| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| **P00XX** | | | **Fuel and Air Metering and Auxiliary Emission Controls** | | | | |
| Crankshaft Position (CKP)- Camshaft Position (CMP) Correlation | P0016 | Calculation of crank position by CKP sensor and CMP sensor disagree by < 6deg crank angle. Detects implausible camshaft/crankshaft sensor correlation by comparing the differences between calculated camshaft and crankshaft positions. | PATH 1 ) Difference between CKP position as calculated by CKP sensor and CMP sensor is >= 6 degrees crank angle. OR PATH 2 ) Difference between CKP position as calculated by CKP sensor and CMP sensor is < 6 degrees crank angle, but the CMP position tolerance is > 12 degrees (cam). CMP position tolerance is the error between TDC and first edge of cam detection. Prevents false | P0642,P0643, P0335, P0336 DTCs not set Ignition ON Engine Speed ≥ 50 rpm | PATH 1 ) 255 crankshaft increments (60 increments/revolution) PATH 2 ) 5 cam phases (4 phases/cam revolution) | Cam sensor (CMP sensor) and Crank sensor (CKP sensor) | A |
| Turbocharger Boost Control Position Not Learned | P003A | Position of the vanes opened during a learn : vane position > 5.54%, OR vane position < 36.94% Position of the vanes closed during a learn : vane position >69.92%, OR vane position < 95.60%. Detects in range vane position errors during a vane sweep to lea | Position of the vanes opened during a learn : vane position < 5.54%, OR vane position > 36.94% Position of the vanes closed during a learn : vane position <69.92%, OR vane position > 95.60% | P117,P118,P2563, P2564,P2565,P2228,P2229 DTCs are not set. ECM is commanding vanes open or closed during a position learn process Injected Fuel <30 mm^3/S 600 rpm< engine speed <750 rpm 0 mph< vehicle speed< 200 kph 71C< Engine Coolant Temp <96C 60 kpa <=Baro <=110 kpa | Diagnostic fail conditions true for for 30 seconds. Performed once per ignition cycle | Turbocharger Vane Position Sensor. | B |
| Turbocharger Boost Control Solenoid Circuit Low | P0047 | Electronic out-put driver circuitry determines the faults (open/short/no load) do not exist on the Turbo Boost Solenoid Cntrl Circuit. | Electronic out-put driver circuitry determines the faults (open/short/no load) do exist on the Turbo Boost Solenoid Cntrl Circuit. | Ignition On | Diagnostic fail conditions true for 4 seconds. Test performed continuously | ECM Electronic out put driver circuitry | B |
| Turbocharger Boost Control Solenoid Circuit High | P0048 | Electronic out-put driver circuitry determines the faults (open/short/no load) do not exist on the Turbo Boost Solenoid Cntrl Circuit. | Electronic out-put driver circuitry determines the faults (open/short/no load) do exist on the Turbo Boost Solenoid Cntrl Circuit. | Ignition On | Diagnostic fail conditions true for 4 seconds. Test performed continuously | ECM Electronic out put driver circuitry | B |
| Fuel Rail Pressure [FRP] Too Low | P0087 | 22.5 Mpa to 198 Mpa Measured Rail Pressure sensor < 15 MPa below Desired rail Pressure. AND Measured Rail Pressure sensor > = 22.5 MPa | Path 1: Measured Rail Pressure sensor > 15 MPa below Desired rail Pressure. Path2: Measured Rail Pressure < = 22.5 MPa | P0090,P0192,P0193, DTCs are not set Rail Pressure control in closed loop control. (closed loop RP control occurs when engine traniations from crank to Run mode) | Path1: Diagnostic fail condition true for 10seconds. Test performed continuously. Path2: Diagnostic fail conditions true for 12.5 seconds . Test | Rail Pressure Sensor | A |
| Fuel Rail Pressure [FRP] Too High | P0088 | 22.5 Mpa to 198 Mpa Measured Rail Pressure sensor < 20 MPa above Desired rail Pressure. AND Measured Rail Pressure sensor < = 189 MPa | PATH 1 ) Measured Rail Pressure sensor > 20 MPa above Desired rail Pressure AND Rail Pressure Desired Fuel Flow <= 100 mm3/sec. AND fuel injection qty > 1 mm3/stroke. PATH2: Measured Rail Pressure sensor >189Mpa | P0087,P0192,P0193 DTCs are not set Rail Pressure control in closed loop control. (closed loop RP control occurs when engine transitions from crank to Run mode) "Rail Pressure Desired Fuel Flow is calculated based on RPM and FR | PATH 1 ) 10 seconds continuous PATH 2 ) 6 seconds continuous | Rail Pressure Sensor | A |

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|---|---|---|---|---|---|---|---|
| Fuel Rail Pressure Regulator Control Circuit | P0090 | Electronic out-put driver circuitry determines the faults (open/short/no load) do not exist on the Fuel Pressure Regulator Cntrl Circuit. | Electronic out-put driver circuitry determines the faults do exist on the Fuel Pressure Regulator Cntrl Circuit. PATH 1 ) open (no load) PATH 2 ) Low side short to ground PATH 3) Low side short to battery Voltage PATH 4) High side short to ground | Ignition On | Diagnostic fail conditions true for: PATH1 ) 220 m seconds PATH 2 ) 500 m seconds Test performed continuously | ECM Electronic out put driver circuitry | A |
| Fuel Rail Pressure Relief (PRV) valve performance | P009E | FRP is to be between 25Mpa - 189Mpa during engine run. Measured FRP gradients must be < negative compared to FRP gradients to detect NO open PRV | Test Enabler: FRP > 189 Mpa Condition #1 to detect open PRV 3 Measured FRP gradients must be more negative then compared gradient to detect open PRV. Condition #2 to detect open PRV 1 Measured FRP gradient must be more negative then compared gradient, AND the SUM of all 3 measured FRP gradients must be | Ignition On | Peformed continuoulsy when FRP is > then 189 Mpa | Monitor FRP gradients | A |

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|---|---|---|---|---|---|---|---|
| Intake Air Temperature (IAT) Sensor 2 Circuit Low Voltage | P0097 | 0.10 volt to 4.8 volts    -40degC to 200 degC    Detects a sensor circuit short to ground | Air temperature sensor voltage <= 0.10 volt -same as- Air temperature>200degC | Ignition On | Diagnostic fail conditions true for 1 seconds    Test performed continuously 100msec rate | Air temperature sensor | B |
| Intake Air Temperature (IAT) Sensor 2 Circuit High Voltage | P0098 | 0.10 volt to 4.8 volts    -40degC to 200 degC Detects a sensor  circuit short high voltage or a  sensor circuit open | Air temperature sensor voltage>=4.8 volt -same as- Air temperature<-40degC | Ignition On | Diagnostic fail conditions true for 1 seconds    Test performed continuously 100msec rate | Air temperature sensor | B |
| **P01XX  Fuel and Air Metering** | | | | | | | |
| Mass Air Flow (MAF) Sensor Performance | P0101 | 106 kg/hr to 1800 kg/hr.  (309 us to 109 us) 0 .87 < Normalized air flow ratio < 1.15 The normalized air flow ratio is derived by dividing the reference air flow by the actual air flow. | Normalized air flow ratio < 0.87  OR Normalized air flow ratio > 1.15 | P0102,P0103,P0107,P0108,P0106,P2228, P2229,P0117,P0118,P0112,P0113,P0652, P0653,P0642,P0643,P0652,P0653,P0698, P0699 DTCs are not set. Baro >= 72kPa ,  500 < RPM < 3100. | Diagnostic fail conditions true for 16 seconds    Test performed continuously . | Mass Air Flow Sensor | B |
| Mass Air Flow (MAF) Sensor Circuit Low Voltage | P0102 | 106 kg/hr to 1800 kg/hr.  (309 us to 109 us) Signal > 90 us same as Flow > 2970 kg/hr Lower threshold for the SRC of the raw airmass signal HFM6 sensor. | Signal > 106 us same as Flow > 1900 kg/hr | 500 < RPM < 3100. | Diagnostic fail conditions true for 3 seconds Test performed continuously | Mass Air Flow Sensor | B |
| Mass Air Flow (MAF) Sensor Circuit High Voltage | P0103 | 106 kg/hr to 1800 kg/hr.  (309 us to 109 us) Signal > 881 us same as Flow > 10 kg/hr Lower threshold for the SRC of the raw airmass signal HFM6 sensor. | Signal < 360 us same as Flow > 72 kg/hr | Ignition On | Diagnostic fail conditions true for  3 seconds Test performed | Mass Air Flow Sensor | B |
| Manifold Absolute Pressure (MAP) Sensor Performance | P0106 | 43.9 mv - 4149 mv  (10 kPA - 307kPa) Absolute value (Baro - MAP) < 15kPa | Absolute value (Baro - MAP) > 15kPa | P0107,P0108,P2228,P2229 DTCs are not set. ECM powered On,  RPM < 750. | Diagnostic fail conditions true for 10 sec. Test performed continuously | Manifold Absolute Pressure (MAP) Sensor and Baro Sensor | A |
| Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage | P0107 | 43.9 mv - 4149 mv  (10 kPA - 307kPa) Detects MAP sensor circuit open or short to ground | MAP Sensor Signal <43.9 mv same as 10kpa | Ignition voltage >11 volts Engine Run time >1sec | Diagnostic fail condition true for 2 seconds Test performed continuously | Manifold Absolute Pressure (MAP) Sensor | A |
| Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage | P0108 | 43.9 mv - 4149 mv  (10 kPA - 307kPa) Detects MAP sensor circuit short to high voltage | MAP Sensor Signal >4149 mv same as 307kpa | Engine Run time >1sec | Diagnostic fail condition true for 2 seconds Test performed continuously | Manifold Absolute Pressure (MAP) Sensor | A |
| Intake Air Temperature (IAT) Sensor Circuit Low Voltage | P0112 | 0.10 volt to 4.8 volts    -40degC to 150 degC    Detects a sensor circuit short to ground | Intake Air temperature sensor voltage <= 0.10 volt      -same as- Air temperature>150degC | Ignition On | Diagnostic set conditions true for 1 second    Test performed continuously 100msec rate | Intake Air temperature sensor | B |
| Intake Air Temperature (IAT) Sensor Circuit High Voltage | P0113 | 0.10 volt to 4.8 volts    -40degC to 150 degC Detects a sensor  circuit short high voltage or a  sensor circuit open | Intake Air temperature sensor voltage>=4.8 volt      -same as- Air temperature<-40degC | Ignition On | Diagnostic set conditions true for 1 second    Test performed continuously 100msec rate | Intake Air temperature sensor | B |

