2014 Volkswagen Passat
Quick Reference Specification Book

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DTC CHART

Engine Code CPKA, CPRA

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake Camshaft Position Slow Response Bank 1	Signal change > 8 CRK ° for > 2.9 Sec. and adjustment angle ≥ 2.50 CRK rev.
P0010	Intake Camshaft Position Actuator Circuit Open Bank 1	Signal voltage, > 4.7 - 5.4 V
P0011	Intake Camshaft Position Actuator Circuit Open Bank 1	Signal voltage, > 4.7 - 5.4 V
P0016	Crankshaft Position – Camshaft Position Correlation	• Permissible deviation < -11 CRK ° or • Permissible deviation > 11 CRK °
P0030	HO2S Heater Control Circuit Bank 1 Sensor 1	Heater voltage 4.70 - 5.40 V
P0031	HO2S Heater Control Circuit Low Bank 1 Sensor 1	Heater voltage < 0 to 3.26 V
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	Signal current > 5.50 A
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	Heater voltage, 4.50 - 5.50 V
P0037	HO2S Heater Control Circuit Low Bank 1 Sensor 2	Heater voltage < 3.00 V
P0038	HO2S Heater Control Circuit High Bank 1 Sensor 2	Heater current, > 2.70 - 5.50 A
P0068	MAF vs Throttle Position Correlation	Plausibility with fuel system • Load calculation < -22% Plausibility with fuel system • Load calculation > 22%
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temperature < -50 °C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0071	Ambient Air Temperature Sensor Range/Performance	• Difference in value between ECT and AAT at engine start (depending on engine off time) > 25 K and • Difference in value between AAT and IAT at engine start (depending on engine off time) > 25 K
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temperature > 77 °C
P0087	Fuel Rail/System Pressure - Too Low	• Fuel trim activity 0.90 - 1.15 • Pressure controller activity > 2 MPa • Difference between target and actual pressure > -16.4
P0100	Mass Air Flow Circuit Fault	MAF sensor signal 0 µs
P0101	Mass Air Flow Circuit Range/ Performance	Mass air flow vs. • Upper threshold model > 60 to 800 kg/h • Lower threshold model < 0 to 400 kg/h • Load calculation > 18% • Fuel system < -18%
P0102	Mass Air Flow Circuit Low Input	MAF sensor signal < 66 µs
P0103	Mass Air Flow Circuit High Input	MAF sensor signal > 4500 µs
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Range/Performance	• Difference of boost pressure signal vs altitude sensor signal > 230 hPa or • Difference of boost pressure signal vs altitude sensor signal < -130 hPa
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	• Difference in value IAT - ECT @ engine start (depending on engine off time) > 25° C • Difference in value IAT - AAT @ engine start > 25° C (depending on engine off time)
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	IAT > 141.0° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0113	Intake Air Temperature Sensor 1 Circuit High Input	IAT < -46° C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	• No change on signal < 2 K or • Signal in range ≥ 89° C with no change and signal ≤ 110° C
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	ECT >140° C
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	ECT < -40° C
P0121	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 1 calculated value > TPS 2 calculated value • TPS 1 calc. value > 9.00%
P0122	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Low Input	Signal voltage < 0.20 V
P0123	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit High Input	Signal voltage > 4.81 V
P0130	O2 Sensor Circuit Bank 1 Sensor 1	O2S ceramic temp. < 640° C
P0131	O2 Sensor Circuit, Bank 1 Sensor 1 Low Voltage	• VM > 1.75 V • UN > 1.50 V • IA or IP > 0.30 V
P0132	O2 Sensor Circuit, Bank 1 Sensor 1 High Voltage	• VM > 3.25 V • UN > 4.40 V • IA or IP > 7 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0133	O2 Circuit Slow Response Bank 1 Sensor 1	Signal dynamic slope check • O2S signal front vs. modeled O2S signal ratio < 0.35 and > 0.01 • Lower value of both counters for area ratios L to R and R to L ≥ 5 times Oscillation check • Lambda amplitude signal > 20% • Cycles > 8 • Time lambda > lambda amplitude 400 m sec. Delay check • Delay modeled lambda signal minus measured signal > 460 m sec. • Cycles > 12
P0135	O2 Heater Circuit Bank 1 Sensor 1	• Heater duty cycle, >100% • O2S ceramic temperature, < 715 °C • Time after O2S heater on 40 Sec
P0136	O2 Circuit Bank 1 Sensor 2 Malfunction	• Delta voltage one step at heater switching > 2.00 V • Number of checks ≥ 4
P0137	O2 Circuit Low Voltage Bank 1 Sensor 2	Cold condition • Signal voltage, < 0.06 V for 3 Sec. Warm condition • Signal voltage < 0.01 V • Reaction at closed loop enrichment - no reaction
P0138	O2 Circuit High Voltage Bank 1 Sensor 2	Signal voltage > 1.08 V for > 5 Sec.
P0139	O2 Circuit Slow Response Bank 1 Sensor 2	• EWMA filtered transient time at fuel cutoff > 0.0 Sec. • In voltage range of 201 - 401 mV • Number of checks, ≥ 3
P013A	O2 Sensor Slow Response Rich to Lean Bank 1 Sensor 2	• EWMA filtered max differential transient time at fuel cutoff ≥ 0.65 Sec • Number of checks ≥ 1

DTC	Error Message	Malfunction Criteria and Threshold Value
P0140	O2 Circuit No Activity Detected Bank 1 Sensor 2	Signal voltage • Signal voltage, 0.40 - 0.60 V for > 3 Sec. Internal resistance • > 40000 ohm
P0141	O2 Heater Circuit Bank 1 Sensor 2	Heater resistance, 702 - 5250 Ohm
P0142	O2 Sensor Circuit Bank 1 Sensor 3	• Delta voltage one step at heater > 2.0 V • Number of checks, 4
P0143	O2 Sensor Circuit Low Voltage Bank 1 Sensor 3	Cold/Warm condition • Signal voltage < 0.06 V for > 3 Sec
P0144	O2 Sensor Circuit High Voltage Bank 1 Sensor 3	Signal voltage > 1.08 V for > 5 Sec.
P0145	O2 Sensor Circuit Slow Response Bank 1 Sensor 3	• EWMA filtered transient time at fuel cutoff > 1.2 Sec • In voltage range of 201.2 - 401.4 mV • Number of checks, 3
P0146	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 3	• Signal voltage 0.40 - 0.60 V for > 3 Sec. • Internal resistance > 40000 Ohm
P0147	O2 Sensor Heater Circuit Bank 1 Sensor 3	Heater (ECM internal) resistance 792 - 4560 ohm
P0169	Incorrect Fuel Composition	• Fuel quantity incorrect • Fuel correction factor incorrect • Internal check failed
P0171	System Too Lean Bank 1	At idle • Adaptive value > 5.02% At part load • Adaptive value > 21%
P0172	System Too Rich Bank 1	At idle • Adaptive value < -5.02% At part load • Adaptive value < -21%
P0190	Fuel Rail Pressure Sensor Circuit	Signal voltage > 4.8 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Actual pressure > 20.6 MPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0192	Fuel Rail Pressure Sensor Circuit Low Input	Signal voltage < 0.2 V
P0201	Injector Circuit Open Cylinder 1	• Low side signal current < 2.1 A • Internal logic failure
P0202	Injector Circuit Open Cylinder 2	• Low side signal current < 2.1 A • Internal logic failure
P0203	Injector Circuit Open Cylinder 3	• Low side signal current < 2.1 A • Internal logic failure
P0204	Injector Circuit Open Cylinder 4	• Low side signal current < 2.1 A • Internal logic failure
P0221	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Range/Performance	• TPS 1 - TPS 2 > 6.30% • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 – calc. value > 9.00%
P0222	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Low Input	Signal voltage < 0.20 V
P0223	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit High Input	Signal voltage > 4.81 V
P0234	Turbocharger Overboost Condition	Difference of set value boost pressure vs altitude sensor signal > 260 - 1275 hPa
P0236	Turbocharger Boost Sensor Circuit Range/Performance	Difference of boost pressure signal vs. altitude sensor signal > 230 hPa or < -130 hPa
P0237	Turbocharger Boost Sensor Circuit Low	Signal voltage < 0.2 V
P0238	Turbocharger Boost Sensor Circuit High	Signal voltage > 4.88 V
P025A	Fuel Pump Module Control Circuit Open	Signal voltage 4.40 - 5.60 V
P025C	Fuel Pump Module Control Circuit Low	Signal voltage 2.15 - 3.25 V
P025D	Fuel Pump Module Control Circuit High	Signal current > 1.10 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P0261	Cylinder 1 Injector Circuit Low	Signal current < 2.1 A
P0262	Cylinder 1 Injector Circuit High	Signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Signal current < 2.1 A
P0265	Cylinder 2 Injector Circuit High	Signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Signal current < 2.1 A
P0268	Cylinder 3 Injector Circuit High	Signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Low	Signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit High	Signal current > 14.70 A
P0299	Turbo Charger Underboost	Difference of set boost pressure vs actual boost pressure value > 150 hPa
P2004	Intake Manifold Runner Control Stuck Open Bank 1	• Normal closed position, unable to reach signal voltage < 2.62 or > 4.65 V or • Normal open position, unable to reach signal voltage < 0.35 or > 2.38 V
P2008	Intake Manifold Runner Control Circuit/Open (Bank 1)	Signal voltage 4.40 - 5.60 V
P2009	Intake Manifold Runner Control Circuit Shorted (Bank 1)	Signal voltage 2.15 - 3.25 V
P2010	Intake Manifold Runner Control Circuit Shorted to B+ (Bank 1)	Signal current > 2.20 A
P2014	Intake Manifold Runner Position Sensor/Switch Circuit (Bank 1)	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance (Bank 1)	Deviation runner flap position vs. actual position > 25%
P2016	Intake Manifold Runner Position Sensor/Switch Circuit Low (Bank 1)	Signal voltage < 0.25 V
P2088	Camshaft Position A Actuator Control Circuit Low (Bank 1) Short to Ground	Signal voltage < 2.15 - 3.25 V
P2089	Camshaft Position A Actuator Control Circuit High (Bank 1) Short to B+	Signal current > 2.2 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2096	Post-Catalyst Fuel Trim System Too Lean (Bank 1)	I-portion of 2nd lambda control loop < 0.030
P2097	Post-Catalyst Fuel Trim System Too Rich (Bank 1)	I-portion of 2nd lambda control loop > 0.030
P3081	Engine Temperature Too Low	Cooling system temperature < 74° C - 84° C after AAT check

