DTC		108	111	112
Name		MAP	IAT	IAT
DTC Name		MAP high pressure	IAT Higher Than Expected Stage 1	IAT Low Voltage
J1939	SPN	106	105	105
	FMI	16	15	4
MIL		ON	OFF	OFF
Detected Item		• Sensor/wiring harness short to power • Sensor malfunction	• Intake air temperature abnormality (High side stage 1)	• Sensor/wiring harness short to ground • Sensor malfunction
DTC Set Preconditions		• Engine Cranking or Running	• Engine Running	• Engine Running
DTC Set Conditions		• MAP pressure > 110.3 kPa [abs] (1.125 kgf/cm^2, 16.00 psia) • and TPS < 3.0 % • and RPM > 1000 min^{-1} (rpm)	• rum-time wait for all IAT HiExp faults 0.0 sec • IAT > 71 degC (160 degF) • and RPM > 1000 min^{-1} (rpm)	• IAT voltage < 0.100 V
Period for Judgment or Number of Occurrence for Judgment		• 2 sec	• 60 sec	• 1 sec
System Action		• AL Disable KC • Power derate 1	• AL Disable • Power derate 1	• AL Disable • Power derate 1
Engine Warning Light		ON	ON	ON

DTC		113	116	117
Name		IAT	ECT/CHT	ECT/CHT
DTC Name		IAT High Voltage	ECT Higher Than Expected Stage 1	ECT/CHT Low Voltage
J1939	SPN	105	110	110
	FMI	3	15	4
MIL		OFF	OFF	OFF
Detected Item		• Sensor/wiring harness open/short to power • Sensor malfunction	• Engine coolant temperature abnormality (High side stage 1)	• Sensor/wiring harness short to ground • Sensor malfunction
DTC Set Preconditions		• Engine Running	• Engine Running	• Engine Running
DTC Set Conditions		• IAT voltage > 4.90 V	• run time wait for ECT HiExp faults 30.0 sec • ECT > 110 degC (230 degF) • and RPM > 600 min^{-1} (rpm)	• ECT voltage < 0.100 V
Period for Judgment or Number of Occurrence for Judgment		• 1 sec	• 20 sec	• 1 sec
System Action		• AL Disable • Power derate 1	• AL Disable • Power derate 1	• AL Disable • Power derate 1
Engine Warning Light		ON	ON	ON

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DTC		118	121	122
Name		ECT/CHT	TPS	TPS
DTC Name		ECT/CHT High Voltage	TPS1 % Lower Than TPS2 %	TPS1 Signal Voltage Low
J1939	SPN	110	51	51
	FMI	3	1	4
MIL		OFF	ON	ON
Detected Item		• Sensor/wiring harness open/short to power • Sensor malfunction	• TPS malfunction	• TPS circuit in the harness short to ground • TPS malfunction
DTC Set Preconditions		• Engine Running	• Key-On, Engine Cranking, or Running	• Key-On, Engine Cranking, or Running
DTC Set Conditions		• ECT voltage > 4.90 V	• (TPS1 % – TPS2 %) < –20.0 %	• TPS1 voltage < 0.200 V
Period for Judgment or Number of Occurrence for Judgment		• 1 sec	• 1 sec	• 0.5 sec
System Action		• AL Disable • Power derate 1	• Shutdown	• Shutdown
Engine Warning Light		ON	ON	ON

DTC		123	127	129
Name		TPS	IAT	IAT
DTC Name		TPS1 Signal Voltage High	IAT Higher Than Expected Stage 2	BP Low Pressure
J1939	SPN	51	105	108
	FMI	3	0	1
MIL		ON	OFF	ON
Detected Item		• TPS circuit in the harness short to power • TPS malfunction	• Intake air temperature abnormality (High side stage 2)	• Sensor out of calibration • Loss for 5V reference feed • (5V_ext1) to MAP • Signal wire open or shorted to ground
DTC Set Preconditions		• Key-On, Engine Cranking, or Running	• Engine Running	• Engine Running
DTC Set Conditions		• TPS1 voltage > 4.80 V	• rum-time wait for all IAT HiExp faults 0.0 sec • IAT > 93 degC (200 degF) • and RPM > 1000 min^{-1} (rpm)	• BP < 57.2 kPa [abs] (0.584 kgf/cm^2, 8.30 psia)
Period for Judgment or Number of Occurrence for Judgment		• 0.5 sec	• 120 sec	• 1 sec
System Action		• Shutdown	• AL Disable • Force idle	• AL Disable KC
Engine Warning Light		ON	ON	ON