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|---|---|---|---|---|---|---|---|
| Engine Coolant Temperature (ECT) Sensor Performance | P0116 | absolute value of (Startup Coolant Temperature Sensor - Startup Air Temperature Sensor 2 ) < 15degC. Detects biased Air Temperature Sensor 2 | PATH 1 ) absolute value of (Startup Coolant Temperature Sensor - Air Temperature Sensor 2) > 15degC AND block heater influenced determined to be not true. Block heater influence is true if after 6.5 mins at VSS | PATH 1 ) absolute value of (Startup Coolant Temperature Sensor - Air Temperature Sensor 2) > 15degC AND block heater influence determined to be not true. Block heater influence is true if after | Diagnostic sets on first fail    Test performed once per key cycle | Coolant Temperature Sensor and Intake Air Temperature Sensor 2 | B |
| Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage | P0117 | 0.065 V to 4.75 V        -40degC to 150 degC Detects a sensor circuit short to ground | Coolant Temperature Sensor voltage <= 0.065 volt        -same as- Coolant Temperature>150degC | Ignition On | Diagnostic set conditions true for 15 second    Test performed continuously | Coolant Temperature Sensor | B |
| Engine Coolant Temperature (ECT) Sensor Circuit High Voltage | P0118 | 0.065 V to 4.75 V        -40degC to 150 degC Detects a sensor  circuit short high voltage or a sensor circuit open | Coolant Temperature Sensor voltage >= 4.8 V -same as- Coolant Temperature >-40 degC | Ignition On | Diagnostic set conditions true for 60 second    Test performed continuously | Coolant Temperature Sensor | B |
| Engine Coolant Temperature (ECT 1/ ECT2) Corrolation | P011A | absolute value of (Engine Coolant Temperature 1 - Engine Coolant Temperature 2) < 5deg C. Detects biased Coolant Temperature Sensor (ECT1 or ECT 2) | absolute value of (Engine Coolant Temperature 1 - Engine Coolant Temperature 2) > 5deg C. Detects biased Coolant Temperature Sensor (ECT1 or ECT 2) | P00117, P0118 DTCs are not set.  IAT  > -30deg C | Diagnostic set conditions true for 4 seconds.    Test performed continuously | Engine Coolant temperature sensor 1 and Engine Coolant temperature | B |
| Engine Coolant Temperature (ECT) Below Thermostat Regulating Temperature | P0128 | Engine Temperature at start < 65 degC  AND ambient air temperature > 10 degC OR Engine Temperature at start < 45 degC  AND ambient air  temperature <= 10 degC. Detects thermostat failures causing engine to run cooler than expected. | PATH 1 High Region ) Modeled coolant temp predicts coolant temp should be < 80 deg C AND  Actual coolant temp is < 72 degC PATH 2 Low Region ) Modeled coolant temp > 55 and Actual coolant temp < 50 degC | P0128 not yet passed; AND  P0112, P0113,P0116,P0117,P0118 DTCs are not set PATH 1 High Region )  Ambient air temp >10 deg C PATH 2 Low Region )  Ambient air temp <=10 deg C '-7 degC<Ambient air temp < 100 degC; -40degC < Engine start-up temp < 65degC; Engine is running; | Test performed once from start-up until a pass/fail/disable condition exists. | Engine coolant temperature sensor. IAT 1 sensor | B |
| Fuel Tempertaure Sensor Performance | P0181 | absolute value of (Startup Intake Air Temperature Sensor - Startup Fuel Temperature Sensor) < 10 degC. Detects bias Fuel Temperature Sensor or Intake Air Temperature Sensor | PATH 1 ) absolute value of (Startup Intake Air Temperature Sensor - Startup Fuel Temperature Sensor ) > 10degC AND block heater influenced determined to be not true. Block heater influence is true if after 6.5 mins at VSS > 24kph the  IAT  drops 2.5degC | PATH 1 ) absolute value of (Startup Intake Air  Temperature Sensor - Startup Fuel Temperature Sensor ) > 10degC AND block heater OR sun load influence determined to be not true.  Block heater influence is true if after 60 sec ECT drops 5 deg or more.  Sun load influence is true if | Diagnostic sets on first fail    Test performed once per key cycle | Intake Air Temperature Sensor and Fuel Temperature Sensor | B |
| Fuel Temperature Sensor Circuit Low Voltage | P0182 | 0.12V -4.57V -30degC to 120degC Detects a sensor circuit short to ground | Fuel temperature<0.07 V - same as - Fuel temperature > 120degC | Ignition On | Diagnostic set conditions true for  1 seconds Test performed continuously at | Fuel temperature sensor | B |
| Fuel Temperature Sensor Circuit High Voltage | P0183 | 0.12V -4.57V -30degC to 120 degC Detects a sensor short to high voltage or sensor circuit open | Fuel temperature > 4.72  V - same as - Fuel temperature < -30degC | Ignition On | Diagnostic set conditions true for  1 seconds Test performed continuously100msec | Fuel temperature sensor | B |

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|---|---|---|---|---|---|---|---|
| Fuel Rail Pressure [FRP] Sensor Performance | P0191 | 0.352V (-7.5 Mpa) < FRP at engine off < 0.65 V (7.7 Mpa) Detects a biased sensor by determining the FRP sensor voltage to be in the correct range for atmospheric pressure at engine off and with sufficient pressure bleed-off time. | PATH 1 ) FRP voltage < 0.352V ( -7.5 Mpa) OR FRP voltage > 0.65V (7.7 Mpa) at ECM initialization PATH 2 ) FRP voltage < 0.352V ( -7.5 Mpa) OR FRP voltage > 0.65V (7.7Mpa) at ECM After - run given bleed off time. | PATH 1 ) P0016, P062F, P0116, P0117, P0118, P0192, P0193, P0652, P0653 DTCs are not set, ECM in INITIALIZATION status, Engine off timer > 20 min 0 degC <= Coolant temperature <= 120 degC, Engine Speed = 0 rpm PATH 2 ) P0652, P0653, P0192, P0193 DTCs are not set, ECM status = AFTERRUN (engine off, ECM still active), fuel temperature ≥ 60 degC, wait timer has elapsed (30-70 seconds after engine shutoff, depending on FRP at shutoff: higher pressure == higher wait time (see chart 2a) | Failure exists for one sample cycle (cycle location either at ECM initialization (PATH1) or during afterrun (PATH2), depending on entry conditions) | Fuel Rail Pressure Sensor (FRP) | A |

Chart 2a

| Rail Pressure at engine shut down (MPa) | Engine Off Time (seconds) |
|---|---|
| 200 | 30 |
| 250 | 50 |
| 400 | 55 |
| 1000 | 60 |
| 1150 | 65 |
| 1300 | 70 |

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|---|---|---|---|---|---|---|---|
| Fuel Rail Pressure [FRP] Sensor Circuit Low Voltage | P0192 | 0.254 V to 4.75 V (-12.44 Mpa to 216.4 Mpa) Detects a Rail Pressure Sensor circuit short to ground | Rail Pressure Sensor voltage < 0.254 V (-12.44 Mpa) | P0652, P0653 DTCs not set | Diagnostic set conditions true for 200 msec Test performed continuously | Rail Pressure Sensor | A |
| Fuel Rail Pressure [FRP] Sensor Circuit High Voltage | P0193 | 0.254 V to 4.75 V (-12.44 Mpa to 216.4 Mpa) Detects a Rail Pressure Sensor short to high voltage or sensor circuit open | Rail Pressure Sensor voltage > 4.75 V (216.4 Mpa) | P0652, P0653 DTCs not set | Diagnostic set conditions true for 200 msec Test performed continuously | Rail Pressure Sensor | A |
| **P02XX  Fuel and Air Metering** | | | | | | | |
| Injector 1 Control Circuit | P0201 | Electronic out-put driver circuitry determines that the faults (open/short/no load) do not exist. | Electronic out-put driver circuitry determines that the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for Cly 1 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 2 Control Circuit | P0202 | Electronic out-put driver circuitry determines that the faults (open/short/no load) do not exist. | Electronic out-put driver circuitry determines that the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for Cly 2 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 3 Control Circuit | P0203 | Electronic out-put driver circuitry determines that the faults (open/short/no load) do not exist. | Electronic out-put driver circuitry determines that the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for Cly 3 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |

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|---|---|---|---|---|---|---|---|
| Injector 4 Control Circuit | P0204 | Electronic out-put driver circuitry determines that the faults (open/short/no load) do not exist. | Electronic out-put driver circuitry determines that the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for Cly 4 | Fault exists for 6 msec. Monitored continuously | ECM Injector Electronic out-put driver circuitry | A |
| Injector 5 Control Circuit | P0205 | Electronic out-put driver circuitry determines that the faults (open/short/no load) do not exist. | Electronic out-put driver circuitry determines that the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for Cly 5 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 6 Control Circuit | P0206 | Electronic out-put driver circuitry determines that the faults (open/short/no load) do not exist. | Electronic out-put driver circuitry determines that the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for Cly 6 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 7 Control Circuit | P0207 | Electronic out-put driver circuitry determines that the faults (open/short/no load) do not exist. | Electronic out-put driver circuitry determines that the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for Cly 7 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 8 Control Circuit | P0208 | Electronic out-put driver circuitry determines that the faults (open/short/no load) do not exist. | Electronic out-put driver circuitry determines that the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for Cly 8 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Turbocharger Engine Overboost | P0234 | Measured Boost is < (see Worksheet Boost Deviation Map) above desired boost. Detects an Overboost condition or a biased high boost sensor. | Measured Boost is >(see Worksheet Boost Deviation Map) above desired boost Detects an Overboost condition or a biased high boost sensor. | P2564,P2565 DTCs are not set 800 rpm <= Engine RPM <=3600 rpm | Diagnostic fail condition true for 10 second Test performed continuously | MAP Sensor (aka Boost Sensor) | A |
| Turbochager Engine Underboost | P0299 | Measured Boost is < (see Worksheet Boost Deviation Map) below Desired Boost Detects an underboost condition or a biased low sensor. | Measured Boost is > (see Worksheet Boost Deviation Map) below Desired Boost Detects an underboost condition or a biased low sensor. | P2564,P2565 DTCs are not set 800 rpm <= Engine RPM <=3600 rpm | Diagnostic fail condition true for 10 second Test performed continuously | MAP Sensor (aka Boost Sensor) | A |
| Cylinder 1 Injector Leaking | P029D | Cylinder #1, FBC is < -7.0 | Cylinder #1, FBC is to be > -7.0 | RPM 600 - 850, coolant temp > 40c, Fueling < 15mm3, Vehicle speed < 5km/hr. | Diagnostic fail condition true for 1 minute Test performed once per key cycle. | Monitor FBC (fuel balance control) | B |
| Cylinder 2 Injector Leaking | P02A1 | Cylinder #2, FBC is < -7.0 | Cylinder #2, FBC is to be > -7.0 | RPM 600 - 850, coolant temp > 40c, Fueling < 15mm3, Vehicle speed < 5km/hr. | Diagnostic fail condition true for 1 minute Test performed once per key cycle. | Monitor FBC (fuel balance control) | B |
| Cylinder 3 Injector Leaking | P02A5 | Cylinder #3, FBC is < -7.0 | Cylinder #3, FBC is to be > -7.0 | RPM 600 - 850, coolant temp > 40c, Fueling < 15mm3, Vehicle speed < 5km/hr. | Diagnostic fail condition true for 1 minute Test performed once per key cycle. | Monitor FBC (fuel balance control) | B |
| Cylinder 4 Injector Leaking | P02A9 | Cylinder #4, FBC is < -7.0 | Cylinder #4, FBC is to be > -7.0 | RPM 600 - 850, coolant temp > 40c, Fueling < 15mm3, Vehicle speed < 5km/hr. | Diagnostic fail condition true for 1 minute Test performed once per key cycle. | Monitor FBC (fuel balance control) | B |
| Cylinder 5 Injector Leaking | P02AD | Cylinder #5, FBC is < -7.0 | Cylinder #5, FBC is to be > -7.0 | RPM 600 - 850, coolant temp > 40c, Fueling < 15mm3, Vehicle speed < 5km/hr. | Diagnostic fail condition true for 1 minute Test performed once per key cycle. | Monitor FBC (fuel balance control) | B |