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0301	Cylinder 1 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0302	Cylinder 2 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0303	Cylinder 3 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0304	Cylinder 4 Misfire Detected	• Emission threshold 1st interval Misfire Rate (MR), > 2.65% • Catalyst damage misfire rate (MR), > 3% - 20%
P0321	Engine Speed Input Circuit Performance	• Comparison of counted teeth vs reference = incorrect • Monitoring reference gap failure.
P0322	Engine Speed Input Circuit No Signal	• Camshaft signal > 3 • Engine speed, no signal
P0324	Knock Control System Error	• Signal fault counter (combustion) > 24 or • Signal fault counter (measuring window) > 2.00

DTC	Error Message	Malfunction Criteria and Threshold Value
P0327	Knock Sensor 1 Circuit Low	• Lower threshold < -0.70 V or for signal range check • Lower threshold < 0 - 1.60 V
P0328	Knock Sensor 1 Circuit High	• Upper threshold > 1.00 V or for signal range check • > 15 - 115.87 V
P0340	Camshaft Position Sensor Circuit	Cam adaption values out of range • > 20° KW • < -20° KW • Difference of adapted and actual values > 9 °KW
P0341	Camshaft Position Sensor Circuit Performance	• Signal pattern incorrect • Defect counter 12
P0342	Camshaft Position Sensor Circuit Low	• Signal voltage low • Crankshaft signals = 8
P0343	Camshaft Position Sensor Circuit High	• Signal voltage high • Valve
P0351	Ignition Coil A Primary Circuit	• Signal current 0.25 to -2.0 mA • Internal check failed
P0352	Ignition Coil B Primary Circuit	• Signal current 0.25 to -2.0 mA • Internal check failed
P0353	Ignition Coil C Primary Circuit	• Signal current 0.25 to -2.0 mA • Internal check failed
P0354	Ignition Coil D Primary Circuit	• Signal current 0.25 to -2.0 mA • Internal check failed

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air Injection System	Deviation SAI pressure sensor > 5.0 kPa
P0413	Secondary Air Injection System Switching Valve Circuit Open	Signal voltage 4.70 - 5.40 V
P0414	Secondary Air Injection System Switching Valve Circuit Low	• Signal voltage 0 to 3.25 V or • Signal current > 2.20 A
P0418	Secondary Air Injection System Control Circuit	Signal voltage 4.70 - 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0420	Catalyst System Efficiency Below Threshold	Front • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 1.00 • Front catalyst < 1.50 • Main catalyst < 1.00 Main: • Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 0.40 • Front catalyst< .90 • while value for front catalyst < 2.00
P043E	Evaporative Emission System Leak Detection Reference Orifice Low Flow	• EVAP pump current during reference measurement engine off > 40 mA • EVAP pump current during reference measurement engine on < 40 mA
P043F	Evaporative Emission System Leak Detection Reference Orifice High Flow	• EVAP pump current during reference measurement engine off > 15mA • EVAP pump current during reference measurement engine on > 15mA
P0441	Evaporative Emission System Incorrect Purge Flow	Deviation < 8% lambda controller and 35% idle controller
P0442	Evaporative Emission System Leak Detected Small Leak	Time for pressure drop < 1.6 - 1.8 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V
P0447	Evaporative Emission System Vent Control Circuit Open	Signal voltage > 4.70 - 5.40 V
P0448	Evaporative Emission System Vent Control Circuit Shorted to B+ or Ground	• Short to B+ - Signal current > 2.2 - 4.0 A • Short to Ground - Signal voltage < 2.74 - 3.26 V
P0455	Evaporative Emission System Leak Detected Gross Leak/ No Flow	Time for pressure drop < 1 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0456	Evaporative Emission System Leak Detected Very Small Leak	Time for pressure drop, < 4.5 - 6.0 Sec.
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage 0 - 3.26 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A
P0491	Secondary Air System Insufficient Flow	SAI pressure sensor vs modeled pressure < 60 to 75%

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P050A	Cold Start Idle Air Control System Performance	Out of range low: • Engine speed deviation < -80 RPM Out of range high: • Engine speed deviation > 80 RPM
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing vs. actual value > 20%
P0501	Vehicle Speed Sensor Range/ Performance	VSS signal < 6 km/h
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	Vehicle speed > 290 km/h
P0506	Idle Control System RPM Lower Than Expected	Integrated engine speed deviation > 2000 RPM or engine speed deviation > 80 RPM
P0507	Idle Air Control System - RPM Higher Than Expected	Idle speed Deviation < -80 RPM
P052A	Cold Start Camshaft Position Timing Over-Advanced	Difference between target and actual position > 6 CRK °
P053F	Cold Start Fuel Pressure Performance	• Difference between target pressure vs actual pressure: > 1.50 MPa or • < -1.50 MPa