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DTC		134	154	171
Name		EGO Sensors	EGO Sensors	Adaptive Learn
DTC Name		EGO1 Open/Lazy (HO2S1)	EGO2 Open/Lazy (HO2S2)	Adaptive Learn Bank 1 High (Gasoline)
J1939	**SPN**	3217	3227	4237
	FMI	5	5	0
MIL		ON	ON	ON
Detected Item		• Open feed circuit to O_2 heater • Open heater ground circuit • Open or shorted to ground O_2 signal wire • open sensor ground (5Vrtn1) • inoperative sensor	• Open feed circuit to O_2 heater • Open heater ground circuit • Open or shorted to ground O_2 signal wire • open sensor ground (5Vrtn1) • inoperative sensor	• exhaust leaks upstream or near the HEGO sensor • reduced fuel supply pressure to the fuel injection system • a inoperative sensor • an injector that is stuck closed or dirty • weak spark or lack of spark to a cylinder • a MAP sensor that indicates pressure that is lower than ture pressure
DTC Set Preconditions		• Engine Running	• Engine Running	• Engine Running, Adaptive Mode
DTC Set Conditions		• EGO cold persistently > 120.0 sec	• EGO cold persistently > 120.0 sec	• AL_BM > 30 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)
Period for Judgment or Number of Occurrence for Judgment		• 5 sec	• 5 sec	• 3 updates
System Action		• CL Disable • AL Disable KC	• CL Disable • AL Disable KC	• CL Disable • AL Disable KC
Engine Warning Light		ON	ON	ON

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DTC		172	182	183
Name		Adaptive Learn	FT	FT
DTC Name		Adaptive Learn Bank1 Low (Gasoline)	FT gasoline low	FT gasoline high
J1939	**SPN**	4237	174	174
	FMI	1	4	3
MIL		ON	ON	ON
Detected Item		• an inoperative O_2 sensor • high fuel supply pressure or temperature • internal mechanical engine damage • an injector that is stuck open or leaking	• Operating in a frigid atmosphere • Sensor out of calibration	• Operating in a hot environment • Sensor out of calibration
DTC Set Preconditions		• Engine Running, Adaptive Mode	• Engine Running	• Engine Running
DTC Set Conditions		• AL_BM < –30 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)	• FT fault mode Temp only • fuel temp < –37.0 degC (–35.0 degF)	• FT fault mode Temp only • fuel temp > 60.0 degC (140.0 degF)
Period for Judgment or Number of Occurrence for Judgment		• 3 updates	• 1 sec	• 1 sec
System Action		• CL Disable • AL Disable KC	• None	• Power derate 2
Engine Warning Light		ON	ON	ON

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DTC		187	217	219
Name		FT	ECT/CHT	Engine Speed
DTC Name		FT Gaseous Fuel Extremery Low	ECT Higher Than Expected 2	RPM Higher Than Max Allowed Governed Speed
J1939	SPN	3468	110	515
	FMI	1	0	15
MIL		ON	OFF	OFF
Detected Item		• Not vaporized completely	• Engine coolant temperature abnormality (High side stage 2)	• Engine over speed condition, stuck throttle, large vacuum leak into intake manifold after throttle blade
DTC Set Preconditions		• Engine Running	• Engine Running	• Engine Running
DTC Set Conditions		• Fuel temp < –40 °C (–40 °F)	• run time wait for ECT HiExp faults 30.0 sec • ECT > 116 degC (240 degF) • and RPM > 600 min^{-1} (rpm)	• RPM > 3800 min^{-1} (rpm)
Period for Judgment or Number of Occurrence for Judgment		• 1 sec	• 30 sec	• 1 sec
System Action		• None	• Power derate 2	• reduce throttle to limit speed
Engine Warning Light		ON	ON	ON

DTC		221	222	223
Name		TPS	TPS	TPS
DTC Name		TPS1 % Higher Than TPS2 %	TPS2 Signal Voltage Low	TPS2 Signal Voltage High
J1939	SPN	51	3673	3673
	FMI	0	4	3
MIL		ON	ON	ON
Detected Item		• TPS malfunction	• TPS circuit in the harness short to ground • TPS malfunction	• TPS circuit in the harness short to power • TPS malfunction
DTC Set Preconditions		• Key-On, Engine Cranking, or Running	• Key-On, Engine Cranking, or Running	• Key-On, Engine Cranking, or Running
DTC Set Conditions		• (TPS1 % – TPS2 %) > 20.0 %	• TPS2 voltage < 0.200 V	• TPS2 voltage > 4.80 V
Period for Judgment or Number of Occurrence for Judgment		• 1 sec	• 0.5 sec	• 0.5 sec
System Action		• Shutdown	• Shutdown	• Shutdown
Engine Warning Light		ON	ON	ON

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DTC		261	262	264
Name		Injectors	Injectors	Injectors
DTC Name		Injector Driver #1 Open/Short-To-Ground	Injector Driver #1 Short-To-Power	Injector Driver #2 Open/Short-To-Ground
J1939	**SPN**	651	651	652
	FMI	5	6	5
MIL		ON	ON	ON
Detected Item		• Loss of 12.0 V feed to injector • open injector coil • open or shorted to ground injector driver circuit in engine harness	• Injector coil shorted internally • Injector driver circuit shorted to voltage between injector and ECM	• Loss of 12.0 V feed to injector • open injector coil • open or shorted to ground injector driver circuit in engine harness
DTC Set Preconditions		• Key-On, Engine Running	• Key-On, Engine Running	• Key-On, Engine Running
DTC Set Conditions		• Injector1 off-state low-side < 4.00 V • and battery voltage > 9.00 V	• Injector1 on-state low-side > 4.00 V • and battery voltage < 16.0 V	• Injector2 off-state low-side < 4.00 V • and battery voltage > 9.00 V
Period for Judgment or Number of Occurrence for Judgment		• 10 samples	• 10 samples	• 10 samples
System Action		• CL Disable • AL Disable KC • Low Rev Limit	• CL Disable • AL Disable KC • Low Rev Limit	• CL Disable • AL Disable KC • Low Rev Limit
Engine Warning Light		ON	ON	ON