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|---|---|---|---|---|---|---|---|
| Cylinder 6 Injector Leaking | P02B1 | Cylinder #6, FBC is < -7.0 | Cylinder #6, FBC is to be > -7.0 | RPM 600 - 850, coolant temp > 40c, Fueling < 15mm3, Vehicle speed < 5km/hr. | Diagnostic fail condition true for 1 minute Test performed once per key cycle. | Monitor FBC (fuel balance control) | B |
| Cylinder 7 Injector Leaking | P02B5 | Cylinder #7, FBC is < -7.0 | Cylinder #7, FBC is to be > -7.0 | RPM 600 - 850, coolant temp > 40c, Fueling < 15mm3, Vehicle speed < 5km/hr. | Diagnostic fail condition true for 1 minute Test performed once per key cycle. | Monitor FBC (fuel balance control) | B |
| Cylinder 8 Injector Leaking | P02B9 | Cylinder #8, FBC is < -7.0 | Cylinder #8, FBC is to be > -7.0 | RPM 600 - 850, coolant temp > 40c, Fueling < 15mm3, Vehicle speed < 5km/hr. | Diagnostic fail condition true for 1 minute Test performed once per key cycle. | Monitor FBC (fuel balance control) | B |
| Throttle Valve Actuator Solenoid Control Circuit | P02E0 | At a 10% or greater TVA duty cycle signal, circuit current > 25 mA | At a 10% or greater EGR duty cycle signal, circuit current < 25 mA | ECM powered up > 0.5sec 10% < TVA Duty Cycle | Diagnostic fail condition true for 1 second Test performed continuously | ECM Electronic out put driver circuitry | B |
| Throttle Valve Actuator (TVA) Position Sensor Performance | P02E7 | Delta from target position < = +/- 3% Delta is the difference between desired TVA position and actual TVA position. TVA is adjusted to achieve desired air flows during regeneration. Detects in range TVA position errors | Delta from target position > = +/- 3% | P02E0,P02E8,P02E9,P0642,P0643 DTCs are not set TVA Actively being controlled | Diagnostic set conditions true for 10 sec. Test performed continously during TVA operation | TVA Position Sensor | B |
| Throttle Valve Actuator (TVA) Position Sensor Circuit low Voltage | P02E8 | 0.102 v to 4.75 v (0% to 100% position) Detects a sensor circuit Low voltage. | TVA Position sensor >= 0.102 v (0% position) | P0698,P0699 DTCs are not set Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously | EGR Position Sensor | B |
| Throttle Valve Actuator (TVA) Position Sensor High Voltage | P02E9 | 0.102 v to 4.75 v (0% to 100% position) Detects a sensor circuit High voltage. | TVA Position sensor <= 4745 mv (100% position) | P0698,P0699 DTCs are not set Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously | EGR Position Sensor | B |
| **P03XX Ignition System or Misfire** | | | | | | | |
| Engine Misfire Detected | P0300 | Misfires do not exist on more than one clyinder | Misfires do exist on more than one clyinder | Ignition On | Diagnostic sets on first fail Test performed once per key cycle | Cylinder to Cylinder engine speed. SW Poling of individual cly. | B |