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0606	ECM Processor Fault	ECM internal check failure or BARO failure (located in the ECM).
P062B	Internal Control Module Fuel Injector Control Performance	Internal logic failure
P0634	ECM Internal Temperature Too High	Power stage temperature > 150° C
P0638	Throttle Actuator Control Range/Performance	• Time to close to reference point > 0.6 Sec. and • Reference point 2.88% • TPS 1 signal 0.40 - 0.60 V • TPS 2 signal 4.20 - 4.60 V • TPS 1 and TPS 2 4.82 - 5.18 V
P0641	Sensor Reference Voltage A Circuit Open	Signal voltage deviation > +/- 0.3 V
P0651	Sensor Reference Voltage B Circuit Open	Signal voltage deviation > +/- 0.3 V
P0657	Actuator Supply Voltage Circuit Open	Signal voltage, > 4.4 - 5.6 V
P0658	Actuator Supply Voltage Circuit Low	Signal voltage, < 2.15 - 3.25 V
P0659	Actuator Supply Voltage Circuit High	Signal current > 1.1 A
P0697	Sensor Reference Voltage Circuit Open	Signal voltage deviation > +/- 0.3 V
U0001	High Speed CAN Communication Bus	CAN message, no feedback
U0002	High Speed CAN Communication Bus Performance	lobal Time Out failure
U0101	Lost Communication with TCM	Time Out failure. No message received by ECM
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN communication with ABS Time Out - no message
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	No CAN messages received

DTC	Error Message	Malfunction Criteria and Threshold Value
U0302	Software Incompatibility with Transmission Control Module	AT vehicle ECM coded as MT vehicle
U0402	Invalid Data Received From Gear Shift Control Module A	Transmission Data implausible message
U0415	CAN Communication With ABS Error	• Speed sensor initialization failed • Speed sensor low voltage error failed • Implausible message received
U0422	Invalid Data Received From Body Control Module (IPC)	Ambient temperature value initialization failure.
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Implausible CAN message received or ambient temperature value = 00
U0447	Lost Communication With Gateway	CAN message implausible

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P117A	Bank 1 Sensor 2 Control Limit Reached	I portion of 3rd lambda control loop > 0.030
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	• Pressure control activity > 0.20 MPa • Fuel trim activity < 0.80 • Difference between actual pressure vs target pressure -16.38 to 16.38 MPa
P12A2	Fuel Rail Pressure Sensor Inappropriately High	• Pressure control activity < -0.05 MPa • Fuel trim activity > 1.65 • Difference between target pressure and actual pressure -16.38 to 16.38 MPa
P12A4	Fuel Rail Pump Control Valve Stuck Closed	• Fuel trim activity .90 to 1.15 • Pressure control activity < -6 MPa • System Deviation < 16.38 MPa
P13EA	Cold Start Ignition Timing Performance Off Idle	Difference between commanded spark timing vs. actual value > 40%

DTC	Error Message	Malfunction Criteria and Threshold Value
P13CF	Sensor for internal pressure of cylinder 1 Short circuit to ground	Cylinder pressure sensor voltage < 0.13 V
P13DO	Sensor for internal pressure of cylinder 1 Implausible signal	• Cylinder pressure sensor voltage < 0.33 V or > 3.09 V or • Deviation between min and max cylinder pressure # 1 < 20 bar • Offset out of range < -7 or > 7 bar or • Pressure based measured TDC position sensor out of range or • Difference of calculated cylinder pressure vs. actual measured cylinder pressure out of range < -10 or > 10 Bar
P13D1	Sensor for internal pressure of cylinder 2 Electrical malfunction	Cylinder pressure sensor voltage > 3.17 V
P13D2	Sensor for internal pressure of cylinder 2 Short circuit to ground	Cylinder pressure sensor voltage < 0.13 V
P13E0	Sensor for internal pressure of cylinder 1 Malfunction	Pressure based measured TDC vs. crank position sensor for cyl. 1 out of range < 1.8 CA or > 1.8 CA
P150A	Engine Off Timer Performance	Difference between engine off time and ECM after run time < -12 Sec. or > 12 Sec.
P1609	Crash Shut Down Was Deployed	Airbag was activated
P169A	Vehicle in Transport Mode	Transport mode active
P2008	Intake Manifold Runner Control Circuit Open	Signal voltage 4.70 - 5.40 V
P2009	Intake Manifold Runner Control Circuit Low	Signal voltage 0 to 3.26 V
P2010	Intake Manifold Runner Control Circuit High	Signal current > 2.20 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2014	Intake Manifold Runner Position Sensor Circuit	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor Circuit Range/ Performance	• Deviation runner flap target position vs actual position > 25% • Actual position 0 to 100%
P2016	Intake Manifold Runner Position Sensor Circuit Low	Signal voltage < 0.25 V
P2088	A Camshaft Position Actuator Control Circuit Low	Signal voltage 0 - 3.25 V
P2089	A Camshaft Position Actuator Control Circuit High	Signal current > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean	Deviation lambda control < -0.03
P2097	Post Catalyst Fuel Trim System Too Rich	Integral part of lambda control > 0.03%
P2101	Throttle Actuator Control Motor Circuit Range/ Performance	• Duty cycle > 80% • Deviation throttle value angles vs. calculated value 4 - 50% • ECM power stage no failure
P2106	Throttle Actuator Control System - Forced Limited Power	Internal check failed
P2122	APP Sensor 1/APP Sensor 2 Circuit D Low Input	Signal voltage < 0.61 V
P2123	APP Sensor 1/APP Sensor 2 Circuit D High Input	Signal voltage > 4.79 V
P2127	APP Sensor 1/APP Sensor 2 Circuit E Low Input	Signal voltage < 0.27 V
P2128	APP Sensor 1/APP Sensor 2 Circuit E High Input	Signal voltage > 2.43 V
P2138	APP Sensor 1/APP Sensor 2 Circuit D/E Voltage Correlation	Signal voltage: Difference between signal APP1 and APP2 > 0.17 - 0.70 V
P2146	Fuel Injector Group A Supply Voltage Circuit Open	• Signal current, < 2.6 A or • Signal current > 14.90 A
P2149	Fuel Injector Group B Supply Voltage Circuit Open	• Signal current, < 2.6 A or • Signal current > 14.90 A
P2177	System Too Lean Off Idle	Adaptive value > 28%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2178	System Too Rich Off Idle	Adaptive value < -21%
P2181	Cooling System Performance	Cooling system temperature too low after a sufficient mass air flow integral 74 - 84° C
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	ECT outlet > 141° C
P2185	Engine Coolant Temperature Sensor 2 Circuit High	ECT outlet < -43° C
P2187	System Too Lean At Idle	Adaptive value > 5.02%
P2188	System Too Rich At Idle	Adaptive value < -5.02%
P2195	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop > 0.08
P2196	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop < -0.08
P2231	O2 Sensor Bank 1 Sensor 1 Signal Circuit Shorted to Heater Circuit	Delta O2S signal front > 190 uA
P2237	O2 Sensor Positive Current Control Circuit Open Bank 1 Sensor 1	• O2S signal front 1.49 - 1.51 V • Delta lambda controller > 0.10
P2243	O2 Sensor Reference Voltage Circuit Open Bank 1 Sensor 1	• O2S signal front > 3.25 V and Internal resistance > 1000 Ohm • O2S signal front < 0.30 V and Internal resistance > 1000 Ohm
P2251	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1	O2S signal front 1.47 to 1.53 V and internal resistance > 1000 Ohm
P2257	Secondary Air Injection System Control Circuit Low	Signal voltage 0 to 3.26 V
P2258	Secondary Air Injection System Control Circuit High	Signal current .60 - 2.40 A
P2270	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	• Sensor voltage of ≤ 0.75 V • O2S signal rear < -2.00 mV • Enrichment after stuck lean 27.9%
P2271	O2 Sensor Signal Stuck Rich Bank 1 Sensor 2	• Sensor voltage of ≥ 0.15 V • After oxygen mass flow > 3000 mg • Number of checks ≥ 1