DTC		265	267	268
Name		Injectors	Injectors	Injectors
DTC Name		Injector Driver #2 Short-To-Power	Injector Driver #3 Open/Short-To-Ground	Injector Driver #3 Short-To-Power
J1939	**SPN**	652	653	653
	FMI	6	5	6
MIL		ON	ON	ON
Detected Item		• Injector coil shorted internally • Injector driver circuit shorted to voltage between injector and ECM	• Loss of 12.0 V feed to injector • open injector coil • open or shorted to ground injector driver circuit in engine harness	• Injector coil shorted internally • Injector driver circuit shorted to voltage between injector and ECM
DTC Set Preconditions		• Key-On, Engine Running	• Key-On, Engine Running	• Key-On, Engine Running
DTC Set Conditions		• Injector2 on-state low-side > 4.00 V • and battery voltage < 16.0 V	• Injector3 off-state low-side < 4.00 V • and battery voltage > 9.00 V	• Injector3 on-state low-side > 4.00 V • and battery voltage < 16.0 V
Period for Judgment or Number of Occurrence for Judgment		• 10 samples	• 10 samples	• 10 samples
System Action		• CL Disable • AL Disable KC • Low Rev Limit	• CL Disable • AL Disable KC • Low Rev Limit	• CL Disable • AL Disable KC • Low Rev Limit
Engine Warning Light		ON	ON	ON

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DTC		270	271	326
Name		Injectors	Injectors	Knock
DTC Name		Injector Driver #4 Open/Short-To-Ground	Injector Driver #4 Short-To-Power	Knock 1 Excessive or Erratic Signal
J1939	**SPN**	654	654	731
	FMI	5	6	2
MIL		ON	ON	ON
Detected Item		• Loss of 12.0 V feed to injector • open injector coil • open or shorted to ground injector driver circuit in engine harness	• Injector coil shorted internally • Injector driver circuit shorted to voltage between injector and ECM	• Knock signal abnormality (High side) • Sensor malfunction
DTC Set Preconditions		• Key-On, Engine Running	• Key-On, Engine Running	• Key On, Engine On
DTC Set Conditions		• Injector4 off-state low-side < 4.00 V • and battery voltage > 9.00 V	• Injector4 on-state low-side > 4.00 V • and battery voltage < 16.0 V	• KNK1 sensor input > 0.500 V • MAP < 55.2 kPa [abs] (0.562 kgf/cm^2, 8.00 psia)
Period for Judgment or Number of Occurrence for Judgment		• 10 samples	• 10 samples	• 3 sec
System Action		• CL Disable • AL Disable KC • Low Rev Limit	• CL Disable • AL Disable KC • Low Rev Limit	• Power derate 1 • Retard Fault KNK
Engine Warning Light		ON	ON	ON

DTC		327	336	337
Name		Knock	Cam/Crank Sensors	Cam/Crank Sensors
DTC Name		Knock 1 Sensor Open or Not Present	Crank Input Signal Noise	Loss of Crankshaft Input Signal
J1939	**SPN**	731	636	636
	FMI	4	2	4
MIL		ON	ON	ON
Detected Item		• Sensor/wiring harness open/short to power • Sensor malfunction	• Crank+ or Crank– circuits in wrong connector terminal slot	• Loss of sensor feed • open sensor ground • open or shorted to ground signal wire
DTC Set Preconditions		• Key On, Engine On	• Key On, Engine On	• Key On, Engine On
DTC Set Conditions		• KNK1 sensor input < 0.005 V • and RPM > 2000 min^{-1} (rpm) • and MAP > 82.7 kPa [abs] (0.844 kgf/cm^2, 12.00 psia)	• Number of invalid cam re-syncs 3 re-syncs • within a time window of <= 800 ms	• Cam pulsed without crank activity > 3 cam pulses
Period for Judgment or Number of Occurrence for Judgment		• 10 sec	• 1 sec	• 1 sec
System Action		• Power derate 1 • Retard Fault KNK	• AL Disable KC	• None
Engine Warning Light		ON	ON	ON

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DTC		341	342	359
Name		Cam/Crank Sensors	Cam/Crank Sensors	Lockoff/Fuel Diagnostics
DTC Name		Camshaft Input Signal Noise	Loss of Camshaft Input Signal	Fuel run-out longer than expected
J1939	**SPN**	723	723	632
	FMI	2	4	31
MIL		ON	ON	ON
Detected Item		• Cam+ or Cam– circuits in wrong connector terminal slot	• Loss of feed voltage to Cam sensor • loss of signal or ground circuits • faulty sensor	
DTC Set Preconditions		• Key On, Engine On	• Key On, Engine On	• Key Off, Engine On
DTC Set Conditions		• Number of invalid cam re-syncs 3 re-syncs • within a time window of <= 700 ms	• No cam pulse in 2.0 cycles • and RPM > 150 min^{-1} (rpm)	• Fuel run-out engine run time > 20000 ms
Period for Judgment or Number of Occurrence for Judgment		• 1 sec	• 1 sec	• N/A
System Action		• AL Disable KC	• AL Disable KC	• Shutdown
Engine Warning Light		ON	ON	OFF