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|---|---|---|---|---|---|---|---|
| Cylinder 1 Misfire Detected | P0301 | Cylinder #1 RPM >= minimum average cylinder speed after an injection event. The minimum average cly speed is calculated every 2 rotations and represents the average speed that all cly are rotating at after a combustion event. | Cylinder #1 RPM < minimum average cylinder speed.  after an injection event for at least 130 counts | 1)P0335,P0336,P0117,P0118,P0201,P0202, P0203,P0204,P0205,P0206,P0207,P0208, P2146,P2149,P2152,P2155,P0502,P062C DTCs are not set. 2)Engine is running 3)Coolant temperature >=  40degC 4)600 rpm < Engine speed < 1300 rpm 5) 3 mm3/S < injected fuel < 25 mm3/S 6)vehicle speed<= 3 Kph 7)Engine run time > 10 seconds | Diagnostic fail condition true for 180 revolutions. Test performend once per key cycle in a total of 440 revolutions | Cylinder to Cylinder engine speed | B |
| Cylinder 2 Misfire Detected | P0302 | Cylinder #2 RPM >= minimum average cylinder speed after an injection event. The minimum average cly speed is calculated every 2 rotations and represents the average speed that all cly are rotating at after a combustion event. | Cylinder #2 RPM < minimum average cylinder speed.  after an injection event for at least 130 counts | 1)P0335,P0336,P0117,P0118,P0201,P0202, P0203,P0204,P0205,P0206,P0207,P0208, P2146,P2149,P2152,P2155,P0502,P062C DTCs are not set. 2)Engine is running 3)Coolant temperature >=  40degC 4)600 rpm < Engine speed < 1300 rpm 5) 3 mm3/S < injected fuel < 25 mm3/S 6)vehicle speed<= 3 Kph 7)Engine run time > 10 seconds | Test performend once per key cycle in a total of 440 revolutions | Cylinder to Cylinder engine speed | B |
| Cylinder 3 Misfire Detected | P0303 | Cylinder #3 RPM >= minimum average cylinder speed after an injection event. The minimum average cly speed is calculated every 2 rotations and represents the average speed that all cly are rotating at after a combustion event. | Cylinder #3 RPM < minimum average cylinder speed after an injection event for at least 130 counts | 1)P0335,P0336,P0117,P0118,P0201,P0202, P0203,P0204,P0205,P0206,P0207,P0208, P2146,P2149,P2152,P2155,P0502,P062C DTCs are not set. 2)Engine is running 3)Coolant temperature >=  40degC 4)600 rpm < Engine speed < 1300 rpm 5) 3 mm3/S < injected fuel < 25 mm3/S 6)vehicle speed<= 3 Kph 7)Engine run time > 10 seconds | Test performend once per key cycle in a total of 440 revolutions | Cylinder to Cylinder engine speed | B |
| Cylinder 4 Misfire Detected | P0304 | Cylinder #4 RPM >= minimum average cylinder speed after an injection event. The minimum average cly speed is calculated every 2 rotations and represents the average speed that all cly are rotating at after a combustion event. | Cylinder #4 RPM < minimum average cylinder speed after an injection event for at least 130 counts  07i-2009MY calibration | 1)P0335,P0336,P0117,P0118,P0201,P0202, P0203,P0204,P0205,P0206,P0207,P0208, P2146,P2149,P2152,P2155,P0502,P062C DTCs are not set. 2)Engine is running 3)Coolant temperature >=  40degC 4)600 rpm < Engine speed < 1300 rpm 5) 3 mm3/S < injected fuel < 25 mm3/S 6)vehicle speed<= 3 Kph 7)Engine run time > 10 seconds | Test performend once per key cycle in a total of 440 revolutions | Cylinder to Cylinder engine speed | B |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Cylinder 5 Misfire Detected | P0305 | Cylinder #5 RPM >= minimum average cylinder speed after an injection event. The minimum average cly speed is calculated every 2 rotations and represents the average speed that all cly are rotating at after a combustion event. | Cylinder #5 RPM < minimum average cylinder speed after an injection event for at least 130 counts | 1)P0335,P0336,P0117,P0118,P0201,P0202, P0203,P0204,P0205,P0206,P0207,P0208, P2146,P2149,P2152,P2155,P0502,P062C DTCs are not set. 2)Engine is running 3)Coolant temperature >= 40degC 4)600 rpm < Engine speed < 1300 rpm 5) 3 mm3/S < injected fuel < 25 mm3/S 6)vehicle speed<= 3 Kph 7)Engine run time > 10 seconds | Test performend once per key cycle in a total of 440 revolutions | Cylinder to Cylinder engine speed | B |
| Cylinder 6 Misfire Detected | P0306 | Cylinder #6 RPM >= minimum average cylinder speed after an injection event. The minimum average cly speed is calculated every 2 rotations and represents the average speed that all cly are rotating at after a combustion event. | Cylinder #6 RPM < minimum average cylinder speed after an injection event for at least 130 counts | 1)P0335,P0336,P0117,P0118,P0201,P0202, P0203,P0204,P0205,P0206,P0207,P0208, P2146,P2149,P2152,P2155,P0502,P062C DTCs are not set. 2)Engine is running 3)Coolant temperature >= 40degC 4)600 rpm < Engine speed < 1300 rpm 5) 3 mm3/S < injected fuel < 25 mm3/S 6)vehicle speed<= 3 Kph 7)Engine run time > 10 seconds | Test performend once per key cycle in a total of 440 revolutions | Cylinder to Cylinder engine speed | B |
| Cylinder 7 Misfire Detected | P0307 | Cylinder #7 RPM >= minimum average cylinder speed after an injection event. The minimum average cly speed is calculated every 2 rotations and represents the average speed that all cly are rotating at after a combustion event. | Cylinder #7 RPM < minimum average cylinder speed after an injection event for at least 130 counts | 1)P0335,P0336,P0117,P0118,P0201,P0202, P0203,P0204,P0205,P0206,P0207,P0208, P2146,P2149,P2152,P2155,P0502,P062C DTCs are not set. 2)Engine is running 3)Coolant temperature >= 40degC 4)600 rpm < Engine speed < 1300 rpm 5) 3 mm3/S < injected fuel < 25 mm3/S 6)vehicle speed<= 3 Kph 7)Engine run time > 10 seconds | Test performend once per key cycle in a total of 440 revolutions | Cylinder to Cylinder engine speed | B |
| Cylinder 8 Misfire Detected | P0308 | Cylinder #8 RPM >= minimum average cylinder speed after an injection event. The minimum average cly speed is calculated every 2 rotations and represents the average speed that all cly are rotating at after a combustion event. | Cylinder #8 RPM < minimum average cylinder speed after an injection event for at least 130 counts | 1)P0335,P0336,P0117,P0118,P0201,P0202, P0203,P0204,P0205,P0206,P0207,P0208, P2146,P2149,P2152,P2155,P0502,P062C DTCs are not set. 2)Engine is running 3)Coolant temperature >= 40degC 4)600 rpm < Engine speed < 1300 rpm 5) 3 mm3/S < injected fuel < 25 mm3/S 6)vehicle speed<= 3 Kph 7)Engine run time > 10 seconds | Test performend once per key cycle in a total of 440 revolutions | Cylinder to Cylinder engine speed | B |
| Crankshaft Position [CKP] Sensor Circuit | P0335 | Receiving valid signals from CKP sensor while CMP sensor is also sending valid signals. Detects crankshaft sensor circuit failure. | CKP edge detection status = FALSE (no digital edge transitions measured in CKP signal.) CKP signal does not match calibrated pattern | P0652, P0653 not set Ignition is ON Engine is running | Failure exists for 20 camshaft phases (4 phases per cam revolution) | Crankshaft Position Sensor (CKP) | A |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Crankshaft Position [CKP] Sensor Performance | P0336 | Receiving valid signals from CKP. Detects implausible crankshaft sensor operation (correct pattern not detected). | A.) CKP pattern not yet recognized AND no transitions in CKP signal are seen. OR B | P0652, P0653 not set Ignition is ON,  Engine running Engine Speed < 0 rpm for one sample (implies engine CKP speed is being calculated but sign | A.) Failure exists for 312 crankshaft increments B.) Failure exists for 312 increments (elapsed from A.) AND | Crankshaft Position Sensor (CKP) | A |
| Camshaft Position [CMP] Sensor Circuit | P0340 | Receiving valid signals from CMP sensor  while CKP sensor is also sending valid signals. Detects camshaft sensor circuit failure. | CMP edge detection status = FALSE (no digital edge transitions measured in CMP signal.) CMP signal does not match calibrated pattern | P0642, P0643, P0335, P0336 not set Ignition is ON Engine Speed ≥ 50 rpm (implies engine crankshaft speed recognized) | Failure exists for 132 crankshaft increments | Camshaft Position Sensor (CMP) | A |
| Camshaft Position [CMP] Sensor Performance | P0341 | Receiving valid signals from CMP. Detects implausible camshaft sensor operation (correct pattern not detected). | CKP signal pattern detected as calibrated AND CMP pattern NOT detected as calibrated. | P0335, P0336 not set Ignition is ON Engine Speed ≥ 50 rpm (implies engine crankshaft speed recognized) | Failure exists for 240 crankshaft (CKP) increments. | Camshaft Position Sensor (CMP) | A |
| Wait to Start Lamp (WTS) Control Circuit | P0381 | Electronic out-put driver circutry determines that faults (open/short and no load) do not exist on the WTS circuit. | Electronic out-put driver circutry determines faults (open/short and no load) do exist on the WTS circuit. | Lamp must be commanded on  for short to battery/open faults. Lamp must be commanded off for shot to ground/no load | Failure exists for 3 sec. Monitoring is continuos | Sensing circuity in the out put drver electronics. | B |
| **P04XX  EGR System** | | | | | | | |
| Exhaust Gas Recirculation(EGR) Flow Insufficient | P0401 | Measured Mass Air Flow values < 60 mg/cly above Desired MAF values.  Measured MAF verses Desired MAF  indicates EGR flow. When Measured MAF is above Desired MAF, EGR flow has been reduced. **Conversion** is (mg/cly) / (RPM/15) = grams per second | Measured Mass Air Flow values ,60 mg/cly above Desired MAF values. | P0101,P0102,P0103,P0403,P0405,P0406 DTCs are not set. EGR Actively being controlled | Diagnostic fail condition true for 15 seconds Test performed continuously | Mass Airflow sensor | B |
| Exhaust Gas Recirculation(EGR) Flow Excessive | P0402 | Measured Mass Air Flow values < 50 mg/hub below Desired MAF values.  Measured MAF verses Desired MAF  indicates EGR flow. When Measured MAF is below Desired MAF, EGR flow has been increased. **Conversion** is (mg/cly) / (RPM/15) = grams per second | Measured Mass Air Flow values > 50 mg/hub below Desired MAF values. | P0101,P0102,P0103,P0403,P0405,P0406 DTCs are not set EGR Actively being controlled | Diagnostic fail condition true for 15 seconds Test performed continuously | Mass Airflow sensor | B |
| Exhaust Gas Recirculation (EGR) Solenoid Control Circuit | P0403 | At a 10% or greater EGR duty cycle signal, circuit current > 25 mA | At a 10% or greater EGR duty cycle signal, circuit current < 25 mA | ECM Power Up Time > 0.5sec Engine running 10% < EGR Duty Cycle | Diagnostic fail condition true for 1 second Test performed continuously | ECM Electronic out put driver circuitry | B |
| Exhaust Gas Recirculation(EGR) Position Sensor Circuit Low Voltage | P0405 | 0.254 v to  4.75 v (0% to 100% position) Detects a sensor circuit Low voltage. | EGR Position sensor <= 254 mv    (0% position) | P0698,P0699 DTCs are not set Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously | EGR Position Sensor | B |
| Exhaust Gas Recirculation(EGR) Position Sensor Circuit High Voltage | P0406 | 0.254 v to  4.75 v (0% to 100% position) Detects a sensor circuit High voltage. | EGR Position sensor >= 4745 mv  (100% position) | P0698,P0699 DTCs are not set Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously | EGR Position Sensor | B |
| Exhaust Gas Recirculation(EGR) Temperature Sensor 1Circuit Low Voltage | P040C | 0.0 v to  5.00 v -40 deg C to 900 deg C Detects a sensor circuit Low voltage. | EGR Temperature sensor <= 395 mv Engine run time >30 seconds | Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously | EGR Position Sensor | B |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Exhaust Gas Recirculation(EGR) Temperature Sensor 1Circuit High Voltage | P040D | 0.0 v to 5.00 v -40 deg C to 900 deg C Detects a sensor circuit High voltage. | EGR Temperature sensor >= 4700 mv Engine run time >30 seconds | Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously. | EGR Position Sensor | B |
| Exhaust Gas Recirculation(EGR) Temperature Sensor Correlation (ECT 1/ ECT 2) | P040F | Absolute value of ( Exhuast Temperature 1- Exhuast Temperature 2 ) < 40 deg C Detects biased Exhaust Temperature Sensors | EGR Temperature sensor #1 <= 40 deg to temperature sensor #2 Engine Time off > 5 hrs | P040C,P040D,P041C, P041D DTCs are not set           Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously. | EGR Position Sensor | B |
| Exhaust Gas Recirculation(EGR) Temperature Sensor 2 Circuit Low Voltage | P041C | 0.0 v to 5.00v -40 deg C to 900 deg C Detects a sensor circuit Low voltage. | EGR Temperature sensor <= 395 mv Engine run time >30 seconds | Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously. | EGR Position Sensor | B |
| Exhaust Gas Recirculation(EGR) Temperature Sensor 2 Circuit High Voltage | P041D | 0.0 v to 5.00 v -40 deg C to 900 deg C Detects a sensor circuit High voltage. | EGR Temperature sensor >= 4700 mv Engine run time >30 seconds | Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously. | EGR Position Sensor | B |
| Catalyst System Low Efficiency | P0420 | DOC out temp > 585 deg C at the start of regen. | DOC out temp < 585 deg C at the start of regen. | Must be in Regen | Diagnostic set when conditions true for 222 secs. Test performed once per regen event | Exhaust Gas Temp sensor (DOC out) | B |
| Fuel Level Sensor 1 Performance | P0461 | Difference between Maximum fuel volume and Minimum fuel volume > 3 Liters. | PATH1:Difference between Maximum fuel volume and Minimum fuel volume < 3 Liters. AND Difference between current vehicle driven distance and vehicle distance at beginning of diagnostic > =160 Km<br><br>OR<br><br>PATH2:Initial volume in tank 1 – current volume in tank 1  < 0.8 L AND Initial volume in tank 2 – current volume in tank 2  >=0.8 L | PATH1:P0462,P0463 not set Engine run time > 10 secIgnition is ON Transfer pump is OFF<br><br>PATH2:P0461,P0462,P0463,P2067,P2068 not set Fuel transfer pump ON for 200 seconds vehicle speed <=0 | Monitor time is 100msec. Continuous | Fuel Level 1 Fault Detection | B |
| Fuel Level Sensor 1 Circuit Low | P0462 | 0.2V to 4.81V Detects circuit faults which causes the fuel level voltage to fall below 200mV | fuel level 1 voltage < 0.2V | Ignition on Engine run time > 1 sec or Powerup time > 1 sec Battery voltage > 10V | Monitor time is 100msec. Continuous | Fuel Level 1 Fault Detection | B |
| Fuel Level Sensor 1 Circuit High | P0463 | 0.2V to 4.81V Detects circuit faults which causes the fuel level voltage to rise above 4.8 V | fuel level 2 voltage > 4.8V | Ignition on Engine run time > 1 sec or Powerup time > 1 sec | Monitor time is 100msec. Continuous | Fuel Level 1 Fault Detection | B |
| Exhaust Gas Recirculation(EGR) Position Sensor Performance | P046C | Delta from target position < = +/- 3% Delta is the difference between desired EGR position and actual EGR position. Detects in range EGR valve positi | Delta from target position > = +/- 3% | P0401,P0402,P0403,P0642,P0643 DTCs are not set EGR Actively being controlled | Diagnostic set conditions true for 5 sec. Test performed continuously during EGR operation. | EGR Position Sensor | B |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Cooling Fan Speed Output Circuit | P0480 | Electronic out-put driver circutry determines that faults (open/short and no load) do not exist on the Fan Speed Output circuit. | Electronic out-put driver circuitry determines that faults (open/short and no load) do exist on the Fan Speed Output circuit. | Cooling Fan must be commanded on for short to battery/open faults. Cooling Fan must be commanded off for short to ground/no load | Failure exists for **600ms.** Monitoring is continuos 20msec rate | Sensing circuity in the out put drIver electronics. | B |
| Cooling Fan System Performance | P0483 | (Actual Cooling Fan Speed - Commanded Cooling Fan Speed) is <+/- 500 rpm. | (Actual Cooling Fan Speed - Commanded Cooling Fan Speed) is < +/- 500 rpm. | Cooling Fan Output Driver Duty Cycle **>= 36%** Cooling Fan Input Shaft speed < 6000 rpm **Cooling Fan Input Shaft speed > 1700** | 30 seconds of weighted accumulated difference. Monitoring is continuous 20msec rate | Cooling Fan speed sensor | B |
| Cooling Fan Speed High | P0495 | Cooling Fan Speed is within a tolerance of the Cooling Fan Input speed as indicated in worksheet P0495 Tables dragspeed. | Cooling Fan Speed is not within a tolerance of the Cooling Fan Input speed as indicated in worksheet P0495 tables drag speed. | Cooling Fan Output Driver Duty Cycle **<=** 35% Cooling Fan clutch fluid model indicates < **15**ml in fan clutch working chamber AND Cooling Fan Input Speed > 1500 rpm | Diagnostic set conditions true for timer dependent on altitude (see Worksheet P0495 tables pump out times) Test performed continuously. | Cooling Fan speed sensor | B |
| Idle Speed Too Low | P0506 | Actual Engine Speed < 100 rpm below TargetTarget Idle Speed | Actual Engine Speed > 100 rpm below TargetTarget Idle Speed | No Related fault code set(P0016,P0117,P0118,P0335,P0336) Engine is running Engine RPM > 300 Idle governor is enabled and requesting | Diagnostic set for 20 seconds. Samples taken every 100msec | Monitoring Engine Speed | B |
| Idle Speed Too High | P0507 | Actual Engine Speed < 200 rpm above TargetTarget Idle Speed | Actual Engine Speed > 200 rpm above TargetTarget Idle Speed | No Related fault code set(P0016,P0117,P0118,P0335,P0336,) Engine is running Engine RPM > 300 Idle governor is enabled and requesting | Diagnostic set for 20 seconds. Samples taken every 100msec | Monitoring Engine Speed | B |
| Cooling Fan Speed Sensor Circuit | P0526 | Fan speed pulses present Detects lack of target wheel pulses | No pulses detected | Engine running | Diagnostic set conditions true for **3000ms.** Test performed continuously | Fan Speed Sensor | B |
| Exhaust Gas Temperature (EGT) Sensor 1 Circuit Low Voltage | P0545 | 0.318 v - 3.37 v (-40 degC - 1000 degC) Detects EGT 1 sensor circuit short to ground | Exhaust Temp Sensor 1 Signal <0.318 v same as -40 degC | Ignition on | Diagnostic fail condition true for 1 sec Test performed continuously | Exhaust Gas Temperature sensor 1 | A |
| Exhaust Gas Temperature (EGT) Sensor 1 Circuit High Voltage | P0546 | 0.318 v - 3.37 v (-40 degC - 1000 degC) Detects EGT 1 sensor circuit short to high voltage or sensor circuit open. | Exhaust Temp Sensor 1 Signal > 3.37 v same as 1000 degC | Ignition on | Diagnostic fail condition true for 1sec Test performed continuously | Exhaust Gas Temperature sensor 1 | A |
| **P06XX Computer and Auxiliary Outputs** | | | | | | | |
| Control Module Not Programmed | P0602 | ECM is programmed. | ECM is not programmed (K_Check_Service_Calibration = TRUE.) | Ignition on | Run every key cycle | | A |

