2 P1A48 P1A49 P0ABC P0ABD P1A22 P1A23 P1A29 P1A2A P1A30 P1A31 NOT < -7 C NOT > 90%	1100 test failures in a 1150 test samples 1 sample / 500 ms	Two Trips
SOH - Delta V - Voltage Deviation High	P1A59	Checks the deviation of the voltage across the battery pack using the 3 module voltage sensors. If one module or electrical connection within the pack is bad, it will manifest itself in a high Delta – V	MAX(ModuleVolt1, ModuleVolt2, ModuleVolt3) - MIN (ModuleVolt1, ModuleVolt2, ModuleVolt3) <---OR---> MAXcorrected (ModuleVolt1, ModuleVolt2, ModuleVolt3) - MINcorrected (ModuleVolt1, ModuleVolt2, ModuleVolt3) Where CorrectedModVolt = PackVoltage – Module VoltageX1 – ModuleVoltage X2 Where X1 and X2 are the VALID signal readings	> 0.75 Volts	Run/Crank Contactor Status Module Voltage 1 Module Voltage 2 Module Voltage 3 any 1 module voltage - AND - Pack Voltage	active closed VALID VALID VALID <---OR---> INVALID VALID	60 test failures in 100 test samples Frequency: 1 sample/100ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Battery Pack Over Current	P1AB0	Battery Pack Over Current. May have Cleared Fuse.	Battery Pack Current	> 140 < -330	Battery Pack Curr Current Sensor Out of Range Diagnostics and Performance (P0AC0, P0AC1, P0AC2, P1A48, P1A49) Run/Crank Contactor Status	VALID NOT FAIL active closed	200 test failures in a 24 test samples Frequency: 1 sample/50 ms	One Trip
Temperature								
Temperature Sensor 1a Ckt Performance	P0A9C	Rationality Check for the Temperature Sensor 1a Located at the ESCM	ModuleTemp1a - ValidModuleTempsAvg	> BattRatThresh Where BattRatThresh = (in: Tpack, out: temp thresh)= [-40 8 -30 8 -20 8 -10 8 0 8 10 8 20 8 30 8 40 8 50 8 60 8]	BatteryModule Temperature1a Run/Crank Contactor Status	valid active closed	30 test failures in a 40 test samples 1 sample / 100 ms	Two Trips
Temperature Sensor 1b Ckt Performance	P0AC6	Rationality Check for the Temperature Sensor 1b Located at the ESCM	ModuleTemp1b - ValidModuleTempsAvg	> BattRatThresh Where BattRatThresh = (in: Tpack, out: temp thresh)= [-40 8 -30 8 -20 8 -10 8 0 8 10 8 20 8 30 8 40 8 50 8 60 8]	BatteryModule Temperature1b Run/Crank Contactor Status	valid active closed	30 test failures in a 40 test samples 1 sample / 100 ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Temperature Sensor 2a Ckt Performance	P0ACB	Rationality Check for the Temperature Sensor 2a Located at the ESCM	ModuleTemp2a - ValidModuleTempsAvg	> BattRatThresh Where BattRatThresh = (in: Tpack, out: temp thresh)= [-40 8 -30 8 -20 8 -10 8 0 8 10 8 20 8 30 8 40 8 50 8 60 8]	BatteryModule Temperature2a Run/Crank Contactor Status	valid active closed	30 test failures in a 40 test samples 1 sample / 100 ms	Two Trips
Temperature Sensor 2b Ckt Performance	P0AE9	Rationality Check for the Temperature Sensor 2b Located at the ESCM	ModuleTemp2b - ValidModuleTempsAvg	> BattRatThresh (in: Tpack, out: temp thresh)= [-40 8 -30 8 -20 8 -10 8 0 8 10 8 20 8 30 8 40 8 50 8 60 8]	BatteryModule Temperature2b Run/Crank Contactor Status	valid active closed	30 test failures in a 40 test samples 1 sample / 100 ms	Two Trips