DTC		420	524	562
Name		Catalyst	Oil Pressure	Battery Voltage
DTC Name		Catalyst Monitor	Oil Pressure Low	Battery Voltage (VBAT) Low
J1939	**SPN**	3050	100	168
	FMI	11	1	17
MIL		OFF	ON	ON
Detected Item			• Low Oil Pressure	• Wiring harness open/short/damage • Battery abnormality
DTC Set Preconditions		• Engine Running	• Key On, Engine On	• Key On, Engine On
DTC Set Conditions		• EGO3/4 RMS > 0.008 phi • and EGO3/4 RMS > EGO1/2 RMS 50 % • and EGO3/4 RMS > CL waveform RMS 50 % • and mass flow at ports >= 10.0 g/sec and <= CBT –CBT_ss +/– 50.0 degF	• run time wait for oil pressure low faults 4.0 sec • RPM lower limit for oil pressure low faults 300 min^{-1} (rpm) • Oil pressure pulled-up input less than a threshold voltage of 2.50 V	• Voltage < 9.00 V • and RPM > 1000 min^{-1} (rpm)
Period for Judgment or Number of Occurrence for Judgment		• 100 updates	• 1 sec	• 5 sec
System Action		• Shutdown • CL Disable • AL Disable • Hard Warning	• Shutdown	• AL Disable KC • Power derate 2
Engine Warning Light		ON	ON	ON

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DTC		563	601	604
Name		Battery Voltage	Internal Processor Diagnostics	Internal Processor Diagnostics
DTC Name		Battery Voltage (VBAT) High	Microprocessor Failure-FLASH	Microprocessor Failure-RAM
J1939	SPN	168	628	630
	FMI	15	13	12
MIL		ON	ON	ON
Detected Item		• System voltage abnormality (High side)	• Faulty ECU	• Faulty ECU
DTC Set Preconditions		• Key-On, Engine Cranking, or Running	• Key on	• Key on
DTC Set Conditions		• Voltage > 16.00 V	• Internal microprocessor error	• Internal ECM microprocessor memory access failure
Period for Judgment or Number of Occurrence for Judgment		• 3 sec	• N/A	• N/A
System Action		• AL Disable KC • Low Rev Limit	• Never Forget • AL Disable KC • Power derate 2	• Never Forget • AL Disable KC • Power derate 2
Engine Warning Light		ON	OFF	OFF

DTC		606	627	628	
Name		Internal Processor Diagnostics	Fuel Pump Relay Control/Coil	Fuel Pump Relay Control/Coil	Fuel Pump Motor Feedback
DTC Name		Microprocessor Failure-COP	Fuel Pump Relay Coil Open	Fuel Pump Relay Ground Short	
J1939	SPN	629	1348	1348	1347
	FMI	31	5	4	5
MIL		ON	ON	ON	ON
Detected Item		• Faulty ECU	• Open coil in relay • Open in relay driver circuit in engine harness	• Relay pull in coil shorted internally • relay driver circuit shorted to ground in wire harness	
DTC Set Preconditions		• Key on	• Key On, Engine Off	• Engine Running	
DTC Set Conditions		• Internal microprocessor error	• Fuel Pump relay coil output open circuit	• Fuel Pump relay coil output shorted to ground	• Fuel pump motor high-side on-state < 4.0 volts • battery voltage > 8.0 volts
Period for Judgment or Number of Occurrence for Judgment		• N/A	• 10 samples	• 10 samples	• 2 sec
System Action		• Never Forget • AL Disable KC • Power derate 2	• None	• None	• None
Engine Warning Light		OFF	ON	ON	ON

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DTC		629		642	643
Name		Fuel Pump Relay Control/Coil	Fuel Pump Motor Feedback	5 V External	5 V External
DTC Name		Fuel Pump Relay Coil Short-To-Power		Sensor Supply Voltage 1 Low (5Vext1)	Sensor Supply Voltage 1 High (5Vext1)
J1939	SPN	1348	1347	1079	1079
	FMI	3	6	4	3
MIL		ON	ON	ON	ON
Detected Item		• Shorted relay pull in coil • relay driver circuit shorted to voltage in wire harness		• Wiring harness short to ground • ECM malfunction	• Wiring harness short to 12.0 V power • ECM malfunction
DTC Set Preconditions		• Engine Running		• Key-On, Engine OFF, or Running	• Key-On, Engine OFF, or Running
DTC Set Conditions		• Fuel Pump relay coil output short to power/ voltage	• Fuel pump motor high-side off-state < 4.0 volts • battery voltage < 16.0 volts	• 5VE1 < 4.60 V	• 5VE1 > 5.40 V
Period for Judgment or Number of Occurrence for Judgment		• 10 samples	• 2 sec	• 1 sec	• 1 sec
System Action		• None	• None	• AL Disable • Power derate 1	• AL Disable • Power derate 1
Engine Warning Light		ON	ON	ON	ON