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|---|---|---|---|---|---|---|---|
| Control Module Internal Performance | P0606 | ECM is operating correctly at proper voltage. All internal hardware modules are communicating correctly.  Injector power stages can be properly shut off by ECM during start-up test.  Internal watchdog module reports that microprocessor responds to querie | PATH1: Microprocessor overvoltage is detected by hardware-based diagnositcs. PATH2: Internal SPI bus communication error detected in hardware. PATH3:  Redunudant injector shut-off path tests faulted during engine startup (test to confirm that ECM can disable injection successfully).                    PATH4:  Internal watchdog module (seperate HW) reports calculation and/or timing error with microprocessor. PATH5:  Injector on-time > 220 microseconds (i.e. still torque-producing) is still being commanded after the driver has released the accelerator pedal and all applicable debounce timers that account for torque interventions have elapsed.                    PATH6: An ECM recovery has been triggered by any of the above paths or RAM and ROM checks | PATH1:  None. PATH2:  None. PATH3:  None. | PATH1:  Continuous PATH2:  Continuous PATH3:  Continuous PATH4:  Continuous | ALL:  Internal ECM Hardware Fault Detection | A |
| Control Module Analog to Digital Performance | P060B | ADC is correctly converting signals within the correct time periods. | Converted ADC voltage from special channel connected to 3.5V microprocessor supply >= 3.87V OR <= 3.37V OR | ECM powered up Engine speed >= 400rpm for engine -speed sync ADC queue test APP2 test impulse carried out for APP2 voltage check test | Continuous | Analog to Digital Converter | A |
| Internal Control Module Engine RPM Performance | P061C | Main and redundant engine speed calculations agree. Detects failure in engine speed calculation through redundant calculation | Difference between CKP engine speed and redundantly-calculated engine speed > 320 rpm | Engine speed < 1300 rpm. | Failure exists for 880 ms. | Crankshaft Position Sensor (CKP) | A |
| TPU error on VSS signal | P062C | Electronic ECM circuitry determines that faults related to the TPU chip used to calculate Vehicle speed  do not exist. | Electronic ECM circuitry determines that faults related to the TPU chip used to calculate Vehicle speed  do exist. | Ignition on | Failure exists for 1 sec. Monitoring is continuos | ECM electronic circuitry | A |
| Control Module Long Term Memory Performance | P062F | Each data block of memory is read for a check sum error and flags a fault is found. | | Ignition on | once at key-up | ECM Hardware Fault Detection | A |
| Intake Air (IA) Heater Switch/Control Circuit | P0640 | digital response signal = low when heartbeat signal is activated | digital response signal = high when heartbeat signal is activated | 1)IAH Commanded OFF 2)11.7 = FALSE | Monitor time is 650msec. Test is conducted every 2 seconds. | Monitored by GPCM and message transferred by CAN | B |
| 5 Volt Reference 1 Circuit Low Voltage | P0642 | 4.86V to 5.1V Detects  circuit faults which lower the 5V reference 1 supply voltage out of regulation | 5 Volt Reference 1 < 4.86V | Ignition on | Monitor time is 160msec. Continuous | ECM Hardware Fault Detection | A |
| 5 Volt Reference 1 Circuit High Voltage | P0643 | 4.86V to 5.1V Detects  circuit faults which raise the 5V reference 1 supply voltage out of regulation | 5 Volt Reference 1 > 5.1V | Ignition on | Monitor time is 160msec. Continuous | ECM Hardware Fault Detection | A |

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|---|---|---|---|---|---|---|---|
| Glow Plug Control Module Performance | P064C | P064C Error Message not received from the Glow Plug Control Module via GMLAN | P064C Error Message received from the Glow Plug Control Module via GMLAN indicating one or more of the conditions below; 1) Any of the 8 glow plug switches is defective 2)No IGN1 voltage 3)GPCM is overtemp 4)GPCM is overvoltage or undervoltage 5)Internal voltage supply to the Intake Air heater is too low 6)Difference between IGN1 and KI 30 (Battery) voltage is too high 7)Difference between battery voltage measured by ECM and battery voltage measured by the GPCM is too high | Ignition on | Monitor time is 3000msec. Frequency is every 250msec. | GPCM detects the faults and sends serial data message via GMLAN to the ECM | B |
| Malfunction Indicator Lamp (MIL) Control Circuit | P0650 | Electronic out-put driver circutry determines that faults (open/short and no load) do not exist on the MIL circuit. | Electronic out-put driver circutry determines faults (open/short and no load) do exist on the MIL circuit. | Lamp must be commanded on for short to battery/open faults. Lamp must be commanded off for shot to ground/no load | Fault exists for 2 sec monitored continuosly | ECM electronic circuitry | A |
| 5 Volt Reference 2 Circuit Low Voltage | P0652 | 4.86V to 5.1V Detects circuit faults which lower the 5V reference 2 supply voltage out of regulation | 5 Volt Reference 2 < 4.86V | Ignition on | Monitor time is 160msec. Continuous | ECM Hardware Fault Detection | A |
| 5 Volt Reference 2 Circuit High Voltage | P0653 | 4.86V to 5.1V Detects circuit faults which raise the 5V reference 2 supply voltage out of regulation | 5 Volt Reference 2 > 5.1V | Ignition on | Monitor time is 160msec. Continuous | ECM Hardware Fault Detection | A |
| Cylinder #1 Glow Plug Control Circuit | P0671 | P0671 Error Message not received from the Glow Plug Control Module via GMLAN indicating an error on Cyl #1 Glow Plug | 1)Glow Plug line is open 2)Glow Plug line is shorted 3)Glow Plug line high resistance 4)Glow Plug line low resistance SEE "GPCM Cert Doc" worksheet | Ignition on Glow plugs commanded on | Monitor time is 1 sec. Frequency is every 250msec. | GPCM detects the faults and sends serial data message via GMLAN to the ECM | B |
| Cylinder #2 Glow Plug Control Circuit | P0672 | P0672 Error Message not received from the Glow Plug Control Module via GMLAN indicating an error on Cyl #2 Glow Plug | 1)Glow Plug line is open 2)Glow Plug line is shorted 3)Glow Plug line high resistance 4)Glow Plug line low resistance SEE "GPCM Cert Doc" worksheet | Ignition on Glow plugs commanded on | Monitor time is 1 sec. Frequency is every 250msec. | GPCM detects the faults and sends serial data message via GMLAN to the ECM | B |
| Cylinder #3 Glow Plug Control Circuit | P0673 | P0673 Error Message not received from the Glow Plug Control Module via GMLAN indicating an error on Cyl #3 Glow Plug | 1)Glow Plug line is open 2)Glow Plug line is shorted 3)Glow Plug line high resistance 4)Glow Plug line low resistance SEE "GPCM Cert Doc" worksheet | Ignition on Glow plugs commanded on | Monitor time is 1 sec. Frequency is every 250msec. | GPCM detects the faults and sends serial data message via GMLAN to the ECM | B |
| Cylinder #4 Glow Plug Control Circuit | P0674 | P0674 Error Message not received from the Glow Plug Control Module via GMLAN indicating an error on Cyl #4 Glow Plug | 1)Glow Plug line is open 2)Glow Plug line is shorted 3)Glow Plug line high resistance 4)Glow Plug line low resistance SEE "GPCM Cert Doc" worksheet | Ignition on Glow plugs commanded on | Monitor time is 1 sec. Frequency is every 250msec. | GPCM detects the faults and sends serial data message via GMLAN to the | B |