DTC	Error Message	Malfunction Criteria and Threshold Value
P2274	O2 Sensor Signal Stuck Lean Bank 1 Sensor 3	• Sensor voltage of ≤ 0.70 V • O2S rear signal not oscillating at reference < 0.62 to 0.65 V • Enrichment after stuck lean 27.9%
P2275	O2 Sensor Signal Stuck Rich Bank 1 Sensor 3	• O2S sensor voltage ≥ 0.15 V • After oxygen mass flow (fuel cutoff) > 4500 mg • Number of checks ≥ 1
P2279	Intake Air System Leak	Threshold to detect a defective system > 1.33 - 1.60
P2293	Fuel Pressure Regulator 2 Performance	• Difference between target pressure vs actual pressure: > 1.50 MPa or • < -1.50 MPa
P2294	Fuel Pressure Regulator 2 Control Circuit	• Signal voltage 1.40 - 3.20 V or • Signal pattern incorrect
P2295	Fuel Pressure Regulator 2 Control Circuit Low	Signal voltage 1.40 - 3.20 V
P2296	Fuel Pressure Regulator 2 Control Circuit High	Signal voltage > 3.20 V

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P2300	Ignition Coil A Primary Control Circuit Low	Signal current > 24.0 mA
P2301	Ignition Coil A Primary Control Circuit High	Signal current > 5.1 - 7.0 V
P2303	Ignition Coil B Primary Control Circuit Low	Signal current > 24.0 mA
P2304	Ignition Coil B Primary Control Circuit High	Signal current > 5.1 - 7.0 V
P2306	Ignition Coil C Primary Control Circuit Low	Signal current > 24.0 mA
P2307	Ignition Coil C Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V
P2309	Ignition Coil D Primary Control Circuit Low	Signal current > 24.0 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
P2310	Ignition Coil D Primary Control Circuit High	Signal voltage > 5.1 - 7.0 V

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P240A	Evaporative Emission System Leak Detection Pump Heater Control Circuit/Open	Signal voltage > 4.70 - 5.40 V
P240B	Evaporative Emission System Leak Detection Pump Heater Control Circuit Low	Signal voltage < 2.74 - 3.26 V
P240C	Evaporative Emission System Leak Detection Pump Heater Control Circuit High	Signal current > 2.2 - 4.0
P2400	Evaporative Emission System Leak Detection Pump Control Circuit Open	Signal voltage > 4.4 - 5.6
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage > 2.15 - 3.25 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal current > 3 A
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit Open	Low signal voltage > 0.5 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Range/Performance	• High signal voltage > 12 Sec. • Number of checks = 30
P2407	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic	• Fluctuation of EVAP pump current during reference measurement engine off > 2mA • Or drop of EVAP pump current during pump phase of 3 sec > 6mA
P2414	O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	Threshold 1 • Signal voltage 3.1 - 4.81 V Threshold 1 • O2S signal 2.5 - 3.2 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2431	Secondary Air Injection Sensor Performance	Difference between SAI pressure sensor and ambient pressure NOT -60.0 to 60.0 hPa
P2432	Secondary Air Injection Sensor Circuit Low	Signal voltage < 0.40 V
P2433	Secondary Air Injection Sensor Circuit High	Signal voltage > 4.65 V
P2440	Secondary Air Injection System Switching Valve Stuck Open	SAI pressure sensor vs modeled while SAI valve is closed < 71.1%
P2450	Evaporative Emission System Switching Valve Performance/ Stuck Open	• Engine off EVAP pump current difference between reference measurement to idle < 3mA • Engine on EVAP pump current difference between reference measurement to idle >3mA
P2626	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	O2S signal front > 4.81 V

DTC CHART

Engine Code CKRA

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P0045	Wastegate Bypass Regulator Valve Circuit Open	Signal Voltage < 4.7 V
P0047	Wastegate Bypass Regulator Valve Circuit Short to Ground	Signal Voltage < 2.97 V
P0048	Wastegate Bypass Regulator Valve Circuit Short to Battery voltage	Signal Current > 3.0 A
P0071	Ambient Air Temperature Sensor Circuit Range / Performance cross check of temperature sensors (engine part) at cold start conditions	• Temperature difference to at least 3 other temperature sensors at startup > 45 K • Temperature difference to at least 3 other temperature sensors during cold start > 20 K
P0072	Ambient Air Temperature Sensor Circuit Low	Error message sent from Cluster to ECU
P0073	Ambient Air Temperature Sensor Circuit High	Error message sent from Cluster to ECU
P0087	Fuel Rail Pressure Control Too Low	• Control deviation > 150 - 200 Bar • Exceeding absolute rail pressure limits < 120 - 125 Bar
P0088	Fuel Rail Pressure Control Too High	• Control deviation < -200 to -300 Bar • Exceeding absolute rail pressure limits > 1950 Bar
P0090	Fuel Pressure Regulator Circuit Open	Signal Voltage < 4.7 V
P0091	Fuel Pressure Regulator Circuit Short to Ground	Signal Voltage < 2.97 V
P0092	Fuel Pressure Regulator Control Circuit Short to Battery Voltage	Signal Current > 3.0 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P00AF	Charge Air Pressure Sensor Circuit Dynamic Response	Characteristic value (amplitude of air mass) < 1 - 1.7 %
P00C6	Fuel Rail Pressure Control Monitoring of fuel Pressure during Engine Start (Cranking)	Fuel rail pressure is < 120 to 180 bar
P00D1	HO2 Sensor Heater Control Performance	• Battery voltage < exhaust gas flow rate, exhaust gas temperature at sensor element • Sensor temperature < 720° C
P00D2	O2S Bank 1 Sensor 2 Heater Output Warm Up Time Exceeded	• Battery voltage < f(exhaust gas flow rate, exhaust gas temperature at sensor element) • Sensor temperature < 720° C
P00D5	HO2 Sensor 1 and HO2 Sensor 2 Offset Adaption	Offset air fuel ratio > 0.05 [-]
P0101	Mass Air Flow Circuit Plausibility Check	Plausibility check by model air mass min. • Ratio of model air mass and actual airflow mass < 0.84 [-] Plausibility check by model air mass max. • Ratio of model air mass and actual airflow mass > 1.8 [-]
	Mass Air Flow Circuit Range Check High Temp. Calculated Value	• PWM signal period time > 60 ms
	Mass Air Flow Circuit Range Check Low Temp. Calculated Value	• PWM signal period time < 40 ms
P0102	Mass Air Flow Circuit Low Input	Range check low calculated value: • PWM signal period time > 83 µs (854 kg/h) Range check low Raw value: • PWM signal period time > 71.4 µs (900 kg/h)