DTC		652	653	686
Name		5 V External	5 V External	Power Relay Control/Coil
DTC Name		Sensor Supply Voltage 2 Low (5Vext2)	Sensor Supply Voltage 2 High (5Vext2)	Power Relay Ground Short
J1939	SPN	1080	1080	1485
	FMI	4	3	4
MIL		ON	ON	ON
Detected Item		• Wiring harness short to ground • ECM malfunction	• Wiring harness short to 12.0 V power • ECM malfunction	• Short to ground in relay pull in coil • short to ground in relay driver circuit in wire harness
DTC Set Preconditions		• Key-On, Engine OFF, or Running	• Key-On, Engine OFF, or Running	• Key On, Engine Off
DTC Set Conditions		• 5VE2 < 4.60 V	• 5VE2 > 5.40 V	• Power relay coil output shorted to ground
Period for Judgment or Number of Occurrence for Judgment		• 1 sec	• 1 sec	• 10 samples
System Action		• AL Disable • Power derate 1	• AL Disable • Power derate 1	• None
Engine Warning Light		ON	ON	OFF

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DTC		687	1111	1112
Name		Power Relay Control/Coil	Engine Speed	Engine Speed
DTC Name		Power Relay Coil Short-To-Power	RPM Above Fuel Rev Limit Level	RPM Above Spark Rev Limit Level
J1939	SPN	1485	515	515
	FMI	3	16	0
MIL		ON	ON	ON
Detected Item		• Shorted relay pull in coil • relay driver circuit shorted to voltage in wire harness	• Engine overspeed condition, faulty Crank sensor or input	• Engine overspeed condition, faulty Crank sensor or input
DTC Set Preconditions		• Key On, Engine Off	• Engine Running	• Engine Running
DTC Set Conditions		• Power relay coil output short to power/voltage	• RPM > 4200 min^{-1} (rpm)	• RPM > 4300 min^{-1} (rpm)
Period for Judgment or Number of Occurrence for Judgment		• 10 samples	• 1 sec	• 1 sec
System Action		• None	• disable fuel injectors or gaseous fuel control actuator	• disable ignition coils
Engine Warning Light		OFF	ON	ON

DTC		1121	1151	1152
Name		FPP	Closed Loop	Closed Loop
DTC Name		FPP1/2 Simultaneous Voltages Out-of-Range	Closed Loop High (LPG)	Closed Loop Low (LPG)
J1939	SPN	91	4236	4236
	FMI	31	0	1
MIL		ON	ON	ON
Detected Item		• Wiring harness open/short/damage • FPP malfunction	• exhaust leaks upstream or near the HEGO sensor • reduced fuel supply pressure to the gaseous fuel control system • a fuel supply or manifold leak • a non-responsive HEGO sensor	• high fuel supply pressure to the gaseous fuel control or faulty pressure regulator • a non-responsive HEGO sensor
DTC Set Preconditions		• Key on, Engine Off	• Engine Running, Closed Loop Mode	• Engine Running, Closed Loop Mode
DTC Set Conditions		• User same parameter as individual FPP 1/2 voltage fault detection above	• CL_BM > 35 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)	• CL_BM < –35 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)
Period for Judgment or Number of Occurrence for Judgment		• 0.5 sec	• Power Derate2 • 5 updates	• 5 updates
System Action		• Power Derate 2 • Low Rev Limit • Force Idle	• CL Disable • AL Disable KC	• CL Disable • AL Disable KC
Engine Warning Light		OFF	ON	ON

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DTC		1153	1154	1155
Name		Closed Loop	Closed Loop	Closed Loop
DTC Name		Closed Loop High (NG)	Closed Loop Low (NG)	Closed Loop Bank 1 High (Gasoline)
J1939	**SPN**	4236	4236	4236
	FMI	0	1	0
MIL		ON	ON	ON
Detected Item		• exhaust leaks upstream or near the HEGO sensor • reduced fuel supply pressure to the gaseous fuel control system • a fuel supply or manifold leak • a non-responsive HEGO sensor	• high fuel supply pressure to the gaseous fuel control or faulty pressure regulator • a non-responsive HEGO sensor	• exhaust leaks upstream or near the HEGO sensor • reduced fuel supply pressure • an injector that is stuck closed
DTC Set Preconditions		• Engine Running, Closed Loop Mode	• Engine Running, Closed Loop Mode	• Engine Running, Closed Loop Mode
DTC Set Conditions		• CL_BM > 35 % • and RPM <= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)	• CL_BM < –35 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)	• CL_BM > 35 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)
Period for Judgment or Number of Occurrence for Judgment		• 5 updates	• 5 updates	• 5 updates
System Action		• CL Disable • AL Disable KC	• CL Disable • AL Disable KC	• CL Disable • AL Disable KC
Engine Warning Light		ON	ON	ON