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|---|---|---|---|---|---|---|---|
| Cylinder #5 Glow Plug Control Circuit | P0675 | P0675 Error Message not received from the Glow Plug Control Module via GMLAN indicating an error on Cyl #5 Glow Plug | 1)Glow Plug line is open 2)Glow Plug line is shorted 3)Glow Plug line high resistance 4)Glow Plug line low resistance SEE "GPCM Cert Doc" worksheet | Ignition on Glow plugs commanded on | Monitor time is 1 sec. Frequency is every 250msec. | GPCM detects the faults and sends serial data message via GMLAN to the | B |
| Cylinder #6 Glow Plug Control Circuit | P0676 | P0676 Error Message not received from the Glow Plug Control Module via GMLAN indicating an error on Cyl #6 Glow Plug | 1)Glow Plug line is open 2)Glow Plug line is shorted 3)Glow Plug line high resistance 4)Glow Plug line low resistance SEE "GPCM Cert Doc" worksheet | Ignition on Glow plugs commanded on | Monitor time is 1 sec. Frequency is every 250msec. | GPCM detects the faults and sends serial data message via GMLAN to the ECM | B |
| Cylinder #7 Glow Plug Control Circuit | P0677 | P0677 Error Message not received from the Glow Plug Control Module via GMLAN indicating an error on Cyl #7 Glow Plug | 1)Glow Plug line is open 2)Glow Plug line is shorted 3)Glow Plug line high resistance 4)Glow Plug line low resistance SEE "GPCM Cert Doc" worksheet | Ignition on Glow plugs commanded on | Monitor time is 1 sec. Frequency is every 250msec. | GPCM detects the faults and sends serial data message via GMLAN to the ECM | B |
| Cylinder #8 Glow Plug Control Circuit | P0678 | P0678 Error Message not received from the Glow Plug Control Module via GMLAN indicating an error on Cyl #8 Glow Plug | 1)Glow Plug line is open 2)Glow Plug line is shorted 3)Glow Plug line high resistance 4)Glow Plug line low resistance SEE "GPCM Cert Doc" worksheet | Ignition on Glow plugs commanded on | Monitor time is 1 sec. Frequency is every 250msec. | GPCM detects the faults and sends serial data message via GMLAN to the | B |
| 5 Volt Reference 3 Circuit Low Voltage | P0698 | 4.86V to 5.1V Detects circuit faults which lower the 5V reference 3 supply voltage out of regulation | 5 Volt Reference 3 < 4.86V | Ignition on | Monitor time is 160msec. Continuous | ECM Hardware Fault Detection | A |
| 5 Volt Reference 3 Circuit High Voltage | P0699 | 4.86V to 5.1V Detects circuit faults which raise the 5V reference 3 supply voltage out of regulation | 5 Volt Reference 3 > 5.1V | Ignition on | Monitor time is 160msec. Continuous | ECM Hardware Fault Detection | A |
| **P07XX-P08XX Transmission** | | | | | | | |
| Transmission Control Module (TCM) Requested MIL Illumination | P0700 | Serial Data communication from the TCM indicates a fault exists with the transmission. | Serial Data communication from the TCM indicates no faults exists with the transmission. | Ignition on | active on first message received. Monitored continuosly | GMLAN Bus | A |
| Park/Neutral Position (PNP) Switch Circuit Low Voltage | P0851 | GMLAN Message for PNP position indicates park nuetral position and agrees with ECM sensed position based on PNP switch inputs to | GMLAN Message for PNP position indicates park nuetral and dis-agrees with ECM sensed position based on PNP switch inputs to ECM | 11v < Battery voltage < 18v , No GMLAN error messages, P0852 not active Ignition on | Failure being transmitted for 5 sec. Checked continuosly | GMLAN, PNP switch inputs to ECM | B |
| Park/Neutral Position (PNP) Switch Circuit High Voltage | P0852 | ECM sensed position based on PNP switch inputs to ECM indacates not park or nuetral. | ECM sensed position based on PNP switch inputs to ECM indacates park or nuetral. | Engine speed > 650rpm, Vehicle speed > 24kPH, Actual Engine Torque > 120 newton meters, 11v < Battery voltage < 18v, No GMLAN error messages, P0851 | Failure being transmitted for 5 sec. Checked continuosly | GMLAN, PNP switch inputs to ECM | B |
| **P12XX-P22XX Fuel and Air Metering and Auxiliary Emission Controls** | | | | | | | |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Injector 1 Control Circuit Shorted | P1224 | Electronic out-put driver circuitry determines that the faults (short load) do not exist. | Electronic out-put driver circuitry determines that the faults (short load) do exist | Engine running. Injection event is being attempted for Cly 1 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 2 Control Circuit Shorted | P1227 | Electronic out-put driver circuitry determines that the faults (short load) do not exist. | Electronic out-put driver circuitry determines that the faults (short load) do exist | Engine running. Injection event is being attempted for Cly 2 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 3 Control Circuit Shorted | P122A | Electronic out-put driver circuitry determines that the faults (short load) do not exist. | Electronic out-put driver circuitry determines that the faults (short load) do exist | Engine running. Injection event is being attempted for Cly 3 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 4 Control Circuit Shorted | P1233 | Electronic out-put driver circuitry determines that the faults (short load) do not exist. | Electronic out-put driver circuitry determines that the faults (short load) do exist | Engine running. Injection event is being attempted for Cly 4 | Fault exists for 6 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 5 Control Circuit Shorted | P1236 | Electronic out-put driver circuitry determines that the faults (short load) do not exist. | Electronic out-put driver circuitry determines that the faults (short load) do exist | Engine running. Injection event is being attempted for Cly 5 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 6 Control Circuit Shorted | P1239 | Electronic out-put driver circuitry determines that the faults (short load) do not exist. | Electronic out-put driver circuitry determines that the faults (short load) do exist | Engine running. Injection event is being attempted for Cly 6 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 7 Control Circuit Shorted | P1242 | Electronic out-put driver circuitry determines that the faults (short load) do not exist. | Electronic out-put driver circuitry determines that the faults (short load) do exist | Engine running. Injection event is being attempted for Cly 7 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector 8 Control Circuit Shorted | P1247 | Electronic out-put driver circuitry determines that the faults (short load) do not exist. | Electronic out-put driver circuitry determines that the faults (short load) do exist | Engine running. Injection event is being attempted for Cly 8 | Fault exists for 3 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Diesel Particulate Filter Regeneration Frequency Too Low | P1448 | Average time between the last two DPF regenerations <= 20 hours | Running average of time between the last two completed DPF regens (with idle time subtraced out) > 20 hours. | Engine running | Diagnostic fail condition true 1 time. Test performed continuously. | Running average of the time between the last two completed DPF | A |
| Intake Air (IA) Heater Feedback Circuit | P154A | digital response signal = high | digital response signal = low and current IAH > 20 A | 1)IAH Commanded ON 2)Battery Voltage at IAH > 8.6 Volt | Monitor time is 650msec. Frequency is every 10msec. | Monitored by GPCM and message transferred by CAN | B |
| Intake Air (IA) Heater Voltage Signal Circuit | P154B | 6.9 volts <= IAH Battery voltage <= 16.0 volts | IAH Battery voltage > 16.0 Volt AND 8.0 volts < GPCM Battery voltage GPCMKL30 < 16.0 Volt | 1)IAH Commanded ON | Monitor time is 650msec. Frequency is every 10msec. | Monitored by GPCM and message transferred by CAN | B |
| Intake Air (IA) Heater Current Signal Circuit | P154C | No failures detected on the IAH line current | IAH current line detected open, shorted to ground or shorted to battery | 1)IAH Commanded ON 2)Battery Voltage at IAH > 6.9 Volt 3)GPCM Ignition voltage >= 6.9 Volt | Monitor time is 320 msec. Frequency is every 10msec. | Monitored by GPCM and message transferred by CAN | B |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Intake Air (IA) Heater Temperature Signal Circuit | P154D | No failures detected on the temperature signal | IAH temperature line detected open, shorted to ground or shorted to battery | 1)IAH Commanded ON 2)6.9 volts < Battery Voltage at IAH > 16.0 volts | Monitor time is 650msec. Frequency is every 10msec. | Monitored by GPCM and message transferred by CAN | B |
| Engine Calibration Information Not Programmed – GPCM | P160C | P160C Error Message not received from the Glow Plug Control Module via GMLAN | P160C Error Message received from the Glow Plug Control Module via GMLAN indicating IQA data has not been programmed in the GPCM | Ignition ON | Monitor time is 1 second. Frequency is every 160msec. | GPCM detects the fault and sends serial data message via GMLAN to the | A |
| Intake Air (IA) Heater Over Temperature | P166B | Temperature IAH <80 °C | Temperature IAH > 80 °C | 1)IAH Commanded ON 2)engine run time > 40 sec 3)Battery Voltage at IAH > 8.6 Volt | Monitor time is 1 second. Frequency is every 160msec. | GPCM detects the fault and sends serial data message via GMLAN to the | B |
| Intake Air (IA) Heater Resistance | P166C | Calculated resistance <= 500 mOhm | Calculated resistance > 500 mOhm and current IAH > 20 A | 1)IAH Commanded ON 2)Battery Voltage at IAH > 8.6 Volt | Monitor time is 1 second. Frequency is every 160msec. | GPCM detects the fault and sends serial data message via GMLAN to the | B |
| Diesel Particulate Filter Efficiency Below Threshold Bank 1 | P2002 | Res flow > f(Delta Pressure and exhaust flow) (see Chart 3A below) detects 8X the standard. | Res flow < f(Delta Pressure and exhaust flow) (see Chart 3A below) detects 8X the standard. | Time since successful regen < = 600 seconds. Distance since successful regen <= 18.6 Miles. Accumulated soot <=40 grams. | Diagnostic set when conditions true for 30 sec. Test performed after a regen | DPF Delta pressure sensor | B |