DTC	Error Message	Malfunction Criteria and Threshold Value
P0103	Mass Air Flow Circuit High Input	Range check High Calculated value: • PWM signal period time > 667.0 µs (-57 kg/h) Range check High Raw value: • Raw value PWM signal period time > 833,35 µs (-150 kg/h)
P0111	Intake Air Temperature Sensor Circuit Performance Cross check of temperature sensors (engine part) at cold start conditions	• Temperature difference to at least 3 other temperature sensors at startup > 30° K • Temperature difference to at least 3 other temperature sensors during cold start > 20 K
P0112	Intake Air Temperature Sensor Circuit Short to Ground	Signal Voltage < 0.04 V
P0113	Intake Air Temperature Sensor Circuit Open or Short to Battery Voltage	Signal Voltage > 2.88 V
P0116	Engine Coolant Temperature Sensor Circuit Warm Up Time Plausibility Cross check of temperature sensors (engine part) at cold start conditions	• Time for coolant temp to reach 19.96° C or increase by 10° K ≥ 300 s for start temp.< 10° C or • > 120 s. for start temp > 10° C • Temperature difference to at least 3 other temperature sensors at startup > 20 °K
P0117	Engine Coolant Temperature Sensor Circuit Short to Ground	Signal voltage < 0.15 V
P0118	Engine Coolant Temperature Sensor Circuit Open or Short to Battery Voltage	Signal voltage> 3.25 V
P0121	Accelerator Pedal Position Sensor Circuit Range / Performance	Signal Voltage> 1.00 V and/or < 0.4 V
P0122	Accelerator Pedal Position Sensor Circuit Low	Signal Voltage> 4.85 V
P0123	Accelerator Pedal Position Sensor Circuit High	Signal voltage < .150 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0128	Thermostat Temperature Below Control Range	• Measured temperature < 70° C • Modeled temperature > 80° C
P0130	2 Sensor Circuit Short to Battery Voltage	• Virtual ground (VM) > 3 V • Nernst voltage (UN) > 4 V • Adjustment voltage (IP) > 1.5 V
	Short to Ground	• Virtual ground (VM) < 2 V • Nernst voltage (UN) < 1.75 V • Adjustment voltage (IP) < 0.3 V
P0132	HO2 Sensor Circuit Short to Battery voltage	Signal voltage > 3.2 V
P0133	HO2 Sensor Circuit Slow Response	• Time to 30% of expected concentration increase > 2.6 s or • Time to 60% minus time to 30% > 1.5 s or • Time to 60% of expected concentration increase > 4.1 s
P0135	HO2 Sensor Heater Circuit Rationality Check	• HO2S ceramic temp. > 840° C • HO2S ceramic temp. < 720° C
	Short to Battery Voltage	• Signal current > 2.2 A
	Short to Ground	• Signal voltage < 2.15 V
	Open	• Signal voltage > 4.4 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0136	HO2 Sensor Circuit Short to Battery Voltage	• Virtual ground (VM) > 3 V • Nernst voltage (UN) > 4 V • Adjustment voltage (IP) > 1.5 V
	Short to Ground	• Virtual ground (VM) < 2 V • Nernst voltage (UN) < 1.75 V • Adjustment adjustment voltage (IP) < 0.3 V
	Dynamic Check Virtual Ground (VM)	• Virtual ground (VM) internal resistance > 1104 O • Internal signal voltage < 1.4 V and/or > 1.6 V
	Dynamic Check Nernst Voltage (UN)	• Nernst voltage (UN) internal resistance > 1104O • Internal signal voltage > 3 V
	Dynamic Check pump current (IP)	• Pump current (IP) < 0.005 [-]
P0138	HO2 Sensor Circuit Short to Battery Voltage	Signal voltage > 3.2 V
P0139	HO2 Sensor Circuit Slow Response	• Time to 30% of expected concentration increase > 2.6 s or • Time to 60% minus time to 30% > 1.5 s or • Time to 60% of expected concentration increase > 4.1 s
P013B	HO2 Sensor Bank 1 Sensor 2 Slow Response Lean to Rich	• Time delay between oxygen signals pre and post NOx trap > 1.5 Sec. (1. sensor later than 2. sensor • Time delay between oxygen signals pre and post NOx trap > 0.45…0.72 Sec. = (exhaust gas mass flow) (2. sensor later than 1. sensor)

DTC	Error Message	Malfunction Criteria and Threshold Value
P0141	HO2 Sensor Heater Circuit Rationality Check	• HO2S ceramic temp. > 840° C • HO2S ceramic temp. < 720° C
	Short to Battery Voltage	• Signal current > 2.2 A
	Short to Ground	• Signal voltage < 2.15 V
	Open	• Signal voltage > 4.4 V
P014D	HO2 Sensor Bank 1 Sensor 1 Slow Response Lean to Rich	• Time delay between oxygen signals pre and post NOx trap > 1.5 Sec. (1. sensor later than 2. sensor • Time delay between oxygen signals pre and post NOx trap > 0.45…0.72 Sec. = (exhaust gas mass flow) (2. sensor later than 1. sensor)
P0181	Fuel Temperature Sensor Circuit Range / Performance	• Temperature difference to at least 2 other temperature sensors at startup > 30° K
	Cross Check of Temperature sensors (engine part) at Cold start Conditions	• Temperature difference to at least 3 other temperature sensors during cold start > 20 K
P0182	Fuel Temperature Sensor Circuit Short to Ground	Signal voltage < 0.05 V
P0183	Fuel Temperature Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 4.7 V
P0191	Fuel Pressure Sensor Circuit Offset Detection During Keep Alive Time	• Signal voltage < 0.409 V or > 0.620 V
	Fuel Pressure Sensor Circuit Adaptation of Pressure Control Valve (PCV)	• Adaptation value out of limit > 130 % or < 83%
P0192	Fuel Pressure Sensor Circuit Short to Ground	Signal voltage < 200 mV
P0193	Fuel Pressure Sensor Circuit Short to Battery Voltage	Signal voltage > 4.8 V
P0201	Cylinder 1 Injector Circuit Open	Signal voltage > 60 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0202	Cylinder 2 Injector Circuit Open	Signal voltage > 60 V
P0203	Cylinder 3 Injector Circuit Open	Signal voltage > 60 V
P0204	Cylinder 4 Injector Circuit	Signal voltage > 60 V
P020A	Cylinder 1 Injection Timing	• Control error < limit from MAP (engine speed and desired torque) -8° CA to -4° CA or • Control error < limit from MAP (engine speed and desired torque) +8° CA to +4° CA
P020B	Cylinder 2 Injection Timing	• Control error < limit from MAP (engine speed and desired torque) -8° CA to -4° CA or • Control error < limit from MAP (engine speed and desired torque) +8° CA to +4° CA
P023C	Cylinder 3 Injection Timing	• Control error < limit from MAP (engine speed and desired torque) -8° CA to -4° CA or • Control error < limit from MAP (engine speed and desired torque) +8° CA to +4° CA
P023D	Cylinder 4 Injection Timing	• Control error < limit from MAP (engine speed and desired torque) -8° CA to -4° CA or • Control error < limit from MAP (engine speed and desired torque) +8° CA to +4° CA
P0234	Charge Air Pressure Sensor Rationality Check Low	Absolute value of control deviation > -200 - -800 hPa
P0236	Charge Air Pressure Sensor Circuit Plausibility Check	Difference between barometric and boost pressure signal > 150 hPa
P0237	Charge Air Pressure Sensor Circuit Short to Ground	Signal voltage < 0.214 V
P0238	Charge Air Pressure Sensor Circuit Open or Short to Battery Voltage	Signal Voltage > 4.88 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P023A	Charge Air Cooler Coolant Pump Circuit Open	Signal Voltage > 4.88 V
P023B	Charge Air Cooler Coolant Pump Circuit Short to Ground	Signal voltage < 0.214 V
P023C	Charge Air Cooler Coolant Pump Circuit Short to Battery Voltage	Signal Current > 3.0 A
P0263	Cylinder 1 Zero Fuel Calibration (monitoring of fuel calibration values)	Calibration value of injector energizing time > 217 µs or < 117µs (at 1400 bar rail pressure).
P0266	Cylinder 2 Zero Fuel Calibration (monitoring of zero fuel calibration values)	Calibration value of injector energizing time > 217 µs or < 117µs (at 1400 bar rail pressure).
P0269	Cylinder 3 Zero Fuel Calibration (monitoring of zero fuel calibration values)	Calibration value of injector energizing time > 217 µs or < 117µs (at 1400 bar rail pressure).
P026A	Charge Air Cooler Efficiency Below Threshold	Charge air intercooler efficiency < 0.4 [-]
P0272	Cylinder 4 Zero Fuel Calibration (monitoring of zero fuel calibration values)	Calibration value of injector energizing time > 217 µs or < 117µs (at 1400 bar rail pressure).
P0299	Charge Air Pressure Sensor Rationality Check High	Absolute value of control deviation > 400 - 800 hPa
P2004	Intake Manifold Runner Control Stuck Open Bank 1	• Normal closed position, unable to reach signal voltage < 2.62 or > 4.65 V or • Normal open position, unable to reach signal voltage < 0.35 or > 2.38 V
P2008	Intake Manifold Runner Control Circuit/Open (Bank 1)	Signal voltage 4.40 - 5.60 V
P2009	Intake Manifold Runner Control Circuit Shorted (Bank 1)	Signal voltage 2.15 - 3.25 V
P2010	Intake Manifold Runner Control Circuit Shorted to B+ (Bank 1)	Signal current > 2.20 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2014	Intake Manifold Runner Position Sensor/Switch Circuit (Bank 1)	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance (Bank 1)	Deviation runner flap position vs. actual position > 25%
P2016	Intake Manifold Runner Position Sensor/Switch Circuit Low (Bank 1)	Signal voltage < 0.25 V
P2088	Camshaft Position A Actuator Control Circuit Low (Bank 1) Short to Ground	Signal voltage < 2.15 - 3.25 V
P2089	Camshaft Position A Actuator Control Circuit High (Bank 1) Short to B+	Signal current > 2.2 A
P2096	Post-Catalyst Fuel Trim System Too Lean (Bank 1)	I-portion of 2nd lambda control loop < 0.030
P2097	Post-Catalyst Fuel Trim System Too Rich (Bank 1)	I-portion of 2nd lambda control loop > 0.030
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 10° K