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DTC		1156	1161	1162
Name		Closed Loop	Adaptive Learn	Adaptive Learn
DTC Name		Closed Loop Bank 1 Low (Gasoline)	Adaptive Learn High (LPG)	Adaptive Learn Low (LPG)
J1939	**SPN**	4236	4237	4237
	FMI	1	0	1
MIL		ON	ON	ON
Detected Item		• high fuel supply pressure to the fuel injection system • a non-responsive HEGO sensor • an injector that is stuck open	• exhaust leaks upstream or near the HEGO sensor • reduced fuel supply pressure to the gaseous fuel control system • a fuel supply or manifold leak • a non-responsive HEGO sensor	• high fuel supply pressure to the gaseous fuel control or faulty pressure regulator • a non-responsive HEGO sensor
DTC Set Preconditions		• Engine Running, Closed Loop Mode	• Engine Running, Adaptive Mode	• Engine Running, Adaptive Mode
DTC Set Conditions		• CL_BM < –35 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)	• AL_BM > 30 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)	• AL_BM < –30 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)
Period for Judgment or Number of Occurrence for Judgment		• 5 updates	• 3 updates	• 3 updates
System Action		• CL Disable • AL Disable KC	• CL Disable • AL Disable KC	• CL Disable • AL Disable KC
Engine Warning Light		ON	ON	ON

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DTC		1163	1164	1165
Name		Adaptive Learn	Adaptive Learn	Catalyst
DTC Name		Adaptive Learn High (NG)	Adaptive Learn Low (NG)	Catalyst inactive on LPG
J1939	**SPN**	4237	4237	3050
	FMI	0	1	11
MIL		ON	ON	OFF
Detected Item		• exhaust leaks upstream or near the HEGO sensor • reduced fuel supply pressure to the gaseous fuel control system • a fuel supply or manifold leak • a non-responsive HEGO sensor	• high fuel supply pressure to the gaseous fuel control or faulty pressure regulator • a non-responsive HEGO sensor	
DTC Set Preconditions		• Engine Running, Adaptive Mode	• Engine Running, Adaptive Mode	• Engine Running
DTC Set Conditions		• AL_BM > 30 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)	• AL_BM < –30 % • and RPM >= 0 min^{-1} (rpm) • and RPM <= 9999 min^{-1} (rpm) • and MAP >= 0.0 kPa [abs] (0.0 kgf/cm^2, 0.0 psia) • and MAP <= 682 kPa [abs] (6.96 kgf/cm^2, 99.0 psia)	• EGO3/4 RMS > 0.008 phi • and EGO3/4 RMS > EGO1/2 RMS 50 % • and EGO3/4 RMS > CL waveform RMS 50 % • and mass flow at ports >= 10.0 g/sec and <= CBT ─CBT_ss +/─ 50.0 degF
Period for Judgment or Number of Occurrence for Judgment		• 3 updates	• 3 updates	• 100 updates
System Action		• CL Disable • AL Disable KC	• CL Disable • AL Disable KC	• Shutdown • CL Disable • AL Disable • Hard Warning
Engine Warning Light		ON	ON	ON

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DTC		1166	1171	1172
Name		Catalyst	EPR Diagnostics	EPR Diagnostics
DTC Name		Catalyst inactive on NG	EPR/CFV Regulation Pressure Higher than Expected	EPR/CFV Regulation Pressure Lower than Expected
J1939	**SPN**	3050	520260	520260
	FMI	11	0	1
MIL		OFF	ON	ON
Detected Item			• Inlet pressure to DEPR is too high.	• Inlet pressure to DEPR is too low. • Malfunctioning lock off valve, plugged fuel filter, closed manual valve or fuel tank out of fuel
DTC Set Preconditions		• Engine Running	• Engine Running	• Engine Running
DTC Set Conditions		• EGO3/4 RMS > 0.008 phi • and EGO3/4 RMS > EGO1/2 RMS 50 % • and EGO3/4 RMS > CL waveform RMS 50 % • and mass flow at ports >= 10.0 g/sec and <= CBT ─CBT_ss +/─ 50.0 degF	• EPR actual-commanded pressure > 2.50 in H_2O	• EPR actual-commanded pressure < -2.50 in H_2O
Period for Judgment or Number of Occurrence for Judgment		• 100 updates	• 5 sec	• 5 sec
System Action		• CL Disable • AL Disable KC	• AL Disable	• AL Disable
Engine Warning Light		ON	ON	ON

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DTC		1173	1174	1175
Name		EPR Diagnostics	EPR Diagnostics	EPR Diagnostics
DTC Name		EPR/CFV comm lost	EPR/CFV Voltage Supply High	EPR/CFV Voltage Supply Low
J1939	**SPN**	520620	520260	520260
	FMI	31	3	4
MIL		OFF	ON	ON
Detected Item		• Faulty CAN cinnection • CAN terminal incorrect	• Supply voltage to the EPR/CFV is too high	• Supply voltage to the EPR/CFV is too low
DTC Set Preconditions		• Engine Running	• Engine Running	• Engine Running
DTC Set Conditions		• No EPR packets recieved within 500 ms	• Voltage supply to EPR/CFV is > 33.0 VDC	• Voltage supply to EPR/CFV is < 18.0 VDC
Period for Judgment or Number of Occurrence for Judgment		• 0.5 sec	• 5 sec	• 5 sec
System Action		• CL Disable • AL Disable KC	• AL Disable • AL Disable KC • Power Derate 2 • Low Rev Limit	• AL Disable • AL Disable KC • Power Derate 2 • Low Rev Limit
Engine Warning Light		ON	ON	ON