Temperature Sensor 3a Ckt Performance	P1A19	Rationality Check for the Temperature Sensor 3a Located at the ESCM	ModuleTemp3a - ValidModuleTempsAvg	> BattRatThresh (in: Tpack, out: temp thresh)= [-40 8 -30 8 -20 8 -10 8 0 8 10 8 20 8 30 8 40 8 50 8 60 8]	BatteryModule Temperature3a Run/Crank Contactor Status	valid active closed	30 test failures in a 40 test samples 1 sample / 100 ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Temperature Sensor 3b Ckt Performance	P1A1C	Rationality Check for the Temperature Sensor 3b Located at the ESCM	ModuleTemp3b - ValidModuleTempsAvg	> BattRatThresh (in: Tpack, out: temp thresh)= [-40 8 -30 8 -20 8 -10 8 0 8 10 8 20 8 30 8 40 8 50 8 60 8]	BatteryModule Temperature3b Run/Crank Contactor Status	valid active closed	30 test failures in a 40 test samples 1 sample / 100 ms	Two Trips
Voltage								
Pack Voltage Sensor Circuit Performance	P0ABB	Rationality Check for the Voltage Sensor Located at The Battery Pack (ESCM)	BatteryPackVoltage- PackRatMean_Volt (PackRatMean_Volt = (PowerElectronicsVolt + ModVolt1 + ModVolt2 + ModVolt3)/ 2.)	> 2	Battery Pack Voltage Validity Startup Timer Battery Current Validity Battery Current Run/Crank Contactor Status	valid > 6 Sec valid > -5 Amps < 5 Amps active closed	9 test failures in a 10 test samples 1 sample / 100 ms	Two Trips
Voltage Sensor 1 Circuit Performance	P1A25	Rationality Check for the Module Voltage Sensor 1 located at the The Battery Pack (ESCM)	ModuleVoltage1 - ModuleVoltsAvg where ModuleVoltsAvg = [MIDDLE(ModVolt1, ModVolt2, ModVolt3) + PackVoltage/3 + PowerElectronicsVolt/3]/3	> 6 Volts	Pack Voltage Startup Timer Battery Current Run/Crank Contactor Status	VALID > 6 seconds VALID > -5 A < 5 A active closed	Frequency: 1 sample/100ms	Two Trips
Voltage Sensor 2 Circuit Performance	P1A2C	Rationality Check for the Module Voltage Sensor 2 located at the The Battery Pack (ESCM)	ModuleVoltage2 - ModuleVoltsAvg where ModuleVoltsAvg = [MIDDLE(ModVolt1, ModVolt2, ModVolt3) + PackVoltage/3 + PowerElectronicsVolt/3]/3	> 6 Volts	Pack Voltage Startup Timer Battery Current Run/Crank Contactor Status	VALID > 6 seconds VALID > -5 A < 5 A active closed	Frequency: 1 sample/100ms	Two Trips
Voltage Sensor 3 Circuit Performance	P1A33	Rationality Check for the Module Voltage Sensor 3 located at the The Battery Pack (ESCM)	ModuleVoltage3 - ModuleVoltsAvg where ModuleVoltsAvg = [MIDDLE(ModVolt1, ModVolt2, ModVolt3) + PackVoltage/3 + PowerElectronicsVolt/3]/3	> 6 Volts	Pack Voltage Startup Timer Battery Current Run/Crank Contactor Status	VALID > 6 seconds VALID > -5 A < 5 A active closed	Frequency: 1 sample/100ms	Two Trips

COMPONENT/ SYSTEM	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA	THRESHOLD VALUE	SECONDARY PARAMETERS	ENABLE CONDITIONS	TIME REQUIRED	MIL ILLUM.
Hybrid Battery 1 Voltage Low	P1A26	Detects a Low Battery Pack Voltage causing Disabled Hybrid	Battery Pack Voltage	< 22 Volts	Run/Crank	active	50ms	Two Trips
Contactor								
Hybrid Battery Contactor Stuck Open	P0AA2	Detects that the Battery Pack has not closed contactor after commanding contactor closed OR Detects that the Open service Disconnect is active	ECM Contactor Commanded Close Time since Commanded Close Contactor Status Contactor Status Contactor Status	Close >= 3 Sec NOT Defaulted Open - Impact Detected, Open - Overtemperature, or Open - ECM commanded NOT Defaulted Open Serv Disconnect	Time Since Key Off OR Controlled Disconnect Contactor Hybrid Default 1 Run/Crank	< 3 Sec FALSE FALSE active	1 test failure in 1 test sample	Two Trips