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Misfire Detected Multiple Cylinder	• Rise in engine speed after fuel injection: Calculated based on values from last two engine revolutions • Error threshold: 180 counts over 440 crankshaft revolutions
P0301	Cylinder 1 Misfire Detected	• Misfire rate within 1000 engine revolutions > 10% • Misfire event detection if actual inner torque < 2,5Nm
P0302	Cylinder 2 Misfire Detected	• Misfire rate within 1000 engine revolutions > 10% • Misfire event detection if actual inner torque < 2,5Nm

DTC	Error Message	Malfunction Criteria and Threshold Value
P0303	Cylinder 3 Misfire Detected	• Misfire rate within 1000 engine revolutions > 10% • Misfire event detection if actual inner torque < 2,5Nm
P0304	Cylinder 4 Misfire Detected	• Misfire rate within 1000 engine revolutions > 10% • Misfire event detection if actual inner torque < 2,5Nm
P0321	Engine Speed Input Circuit Rationality Check	• Consecutive not plausible signals > 15 • Cam phase signals without plausible signal > 4 cam rotations. • Monitoring reference gap = failure
P0322	Engine Speed Input Circuit No Signal	• Camshaft signals > 3.00 [-] • Crankshaft signals = No signal
P0381	Glow Plug Control Indicator Lamp Circuit (Wait to Start)	Not equal with lamp request bit. (via CAN)
P0383	Glow Plug Time Control Module Control Circuit Short to Ground	Signal voltage < 200 mV

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0401	EGR System Rationality Check Low Flow Detected	Control deviation: EGR < -45 - -200 g/rev
P0402	EGR System Rationality Check Excessive Flow Detected	Mass air flow ratio calculated from: mass air flow measured vs. mass air flow modeled > 1.16 [-]

DTC	Error Message	Malfunction Criteria and Threshold Value
P0403	HP EGR Actuator Circuit Open	• Signal voltage > 0.8 V or < 2.0 V
	HP EGR Actuator Circuit Short to Ground or Malfunction Error	• Signal Voltage < 150 mV
	HP EGR Actuator Circuit Short to Battery Voltage	• Signal Current > 8.0 A - 18 A
	HP EGR Actuator Circuit Functional check: Stuck Open	• Stuck Valve > 12.00%
P0404	HP EGR Actuator Circuit Functional check: Stuck Close	Stuck Valve < 12.00%
P0405	HP EGR Position Sensor Circuit Short to Ground	Signal Voltage < 150 mV
P0406	HP EGR Position Sensor Circuit Short to Battery Voltage	Signal Voltage > 4.80 V.
P040B	Exhaust Gas Recirculation Temperature Sensor Circuit Plausibility Check	• Sensor temperature < 55° C • Temperature difference to other temperature sensors during cold start > 40 K
P040C	EGR Temperature Sensor Circuit Short to Ground	Signal voltage < 0.06 V
P040D	EGR Temperature Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 3.24 V
P0420	Catalyst System Functional Check: Conversion Efficiency	Ratio of measured and modeled heat quantity < 0.3 [-]
P045A	LP EGR Actuator Circuit Open or Malfunction Error	Signal voltage > 0.8 V or < 2.0 V
P045B	LP EGR Actuator Circuit Position Sensor Signal in Desired Range (closed)	Signal Voltage > 1.0 V or < 0.4 V
P045C	LP EGR Actuator Circuits Short to Ground	Signal Voltage < 150 mV
P045D	LP EGR Actuator Circuits Short to Battery Voltage	Signal Current > 8.0 A - 18 A
P045E	LP EGR Position Sensor Circuit EGR Stuck Open	Comparison of actual and desired position signal: • Valve stuck (open) > 12%

DTC	Error Message	Malfunction Criteria and Threshold Value
P045F	LP EGR Position Sensor Circuit EGR Stuck Closed	Comparison of actual and desired position signal: • EGR valve Stuck (closed) < 12%
P046C	HP EGR Actuator Circuit Position Sensor Signal in Desired Range (closed)	Signal Voltage > 1.0 V or < 0.4 V
P0470	Differential Pressure Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 4.9 V
P0471	Differential Pressure Sensor Circuit Dynamic Check	Detection of false connected hose lines: • Differential of pressure signal < -27 Offset detection during after-run: • Differential of pressure signal < -27 or > 47 hPa
P0472	Differential Pressure Sensor Circuit Short to Ground	Sensor voltage < 0.2 V
P0473	Differential Pressure Sensor Circuit Open or Short to Battery	Signal voltage > 4.9 V
P0474	Exhaust Pressure Sensors Circuit Detection of a Disconnected Pressure Sensor Hose Line Downstream of Particular Filter	Difference between modeled and actual pressure differential across low pressure EGR > 40 hPa
P0475	Exhaust Door Control Unit Circuit Open Exhaust Door Control Unit Circuit Malfunction Error	Signal voltage > 0.8 V or < 2.0 V Signal Current > 8.0 A - 18 A
P0477	Exhaust Door Control Unit Circuit Short to Ground	Signal Current > 8.0 A - 18 A
P0478	Exhaust Door Control Unit Circuit Short to Battery Voltage	Signal Current > 8.0 A - 18 A
P047F	Exhaust Door Control Unit Circuit Stuck Open	Exhaust Door Flap stuck Open < 10%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0486	LP EGR Position Sensor Circuit Open LP EGR Position Sensor Circuit Short to Ground	• Signal Voltage > 4.7 V • Signal Voltage < 0.21 V
P048A	Exhaust Door Control Unit Circuit Stuck Closed	Exhaust Door Flap stuck closed > 10%
P048B	Exhaust Flap Position Sensor Circuit Short to Ground	Signal Voltage < 0.25 V
P048C	Exhaust Door Control Unit Circuit Position Sensor Signal in Desired Range (closed)	Position sensor signal in desired range during closed position learning > 1.1 V or < 0.5 V
P048E	Exhaust Flap Position Sensor Circuit Short to Battery Voltage	Signal Voltage > 4.85 V

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor Performance	Brake control unit error message sent
P0502	Vehicle Speed Sensor Circuit Low Input	Brake control unit error message sent
P0503	Vehicle Speed Sensor Intermittent High Signal	Vehicle speed > 320 km/h
P0506	Idle Control System RPM Lower than Expected	Control deviation < 10%
P0507	Idle Control System RPM Higher than Expected	Control deviation > 10%
P050E	Cold Start Engine Exhaust Temperature Too Low	• Sensor temperature < 170° C • Control deviation > limit from map (engine speed, torque)
P0534	Vehicle Speed Sensor Intermittent / Erratic / High	-
P0544	Exhaust Gas Temperature Sensor Circuit (Upstream Turbocharger) Open or Short to Battery Voltage	Signal voltage > 1.72 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0545	Exhaust Gas Temperature Sensor Circuit (Upstream Turbocharger) Short to Ground	Signal voltage < 0.45 V
P054E	Idle Control System Fuel Quantity Higher Than Expected	Fuel quantity < 0.004 g/rev
P054F	Idle Control System Fuel Quantity Lower Than Expected	Fuel quantity > 0.0182 - 0.0325 g/rev
P0562	System Voltage Low Voltage	Internal check failure of voltage supply for ECM off timer