Chart 3a

| Volume of exhaust Flow in meters^3 / hours | Calculated Res Flow= DPF Delta pressure / exhaust flow in hPa/(meters^3/hours) |
|---|---|
| 0 | -0.0418 |
| 25 | -0.0418 |
| 50 | -0.0418 |
| 100 | -0.0418 |
| 200 | -0.0418 |
| 400 | -0.0418 |
| 1000 | -0.0468 |
| 1001 | -0.0468 |
| 1002 | -0.0468 |
| 1600 | -0.0518 |
| 1601 | -0.0518 |
| 1602 | -0.0518 |
| 1800 | -0.0518 |
| 2000 | -0.0518 |
| 2200 | -0.0518 |
| 2400 | -0.0518 |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Exhaust Gas Temperature (EGT) Sensor 2 Circuit Low Voltage | P2032 | 0.318 v - 3.37 v  (-40 degC - 1000 degC) Detects EGT 2 sensor circuit open or short to ground | Exhaust Temp Sensor 2 Signal <0.318 v same as -40 degC | Ignition on | Diagnostic fail condition true for 1 sec Test performed continuously | Exhaust Gas Temperature sensor 2 | A |
| Exhaust Gas Temperature (EGT) Sensor 2 Circuit High Voltage | P2033 | 0.307 v - 3.37 v  (-40 degC - 1000 degC) Detects EGT 2 sensor circuit open or short to ground | Exhaust Temp Sensor 2 Signal > 3.37 v same as 1000 degC | Ignition on | Diagnostic fail condition true for 1 sec Test performed continuously | Exhaust Gas Temperature sensor 2 | A |
| Fuel Level Sensor 2 Performance | P2066 | Initial volume in tank 2 – current volume in tank 2  >=0.8 L | Initial volume in tank 2 – current volume in tank 2  < 0.8 L | PATH1:P0462,P0463 not set Engine run time > 10 sec, Transfer pump is OFF\n\nPATH2:P0461,P0462,P0463,P2067,P2068 not set Fuel transfer pump ON for 240 seconds OR tank indication < 72 L vehicle speed <=0 | Monitor time is 100msec. Continuous | Fuel Level 2 input | B |
| Exhaust Gas Temperature (EGT) Sensor 1-2 Correlation | P20E2 | absolute value of (Startup Exhaust Gas Temperature 1 Sensor  -  Startup Exhaust Gas Temperature 2 Sensor)  <= 20 degC. | absolute value of (Startup Exhaust Gas Temperature 1 Sensor  -  Startup Exhaust Gas Temperature 2 Sensor)  > 20 degC. | P0545,P0546,P2032,P2033 DTCs are not set. Engine Off Timer > 5 hrs | Diagnostic sets on first fail     Test performed once per key cycle | EGT Temperature sensor 1 and EGT Temperature sensor 2 | B |
| Accelerator Pedal Position (APP) Sensor 1 Circuit Low Voltage | P2122 | 0.806 volt to 4.75 volts Detects a sensor circuit short to ground | Accelerator pedal supply voltage <= 0.806 volts | P2122, P2123 are not currently set No sensor supply errors. No A-to-D pulse test Ignition ON | Diagnostic fail conditions true for 0.24 seconds Test performed continuously 100msec | Accelerator pedal sensor 1 | C |
| Accelerator Pedal Position (APP) Sensor 1 Circuit High Voltage | P2123 | 0.806 volt to 4.75 volts Detects a sensor   circuit short high voltage or a sensor circuit open | Accelerator pedal supply voltage >= 4.75 volts | P2122, P2123 are not currently set No sensor supply errors. No A-to-D pulse test Ignition ON | Diagnostic fail conditions true for 0.24 seconds Test performed continuously 100msec | Accelerator pedal sensor 1 | C |
| Accelerator Pedal Position (APP) Sensor 2 Circuit Low Voltage | P2127 | 0.308 volt to 2.5 volts Detects a sensor circuit short to ground | Accelerator pedal supply voltage <= 0.308 volts | P2127, P2128 are not currently set No sensor supply errors. No A-to-D pulse test Ignition ON | Diagnostic fail conditions true for 0.24 seconds Test performed continuously 100msec | Accelerator pedal sensor 2 | C |
| Accelerator Pedal Position (APP) Sensor 2 Circuit High Voltage | P2128 | 0.308 volt to 2.5 volts Detects a sensor   circuit short high voltage or a sensor circuit open | Accelerator pedal supply voltage >= 2.5 volts | P2127, P2128 are not currently set No sensor supply errors. No A-to-D pulse test Ignition ON | Diagnostic fail conditions true for 0.24 seconds Test performed continuously 100msec | Accelerator pedal sensor 2 | C |
| Accelerator Pedal Position (APP) Sensor 1-2 Correlation | P2138 | 0.806 volt to 4.75 volts Detects a sensor 1 to sensor 2 correlation error | Accelerator pedal sensor 1 & 2 differ by more than 2%. | P2122, P2123, P2127, P2128 are not currently set.  No sensor supply errors. Ignition ON | Diagnostic fail conditions true for 0.3 seconds Test performed continuously 100msec | Accelerator pedal sensor 1 & 2 | C |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Injector Positive Voltage Control Circuit Group 1 | P2146 | Electronic out-put driver circuitry determines the faults (open/short/no load) do not exist | Electronic out-put driver circuitry determines the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for injectors 1&4 connected to bank 1 | Fault exists for 6 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector Positive Voltage Control Circuit Group 2 | P2149 | Electronic out-put driver circuitry determines the faults (open/short/no load) do not exist | Electronic out-put driver circuitry determines the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for injectors 7&6 connected to bank 2 | Fault exists for 6 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector Positive Voltage Control Circuit Group 3 | P2152 | Electronic out-put driver circuitry determines the faults (open/short/no load) do not exist | Electronic out-put driver circuitry determines the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for injectors 2&5 connected to bank 3 | Fault exists for 6 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Injector Positive Voltage Control Circuit Group 4 | P2155 | Electronic out-put driver circuitry determines the faults (open/short/no load) do not exist | Electronic out-put driver circuitry determines the faults (open/short/no load) do exist | Engine running. Injection event is being attempted for injectors 8&3 connected to bank 4 | Fault exists for 6 msec. Monitored continuosly | ECM Injector Electronic out-put driver circuitry | A |
| Engine Coolant Temperature (ECT) Sensor 2 Circuit Low Voltage | P2184 | 0.065 V to 4.75 V      -40degC to 150 degC Detects a sensor circuit short to ground | Coolant Temperature Sensor voltage <= 0.065 volt      -same as- Coolant Temperature>150degC | Ignition On | Diagnostic set conditions true for 15 second      Test performed continuously 100msec rate | Coolant Temperature Sensor | B |
| Engine Coolant Temperature (ECT) Sensor 2 Circuit High Voltage | P2185 | 0.065 V to 4.75 V      -40degC to 150 degC Detects a sensor  circuit short high voltage or a sensor circuit open | Coolant Temperature Sensor voltage >= 4.8 V -same as- Coolant Temperature >-40 degC | Ignition On | Diagnostic set conditions true for 60 second      Test performed continuously 100msec rate | Coolant Temperature Sensor | B |
| Barometric Pressure (BARO) Circuit Low Input | P2228 | 1.5 v - 4.8 v  (60kPA - 120kPa) Detects Baro sensor circuit open or grounded | Baro Sensor Signal <1.5 v | P0652,P0653 DTCs not set Ignition On | Diagnostic fail condition true for 800msec Test performed continuously | Barometric Pressure (Baro) Sensor | B |
| Barometric Pressure (BARO) Circuit High Input | P2229 | 1.5 v - 4.8 v  (60kPA - 120kPa) Detects Baro sensor circuit shorted to high voltage | Baro Sensor Signal >4.8v | P0652,P0653 DTCs  not set Ignition On | Diagnostic fail condition true for 800msec Test performed continuously | Barometric Pressure (Baro) Sensor | B |
| Diesel Particulate Filter Differential Pressure Too High | P244B | Differential pressure less than a calibration map See Worksheet 244B Temp Map. | Differential pressure sensor > calibration map based on exhaust flow rate and DPF temperature | Engine running | Diagnostic fail conditions true for 30 sec.  Test performed continuously | Differential pressure sensor | A |
| Catalyst Temperature Too Low During Regeneration | P244C | Exhaust temperature before the DPF within 100 deg of the control target temperature. See Worksheet 244C Target Temp Map. | Exhaust temperature sensor before the DPF below the control target temperature by 100 Deg C. | Control system in active DPF regeneration | Diagnostic fail conditions true for 5 min.  Test performed continuously. | Exhaust temperature sensor before the DPF | B |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Diesel Particulate Filter Differential Pressure Sensor Performance | P2453 | 1. Not more than + or - 41 hPa from the differential pressure sensor value with engine off.<br>  2. Or sensor detects and increase in pressure with increase in exhaust flow.<br>  3. Or sensor detects and decrease in pressure with decrease in exhaust flow. | 1. abs(Differential pressure sensor signal) > 41 hPa.<br>  2. Or Differential pressure sensor gradient > 6 hPa/sec.<br>  3. Or Differential pressure sensor gradient < - 6 hPa/sec.<br><br>- | 1. Engine off.<br><br>  2.Engine running and when a change in the exahust flow gradient > 200 m^3/h/sec.<br>  3. Engine running and when a change in the exhausf flow gradient < -200 m^3/h/sec. | 1. Fail conditions true for 500 msec. Test performed once during ECM power down.<br>2.  Fail conditions true for 900 msec.  Test performed continuously.<br>3. Fail conditions true for 900 msec.  Test performed continuously. | Differential pressure sensor | A |
| Diesel Particulate Filter Differential Pressure Sensor Circuit Low Voltage | P2454 | 0.930 v - 4.745 v  ( -144 hPA to 1000 hPa) Detects differential pressure sensor circuit short to low voltage | Differential pressure sensor signal < .930 v (20Hpa) | Ignition On | Diagnostic fail condition true for 3.75 seconds. Test performed continuously | Differential pressure sensor | A |
| Diesel Particulate Filter Differential Pressure Sensor Circuit High Voltage | P2455 | 0.930 v - 4.745 v  ( -144 hPA to 1000 hPa) Detects differential pressure sensor circuit short to high voltage | Differential pressure sensor signal > 4.745 v (1000Hpa) | Ignition On | Diagnostic fail condition true for 3.75 seconds. Test performed continuously | Differential pressure sensor | A |
| Exhaust Gas (EGR) Cooler Performance | P2457 | Temperature difference between temperature sensor #2 and temperature sensor #1 is => MAP | Temperature difference between temperature sensor #2 and temperature sensor #1 is => MAP<br>EGR opening position > 4% for 60 seconds | P040C,P040D,P041C, P041D and P040F DTCs are not set<br>Ignition on | Diagnostic fail condition true for 3 seconds Test performed continuously | | B |
| Diesel Particulate Filter Regeneration Frequency Too High | P2459 | Average time between last two DPF regenerations > 1 Hr, 10 min | Running average of the time between the last two *completed* DPF regens < 1 hours 10 min. | Engine running | Diagnostic fail condition true 1 time. Test performed continuously. | Time between DPF regeneration. | A |
| Diesel Particulate Filter - Soot Accumulation | P2463 | DPF has accumulated < 70 grams of particulates | DPF has accumulated >= 70 grams of particulates | Engine running | Diagnostic fail condition true for 5 mins. Test performed continuosly | DPF Delta pressure sensor | A |
| **P25XX Auxiliary Inputs** | | | | | | | |
| ECM Power Relay Circuit | P2510 | Relay is responding corectly to ECM command to turn off. | Relay is responding incorrectly to ECM command to turn off. | Engine has tranistioned from start to run or After run ( Power down) has occurred | Diagnostic set conditions !st failure Test performed twice a drive cycle | Updates to the EEPROM Variables. | A |
| Turbocharger Boost Control Position Sensor Performance | P2563 | Delta from target turbo vane position <  +/- 15%.        Delta is the difference between desired turbo vane position and the actual turbo vane position.<br>Detects turbo vane position | Delta from target turbo vane position  >  +/- 15%. | P0045, P2564<br>Engine Run time>30 sec | Diagnostic set conditions true for  for 5 sec<br>Test performed continuously | Turbocharger Vane Position Sensor. | B |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Turbocharger Boost Control Position Sensor Circuit Low Voltage | P2564 | 0.277 v to 4.780 v (0% to 100% position) Detects Turbocharger Vane Position sensor circuit open and shorted to ground | Turbocharger Vane Position Sensor Signal < 0.277v | Engine Run time>3sec | Diagnostic set condition true for 1Seconds Test performed continuously | Turbocharger Vane Position Sensor. | B |
| Turbocharger Boost Control Position Sensor Circuit High Voltage | P2565 | 0.277 v to 4.780 v (0% to 100% position) DetectsTurbocharger Vane Position sensor circuit shorted to high voltage voltage | Turbocharger Vane Position Sensor Signal > 4.78v | Engine Run time>3sec | Diagnostic set condition true for 1 seconds Test performed continuously | Turbocharger Vane Position Sensor. | B |
| **P26XX Computer and Auxiliary Outputs** | | | | | | | |
| Control Module Ignition Off Timer Performance | P2610 | ignition off time delta = 1sec AND ignition off timer >= 0 sec AND ignition off timer <= 10 sec AND  timer is incrementing  Detects a faulty Ignition off Timer circuit. | Ignition off timer reads < 0 sec          OR Ignition off timer reads <=5 sec >10 sec          OR timer unchanged for  60 sec                    OR | ECM powered up | Diagnostic set conditions 1st failure Test performed once during  drive cycle and once at after run | SW calculation | B |
| Fuel Transfer Pump Flow Insufficient | P2636 | Initial volume in tank 1 – current volume in tank 1  >= 0.8 L AND Initial volume in tank 2 – current volume in tank 2  >= 0.8 L | Initial volume in tank 1 – current volume in tank 1  < 0.8 L AND Initial volume in tank 2 – current volume in tank 2  < 0.8 L | P0461,P0462,P0463,P2067,P2068 not set Transfer pump is ON for 200 seconds | Monitor time is 100msec. Continuous | Transfer pump Fault Detection | B |
| Fuel Injector Calibration Not Programmed | P268A | Injector Calibration Data (IQA) is programmed in the ECM | Injector Calibration Data (IQA) is not programmed in the ECM | Ignition on | Diagnostic set conditions 1st failure Test performed once at key-up | SW calculation | A |
| Cylinder 1 Injector Data Incorrect  (IQA) | P268C | Cylinder #1, IQA values are to be = between ECM and GPCM for successful pass | Cylinder #1 IQA values are not = between ECM and GPCM | NONE | Runs continuously at key on, engine run | Compare IQA values stored in ECM and GPCM. Must be equal to pass. | A |
| Cylinder2 Injector Data Incorrect (IQA) | P268D | Cylinder #2, IQA values are to be = between ECM and GPCM for successful pass | Cylinder #2 IQA values are not = between ECM and GPCM | NONE | Runs continuously at key on, engine run | Compare IQA values stored in ECM and GPCM. Must be equal to pass. | A |
| Cylinder 3 Injector Data Incorrect  (IQA) | P268E | Cylinder #3, IQA values are to be = between ECM and GPCM for successful pass | Cylinder #3 IQA values are not = between ECM and GPCM | NONE | Runs continuously at key on, engine run | Compare IQA values stored in ECM and GPCM. Must be equal to pass. | A |
| Cylinder 4 Injector Data Incorrect (IQA) | P268F | Cylinder #4, IQA values are to be = between ECM and GPCM for successful pass | Cylinder #4 IQA values are not = between ECM and GPCM | NONE | Runs continuously at key on, engine run | Compare IQA values stored in ECM and GPCM. Must be equal to pass. | A |