DTC		1176	1177	1611
Name		EPR Diagnostics	EPR Diagnostics	5V External
DTC Name		EPR/CFV Internal Actuator Fault Detection	EPR/CFV Internal Circuitry Fault Detection	Sensor Supply Voltage (5Vext 1/2) Simultaneous Out-of-Range
J1939	**SPN**	520260	520260	1079
	FMI	12	12	31
MIL		ON	ON	ON
Detected Item		• Short or open circuit in actuator coil • Associated wiring • Overheating of actuator drive electronics	• DEPR internal microprocessor or memory failure, fuel temperature sensor failure.	• Wiring harness short to 12V power or ground • ECM malfunction
DTC Set Preconditions		• Engine Running	• Engine Running	• Engine On
DTC Set Conditions		• the DEPR electronics detect a fault condition associated with its internal actuator.	• the DEPR electronics detect a fault condition associated with its internal circuitry.	• 5Vext1> 5.40 V or 5Vext1< 4.60 V, and 5Vext2 > 5.40 V or 5Vext2 < 4.60 V
Period for Judgment or Number of Occurrence for Judgment		• 0.25 sec	• 0.25 sec	• 1 sec
System Action		• AL Disable	• AL Disable	• Power Derate 2 • Low Rev Limit • Force Idle
Engine Warning Light		ON	ON	ON

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DTC		1612	1613	1614
Name		Internal Processor Diagnostics	Internal Processor Diagnostics	Internal Processor Diagnostics
DTC Name		Microprocessor Failure-RTI 1	Microprocessor Failure-RTI 2	Microprocessor Failure-RTI 3
J1939	**SPN**	629	629	629
	FMI	31	31	31
MIL		ON	ON	ON
Detected Item		• Faulty ECU	• Faulty ECU	• Faulty ECU
DTC Set Preconditions		• Key on	• Key on	• Key on
DTC Set Conditions		• Internal microprocessor error	• Internal microprocessor error	• Internal microprocessor error
Period for Judgment or Number of Occurrence for Judgment		• N/A	• N/A	• N/A
System Action		• Shutdown • CL Disable • AL Disable • Hard Warning	• Never Forget • AL Disable KC • Power derate 2	• Never Forget • AL Disable KC • Power derate 2
Engine Warning Light		ON	OFF	OFF

DTC		1615	1616	1673
Name		Internal Processor Diagnostics	Internal Processor Diagnostics	General System Diagnostics
DTC Name		Microprocessor Failure-A/D	Microprocessor Failure-Interrupt	Calibration Configuration Error
J1939	**SPN**	629	629	1634
	FMI	31	31	13
MIL		ON	ON	ON
Detected Item		• Faulty ECU	• Faulty ECU	• ECM malfunction
DTC Set Preconditions		• Key on	• Key on	• Key ON
DTC Set Conditions		• Internal microprocessor error	• Internal microprocessor error	• Specific calibration variable checks do not return expected results
Period for Judgment or Number of Occurrence for Judgment		• N/A	• N/A	• N/A
System Action		• Never Forget • AL Disable KC • Power derate 2	• Never Forget • AL Disable KC • Power derate 2	• Never Forget • AL Disable KC • Power derate 2
Engine Warning Light		OFF	OFF	OFF

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DTC		2111	2112	2121
Name		TPS	TPS	FPP
DTC Name		Unable to Reach Lower TPS	Unable to Reach Higher TPS	FPP1 Lower Than FPP2
J1939	SPN	51	51	91
	FMI	7	7	18
MIL		ON	ON	ON
Detected Item		• TPS malfunction	• TPS malfunction	• Wiring harness open/short/damage • FPP malfunction
DTC Set Preconditions		• Cranking or Running	• Cranking or Running	• Key On, Engine Off
DTC Set Conditions		• target TPS-actual TPS < –20.0 % • persistently longer than 200 ms while battery voltage > 9.00 V and battery voltage < 16.0 V	• target TPS-actual TPS > 20.0 % • persistently longer than 200 ms while battery voltage > 9.00 V and battery voltage < 16.0 V	• (FPP 1 % - FPP 2 %) < 20.0 %
Period for Judgment or Number of Occurrence for Judgment		• 1 sec	• 1 sec	• 1.5 sec
System Action		• Shutdown	• Shutdown	• Power derate 2 • Low Rev Limit
Engine Warning Light		ON	ON	ON

DTC		2122	2123	2126
Name		FPP	FPP	FPP
DTC Name		FPP1 Voltage High	FPP1 Voltage Low	FPP1 Higher Than FPP2
J1939	SPN	91	91	91
	FMI	3	4	16
MIL		ON 2Hz	ON 2Hz	ON
Detected Item		• Wiring harness open/short/damage • FPP malfunction	• Wiring harness open/short/damage • FPP malfunction	• Wiring harness open/short/damage • FPP malfunction
DTC Set Preconditions		• Key On	• Key On, Engine Off	• Key On, Engine Off
DTC Set Conditions		• FPP1 voltage > 4.80 V	• FPP1 voltage < 0.200 V	• (FPP 1 % - FPP 2 %) > 20.0 %
Period for Judgment or Number of Occurrence for Judgment		• 0.5 sec	• 0.5 sec	• 1.5 sec
System Action		• Power derate 1 • Low Rev Limit	• Power derate 1 • Low Rev Limit	• Power derate 2 • Low Rev Limit
Engine Warning Light		ON	ON	ON