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P06A3	Sensor Reference Voltage “D” Circuit/Open	Sensor supply voltage < 2.97 V or > 3.63 Vr
P0604	EEPROM Memory Error	• EEPROM could not be erased - data still available • Write EEPROM not possible • Checksum error in 3 or more locations
P0605	ECM Internal Test Error	ECM internal self test failed
P0606	Internal Control Module Memory Check Sum Error	ECM internal self test failed
P0607	Control Module Performance	ECM internal self test failed
P0627	Fuel Pump Circuit Open	Signal current < 0.8 mA
P0628	Fuel Pump Circuit Short to Ground	Signal voltage < 2.0 V
P0629	Fuel Pump Circuit Short to Battery Voltage	Signal current > 1.0 A
P0634	ECM Internal Temperature Too High	Output driver temperature too high >150° C
P0638	Throttle Valve Actuator Control Motor Circuit Internal Error	Diagnostic signal from actuator module = defective state
P0641	Sensor Reference Voltage “A” Circuit Open	Sensor supply voltage < 4.8 V or > 5.2 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P064C	Glow Plug Time Control Module Circuit Wrong Calibration	• Received number of cylinders is unequal to ECU application or • Received Glow plug type is unequal to ECU application
P0651	Sensor Reference Voltage “B” Circuit Open	Sensor supply voltage < 4.8 V or > 5.2 V
P066A	Glow Plug Cylinder 1 Circuit Short to Battery Voltage	Signal current > 70 A
P066C	Glow Plug Cylinder 2 Circuit Short to Battery Voltage	Signal current > 70 A
P066E	Glow Plug Cylinder 3 Circuit Short to Battery Voltage	Signal current > 70 A
P0670	Glow Plug Time Module Control Circuit Open or Short to Battery Voltage	Signal Voltage > 3.44 V
P0671	Glow Plug Cylinder 1 Circuit Open or Short to Ground	Signal current < 2.2 A
P0672	Glow Plug Cylinder 2 Circuit Open or Short to Ground	Signal current < 2.2 A
P0673	Glow Plug Cylinder 3 Circuit Open or Short to Ground	Signal current < 2.2 A
P0674	Glow Plug Cylinder 4 Circuit Open or Short to Ground	Signal current < 2.2 A
P067A	Cylinder 4 Glow Plug Control Circuit Low	Signal current > 70 A
P0684	Glow Plug Time Control Module Circuit No PCM Communication	• Missing communication from the Glow plug time module • Monitoring of supply voltage, Message from glow plug time module - Error Message
P068A	ECM Power Relay Performance - Open to Early	Internal test
P068B	ECM Power Relay Performance - Stuck	Internal test
P0697	Sensor Reference Voltage “C” Circuit Open	Sensor supply voltage < 3.168 V or > 3.432 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P06B9	Glow Plug Cylinder 1 Resistance Check	Glow plug resistance time interval after glow start: • - 9 s (< 0,3 O), • 9 - 14 s (< 0.4 O) • After 14 s (< 0.5 O) • Anytime (> 1.2 O)
P06BA	Glow Plug Cylinder 2 Resistance Check	Glow plug resistance time interval after glow start: • - 9 s (< 0,3 O), • 9 - 14 s (< 0.4 O) • After 14 s (< 0.5 O) • Anytime (> 1.2 O)
P06BB	Glow Plug Cylinder 3 Resistance Check	Glow plug resistance time interval after glow start: • - 9 s (< 0,3 O), • 9 - 14 s (< 0.4 O) • After 14 s (< 0.5 O) • Anytime (> 1.2 O)
P06BC	Glow Plug Cylinder 4 Resistance Check	Glow plug resistance time interval after glow start: • - 9 s (< 0,3 O), • 9 - 14 s (< 0.4 O) • After 14 s (< 0.5 O) • Anytime (> 1.2 O)
P06C5	Glow Plug Cylinder 1 Incorrect Type	Wrong current slope
P06C6	Glow Plug Cylinder 2 Incorrect Type	Wrong current slope
P06C7	Glow Plug Cylinder 3 Incorrect Type	Wrong current slope
P06C8	Glow Plug Cylinder 4 Incorrect Type	Wrong current slope
P06FE	Cold Start Diesel Intake Air Flow Control Performance	Valve stuck open > 12%
U0001	High Speed CAN Communication Bus	CAN driver A status Bus Off.
U0002	High Speed CAN Communication Bus Performance	CAN driver A status no communication
U0101	Lost Communication with TCM	Value from TCM = error state
U012C	Lost Communication With Anti-Lock Brake System (ABS) Control Module	No TCM messages received.

DTC	Error Message	Malfunction Criteria and Threshold Value
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Message from ABS module = missing
U0146	Lost Communication With Gateway “A”	Fault message from gateway module = true
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	Fault messages received from Instrument cluster
U0302	Software Incompatibility with Transmission Control Module	Fault message from automatic transmission module.
U0402	Invalid Data Received From Transmission Control Module	Wrong TCM messages received.
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	Implausible ABS messages sent. Veh speed > 320 km/h or missing vehicle speed data.
U0422	CAN: Instrument cluster	Ambient temperature value initialization, Audi 01 h
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Error message sent from instrument cluster to ECU = invalid data.
U1006	NOX Sensor No Communication	NOx sensor messages not received.
U1024	Instrument cluster control module Read out DTC	Error message sent from instrument cluster to ECU, invalid data
U1034	NOx Sensor 1 Implausible Signal	Time out fault message from NOx sensor

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P1004	Torque difference Cylinder 1 Limiting Value Exceeded	Control error < limit from MAP f (engine speed and desired torque) -50 to -30 Nm or +50 to +30 Nm
P1005	Torque difference Cylinder 2 Limiting Value Exceeded	Control error < limit from MAP f (engine speed and desired torque) -50 to -30 Nm or +50 to +30 Nm