| SENSED PARAMETER | FAULT CODE | ACCEPTABLE OPERATING RANGE AND RATIONALITY | PRIMARY MALFUNCTION DETECTION PARAMETERS | SECONDARY MONITORING PARAMETERS AND CONDITIONS | MONITORING TIME LENGTH AND FREQUENCY OF CHECK | MONITORING METHOD | FAULT CODE STORAGE AND MIL ILLUMINATION |
|---|---|---|---|---|---|---|---|
| Cylinder 5 Injector Data Incorrect (IQA) | P2690 | Cylinder #5, IQA values are to be = between ECM and GPCM for successful pass | Cylinder #5 IQA values are not = between ECM and GPCM | NONE | Runs continuously at key on, engine run | Compare IQA values stored in ECM and GPCM. Must be equal to pass. | A |
| Cylinder 6 Injector Data Incorrect (IQA) | P2691 | Cylinder #6, IQA values are to be = between ECM and GPCM for successful pass | Cylinder #6 IQA values are not = between ECM and GPCM | NONE | Runs continuously at key on, engine run | Compare IQA values stored in ECM and GPCM. Must be equal to pass. | A |
| Cylinder 7 Injector Data Incorrect (IQA) | P2692 | Cylinder #7, IQA values are to be = between ECM and GPCM for successful pass | Cylinder #7 IQA values are not = between ECM and GPCM | NONE | Runs continuously at key on, engine run | Compare IQA values stored in ECM and GPCM. Must be equal to pass. | A |
| Cylinder 8 Injector Data Incorrect (IQA) | P2693 | Cylinder #8, IQA values are to be = between ECM and GPCM for successful pass | Cylinder #8 IQA values are not = between ECM and GPCM | NONE | Runs continuously at key on, engine run | Compare IQA values stored in ECM and GPCM. Must be equal to pass. | A |
| **UXXXX Communications** | | | | | | | |
| Lost communications with Transmission Control System | U0101 | ECM reports no loss of communication with the TCM | PATH 1)The ECM fails to receive messages $19D, $0F9, $1F5, $4C9 or $199 | Ignition on | Monitor time is 1000msec. Frequency is every 160msec. | CAN Message from the TCM | A |
| Lost Communications with Glow Plug Control Module | U0106 | ECM reports no loss of communication with the GPCM | PATH 1)The ECM fails to receive message $3BD. PATH 2)GPCM reports message $3B9 from ECM is missing | Ignition on | Monitor time is 1000msec. Frequency is every 160msec. | Message from GPCM and ECM signal indicating loss of GPCM message | B |

## LOOK-UP TABLES

### COOLER MAP

| injection qty mm | | RPM | | | | |
|---|---|---|---|---|---|---|
| | | 800 | 1000 | 2000 | 2500 | 3000 |
| | 5 | -10 | -30 | -30 | -30 | -30 |
| | 10 | -10 | -30 | -30 | -30 | -30 |
| | 15 | -10 | -30 | -30 | -30 | -30 |
| | 20 | -10 | -30 | -30 | -30 | -30 |
| | 25 | -10 | -30 | -30 | -30 | -30 |

### BOOST DEVIATION MAP

AirCtl_mMaxDvt_MAP

| y/x | 40 | 1800 | 2000 | 3000 | 4000 |
|---|---|---|---|---|---|
| 1 | 400 | 400 | 100 | 300 | 400 |
| 20 | 400 | 400 | 100 | 300 | 400 |
| 40 | 400 | 400 | 100 | 300 | 400 |
| 80 | 400 | 400 | 400 | 400 | 400 |
| 125 | 400 | 400 | 400 | 400 | 400 |

AirCtl_mMinDvt_MAP

| y/x | 40 | 1800 | 2000 | 3000 | 4000 |
|---|---|---|---|---|---|
| 1 | -400 | -400 | 100 | 300 | -400 |
| 20 | -400 | -400 | 100 | 300 | -400 |
| 40 | -400 | -400 | 100 | 300 | -400 |
| 80 | -400 | -400 | -400 | -400 | -400 |
| 125 | -400 | -400 | -400 | -400 | -400 |

### DTC P0495

| Coolant Temp °C | Barometric pressure | | | | | | |
|---|---|---|---|---|---|---|---|
| | 760 hpa (>= 8000 ft) | 761 hpa (7966 ft) | 805 hpa (6500 ft) | 850 hpa (5000 ft) | 910 hpa (3000 ft) | 990 hpa (1000 ft) | 1000 hpa (0 ft) |
| -6.74 | 20min | 19.96 | 19.96 | 18.13 | 13.76 | 10.43 | 10 |
| -6.04 | 20 | 19.96 | 19.96 | 18.13 | 13.76 | 10.43 | 10 |
| 36.96 | 20 | 19.96 | 19.96 | 18.13 | 13.76 | 10.43 | 10 |
| 99.96 | 20 | 19.96 | 19.96 | 18.13 | 13.76 | 10.43 | 10 |
| 101 | 30 | 29.92 | 19.96 | 18.13 | 13.76 | 10.43 | 10 |
| 103 | 40 | 40 | 40 | 18.13 | 13.76 | 10.43 | 10 |
| 105 | 1092.23 | 1092.23 | 1092.23 | 1092.23 | 1092.23 | 10.43 | 10 |

| Fan Input Speed | 400 | 800 | 1200 | 1600 | 2000 | 2400 | 2800 | 3200 | 3600 | 4000 | 4400 | 4800 | 5200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fan Speed | 400 | 800 | 1200 | 1600 | 1700 | 1700 | 1700 | 1750 | 1750 | 1750 | 1750 | 1750 | 1750 |

### 244B TEMP MAP

Diesel Particulate Filter Differential Pressure Too High cal m

# 08 GRP01 All Engines

**DPF Surface Temperature [deg. C]**

| Exhaust flow rate [m^3/hr] | 100 | 200 | 275 | 300 | 325 | 350 | 375 | 400 | 425 | 450 | 475 | 500 | 525 | 550 | 600 | 650 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 40 | 40 | 40 | 40 | 40 | 40 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 52 |
| 300 | 58 | 65 | 90 | 95 | 87 | 79 | 82 | 86 | 89 | 93 | 96 | 88 | 92 | 96 | 96 | 100 | |
| 400 | 102 | 105 | 111 | 117 | 98 | 96 | 99 | 99 | 98 | 98 | 110 | 124 | 128 | 132 | 136 | 140 | |
| 500 | 145 | 145 | 132 | 138 | 109 | 113 | 116 | 112 | 107 | 103 | 125 | 129 | 164 | 168 | 172 | 180 | |
| 600 | 182 | 182 | 168 | 178 | 167 | 198 | 174 | 167 | 160 | 132 | 160 | 157 | 208 | 212 | 216 | 224 | |
| 700 | 218 | 218 | 204 | 217 | 224 | 284 | 233 | 223 | 213 | 162 | 196 | 185 | 173 | 161 | 260 | 268 | |
| 900 | 312 | 312 | 316 | 227 | 214 | 216 | 214 | 225 | 230 | 235 | 247 | 260 | 266 | 272 | 274 | 364 | |
| 1100 | 448 | 432 | 428 | 428 | 432 | 432 | 436 | 440 | 308 | 332 | 373 | 382 | 392 | 383 | 377 | 480 | |
| 1300 | 620 | 600 | 584 | 584 | 584 | 580 | 580 | 584 | 584 | 384 | 412 | 435 | 465 | 494 | 481 | 620 | |
| 1500 | 620 | 764 | 740 | 736 | 732 | 728 | 724 | 724 | 728 | 732 | 469 | 511 | 558 | 605 | 587 | 756 | |
| 1700 | 620 | 1000 | 980 | 988 | 996 | 988 | 980 | 968 | 968 | 964 | 960 | 960 | 960 | 960 | 625 | 968 | |
| 1900 | 620 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |
| 2100 | 620 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |
| 2400 | 620 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |
| 2700 | 620 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |
| 3000 | 620 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |

**Catalyst Temperature Too Low/High During Regeneration Target Temp Map 244C**

| Injector F | Engine RPM | | | |
|---|---|---|---|---|
| | 800 | 1000 | 1500 | 2100 |
| 0 | 620 | 651.5 | 651.5 | 651.5 |
| 40 | 620 | 651.5 | 651.5 | 651.5 |
| 50 | 620 | 651.5 | 651.5 | 651.5 |
| 60 | 620 | 651.5 | 651.5 | 651.5 |