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DTC		2127	2128	2135
Name		FPP	FPP	TPS
DTC Name		FPP2 voltage low	FPP2 voltage high	TPS1/2 Simultaneous Voltages out of range
J1939	SPN	29	29	51
	FMI	4	3	31
MIL		ON 2Hz	ON 2Hz	ON
Detected Item		• Wiring harness open/short/damage • FPP malfunction	• Wiring harness open/short/damage • FPP malfunction	• TPS malfunction
DTC Set Preconditions		• Key On	• Key On	• Key On, Engine On
DTC Set Conditions		• FPP1 voltage < 0.200 V	• FPP1 voltage > 4.80 V	• User same parameter as individual TPS1/2 voltage fault detection above
Period for Judgment or Number of Occurrence for Judgment		• 0.5 sec	• 0.5 sec	• 0.5 sec
System Action		• Power derate 1 • Low Rev Limit	• Power derate 1 • Low Rev Limit	• Shutdown
Engine Warning Light		ON	ON	ON

DTC		2300	2301	2303
Name		Spark Coil Primary	Spark Coil Primary	Spark Coil Primary
DTC Name		Spark Coil #1 Primary Open/Short-to-Ground	Spark Coil #1 Primary Short-to-Power	Spark Coil #2 Primary Open/Short-to-Ground
J1939	SPN	1268	1268	1269
	FMI	5	6	5
MIL		ON	ON	ON
Detected Item		• a short to ground or open circuit in the harness • an open internal to the primary coil	• a short to power in the harness • a short internal to the primary coil	• a short to ground or open circuit in the harness • an open internal to the primary coil
DTC Set Preconditions		• Key On, Engine On	• Key On, Engine On	• Key On, Engine On
DTC Set Conditions		• Adaptive dwell adjustment >= 2.0 ms • or total dwell >= 14.0 ms • and battery voltage > 11.0 V	• Adaptive dwell adjustment <= –2.0 ms • or total dwell <= 4.0 ms • and battery voltage < 16.0 V	• Adaptive dwell adjustment >= 2.0 ms • or total dwell >= 14.0 ms • and battery voltage > 11.0 V
Period for Judgment or Number of Occurrence for Judgment		• 10 sparks	• 10 sparks	• 10 sparks
System Action		• CL Disable • AL Disable • Low Rev Limit	• CL Disable • AL Disable • Low Rev Limit	• CL Disable • AL Disable • Low Rev Limit
Engine Warning Light		ON	ON	ON

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DTC		2304	2306	2307
Name		Spark Coil Primary	Spark Coil Primary	Spark Coil Primary
DTC Name		Spark Coil #2Primary Short-to-Power	Spark Coil #3 Primary Open/Short-to-Ground	Spark Coil #3 Primary Short-to-Power
J1939	**SPN**	1269	1270	1270
	FMI	6	5	6
MIL		ON	ON	ON
Detected Item		• a short to power in the harness • a short internal to the primary coil	• a short to ground or open circuit in the harness • an open internal to the primary coil	• a short to power in the harness • a short internal to the primary coil
DTC Set Preconditions		• Key On, Engine On	• Key On, Engine On	• Key On, Engine On
DTC Set Conditions		• Adaptive dwell adjustment <= –2.0 ms • or total dwell <= 4.0 ms • and battery voltage < 16.0 V	• Adaptive dwell adjustment >= 2.0 ms • or total dwell >= 14.0 ms • and battery voltage > 11.0 V	• Adaptive dwell adjustment <= –2.0 ms • or total dwell <= 4.0 ms • and battery voltage < 16.0 V
Period for Judgment or Number of Occurrence for Judgment		• 10 sparks	• 10 sparks	• 10 sparks
System Action		• CL Disable • AL Disable • Low Rev Limit	• CL Disable • AL Disable • Low Rev Limit	• CL Disable • AL Disable • Low Rev Limit
Engine Warning Light		ON	ON	ON

DTC		2309	2310
Name		Spark Coil Primary	Spark Coil Primary
DTC Name		Spark Coil #4 Primary Open/Short-to-Ground	Spark Coil #4 Primary Short-to-Power
J1939	**SPN**	1271	1271
	FMI	5	6
MIL		ON	ON
Detected Item		• a short to ground or open circuit in the harness • an open internal to the primary coil	• a short to power in the harness • a short internal to the primary coil
DTC Set Preconditions		• Key On, Engine On	• Key On, Engine On
DTC Set Conditions		• Adaptive dwell adjustment >= 2.0 ms • or total dwell >= 14.0 ms • and battery voltage > 11.0 V	• Adaptive dwell adjustment <= –2.0 ms • or total dwell <= 4.0 ms • and battery voltage < 16.0 V
Period for Judgment or Number of Occurrence for Judgment		• 10 sparks	• 10 sparks
System Action		• CL Disable • AL Disable • Low Rev Limit	• CL Disable • AL Disable • Low Rev Limit
Engine Warning Light		ON	ON

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