DTC	Error Message	Malfunction Criteria and Threshold Value
P1006	Torque difference Cylinder 3 Limiting Value Exceeded	Control error < limit from MAP f (engine speed and desired torque) -50 to -30 Nm or +50 to +30 Nm
P1007	Torque difference Cylinder 4 Limiting Value Exceeded	Control error < limit from MAP f (engine speed and desired torque) -50 to -30 Nm or +50 to +30 Nm
P13CE	Cylinder 1 Pressure Sensor Circuit Short to Battery Voltage	Signal voltage > 3.17 V
P13CF	Cylinder 1 Pressure Sensor Circuit Short to Ground	Cylinder pressure sensor voltage < 0.13 V
P13D0	Cylinder 1 Pressure Sensor Circuit Out of Range Cylinder 1 Constant Pressure Cylinder 1 Pressure Sensor Offset Cylinder 1 Plausibility with Calculated Pressure	• Signal voltage < 0.33 V and/or > 3.09 V • Deviation between maximum and minimum cylinder pressure sensor 1 < 20 bar • Offset out of range < -7 bar and/or > 7 bar • Difference between calculated cylinder pressure, based on intake air pressure and compression ratio, and measured cylinder pressure sensor #1 out of range < -10 bar and/or > 10 bar
P13D1	Cylinder 2 Pressure Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 3.17 V
P13D2	Cylinder 2 Pressure Sensor Circuit Short to Ground	Signal voltage < 0.13 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P13D3	Cylinder 2 Pressure Sensor Circuit Out of Range	• Signal voltage < 0.33 V and/or > 3.09 V
	Cylinder 2 Constant Pressure	• Deviation between maximum and minimum cylinder pressure sensor 1 < 20 bar
	Cylinder 2 Pressure Sensor Offset	• Offset out of range < -7 bar and/or > 7 bar
	Cylinder 2 Plausibility with Calculated Pressure	• Difference between calculated cylinder pressure, based on intake air pressure and compression ratio, and measured cylinder pressure sensor #1 out of range < -10 bar and/or > 10 bar
P13D4	Cylinder 3 Pressure Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 3.17 V
P13D5	Cylinder 3 Pressure Sensor Circuit Short to Ground	Signal voltage < 0.13 V
P13D6	Cylinder 3 Pressure Sensor Circuit Out of Range	• Signal voltage < 0.33 V and/or > 3.09 V
	Cylinder 3 Constant Pressure	• Deviation between maximum and minimum cylinder pressure sensor 1 < 20 bar
	Cylinder 3 Pressure Sensor Offset	• Offset out of range < -7 bar and/or > 7 bar
	Cylinder 3 Plausibility with Calculated Pressure	• Difference between calculated cylinder pressure, based on intake air pressure and compression ratio, and measured cylinder pressure sensor #1 out of range < -10 bar and/or > 10 bar
P13D7	Cylinder 4 Pressure Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 3.17 V
P13D8	Cylinder 4 Pressure Sensor Circuit Short to Ground	Signal voltage < 0.13 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P13D9	Cylinder 4 Pressure Sensor Circuit Out of Range	• Signal voltage < 0.33 V and/or > 3.09 V
	Cylinder 4 Constant Pressure	• Deviation between maximum and minimum cylinder pressure sensor 1 < 20 bar
	Cylinder 4 Pressure Sensor Offset	• Offset out of range < -7 bar and/or > 7 bar
	Cylinder 4 Plausibility with Calculated Pressure	• Difference between calculated cylinder pressure, based on intake air pressure and compression ratio, and measured cylinder pressure sensor #1 out of range < -10 bar and/or > 10 bar
P13E0	Cylinder 1 Pressure Sensor Circuit Plausibility Check	Pressure based measured TDC position sensor #1 out of range < -1.8 CA and/or > 1.8 CA
P13E1	Cylinder 2 Pressure Sensor Circuit Plausibility Check	Pressure based measured TDC position sensor #1 out of range < -1.8 CA and/or > 1.8 CA
P13E2	Cylinder 3 Pressure Sensor Circuit Plausibility Check	Pressure based measured TDC position sensor #1 out of range < -1.8 CA and/or > 1.8 CA
P13E3	Cylinder 4 Pressure Sensor Circuit Plausibility Check	Pressure based measured TDC position sensor #1 out of range < -1.8 CA and/or > 1.8 CA
P140C	Low Pressure EGR Sensor Position Circuit High	Position sensor signal < 4850 mV
P140E	Low Pressure EGR Sensor Position Circuit Low	Position sensor signal < 150 mV
P146D	Reducing Agent Tank Heater Circuit Short To External Battery Voltage	Signal voltage > 3.29 V
P146F	Reducing Agent Line Heating Circuit Short To External Battery Voltage	Signal voltage > 3.2 V
P148B	Reducing Agent Line Heater Circuit Monitoring Voltage	Heating active when switched off > 200 µA
P148C	Reducing Agent Pump Heater Circuit Monitoring Voltage	Heating active when switched off > 200 µA

DTC	Error Message	Malfunction Criteria and Threshold Value
P169A	Transport Mode Active	Transport mode active
P2002	Particulate Trap Efficiency / Performance	• Differential pressure Signal < (exhaust gas volume flow) or • Accumulated loading increment from differential pressure < 1 g
P202A	Reducing Agent Tank Heater Control Circuit Rationality Check	Conductance during heating ≤ 0.1 S
P202B	Reducing Agent Tank Heater Control Circuit Short to Ground	Max. power at engagement < 0.159 S
P202C	Reducing Agent Tank Heater Circuit Open or Short to Battery Voltage	Max. power at engagement > 0.85 S
P2031	Exhaust Gas Temperature Sensor 3 Circuit Open or Short to Battery Voltage	Sensor 2 voltage > 1.72 V
P2032	Exhaust Gas Temperature Sensor 3 Circuit Short to Ground	Sensor 2 voltage < 0.45 V
P203A	Reducing Agent Reservoir Level Sensor Circuit Range Check	• Level signal < 25% PWM or > 85% PWM • Interval between Monitoring pulses < 80 Sec
P203B	Reducing Agent Reservoir Level Sensor Circuit Rationality Check Monitoring of Electrical Status	• PWM signal < 34% • PWM signal = 34 - 44%
P2047	Reducing Agent Injection Valve Circuit Open	Signal Voltage > 2.99 V
P2048	Reducing Agent Injection Valve Circuit Short to Ground	• Signal Voltage < 2.04 V • Signal Current > 1600 mA
P2049	Reducing Agent Injection Valve Circuit Short to Battery Voltage	• Signal Voltage > 0.25 V • Signal Current < 200 mA
P204A	Reducing Agent Metering Pressure Sensor Circuit Short to Ground	Signal voltage < 0.38 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P204B	Reducing Agent Metering Pressure Sensor Circuit Range/Performance	Sensor Pressure >500 hPa
P204D	Reducing Agent Metering Pressure Sensor Circuit Short to Battery voltage	Signal voltage > 4.72 V
P204F	Reducing Agent System Performance	Adaptation value (ratio) over threshold > 2 [-]
P205A	Reducing Agent Tank Temperature Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 3.12 V
P205B	Reducing Agent Tank Temperature Sensor Circuit Range / Performance	Absolute value of temperature difference to ECT > 30 K and/or < -52 Kelvin
P205C	Reducing Agent Tank Temperature Sensor Circuit Short to Ground	Signal voltage < 0.16 V
P2080	Exhaust Gas Temperature Sensor 1 Circuit Plausibility Check	• Sensor temperature < 85° C • Temperature difference to other temperature sensors during cold start > 40 K
P2084	Exhaust Gas Temperature Sensor 2 Circuit Plausibility Check	• Sensor temperature < 85° C • Temperature difference to other temperature sensors during cold start > 40 K
P208A	Reducing Agent Pump Control Circuit Open	Signal voltage > 2.99 V
P208B	Reducing Agent Pump Control Circuit Monitoring Engine Speed	Engine speed > 300 RPM
P208C	Reducing Agent Pump Control Circuit Short to Ground	Signal voltage < 2.04 V
P208D	Reducing Agent Pump Control Circuit Short to Battery Voltage	Signal Current > 6.0 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P208E	Reductant Injection Valve Stuck Closed	• Number of consecutive failed attempts to open valve > 40 [-] • Number of consecutive successful attempts to open valve < 10 [-] (during initial test activation of the valve before the urea pressure has been built up)
P20A0	Reducing Agent Reversing Valve Circuit Open	Diagnostic signal from power stage > 2.99 V
P20A2	Reducing Agent Purge Control Valve Circuit Short to Ground	Diagnostic signal from power stage < 2.04 V
P20A3	Reducing Agent Purge Control Valve Circuit Short to Battery Voltage	Diagnostic signal from power stage > 2.2 A
P20A5	Reducing Agent Purge Control Valve Stuck Closed	Pressure drop after switching valve < 3000 hPa
P20B5	Reducing Agent Pump Heater Control Circuit Open	Current during heating < 2 A
P20B7	Reducing Agent Metering Unit Heater Control Circuit Low	Max. power at engagement < 5 A
P20B8	Reducing Agent Metering Unit Heater Control Circuit High	Max conductance at engaging dosing unit > 0.89 Sec.
P20B9	Reducing Agent Tank Heater Circuit Open	Signal Voltage > 4.5 V
P20BB	Reducing Agent Tank Heater Circuit Short to Ground	Signal Voltage < 2.97 V
P20BC	Reducing Agent Tank Heater Circuit Out of Range High	Signal Current > 2.2 A
P20BD	Reducing Agent Line Heater Circuit Open	Signal Voltage > 4.5 V
P20BF	Reducing Agent Line Heater Circuit Short to Ground	Signal Voltage < 2.97 V
P20C0	Reducing Agent Line Heater Circuit Out of Range High	Signal current > 2.2 A
P20E8	Reducing Agent Metering Pressure Sensor Too Low	Urea system pressure < 3750 hPa
P20E9	Reducing Agent Metering Pressure Sensor Too High	Urea system pressure > 6500 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P20EE	CR NOx Catalyst Conversion Efficiency	Difference between simulated efficiency of a non defective system under the current operating conditions and the measured actual efficiency > 40%
P2100	Throttle Actuator Control Motor Circuit Open	Signal Voltage < 4.7 V
P2101	Throttle Valve Actuator Control Motor Circuit Internal Electrical Error	Signal Current > 3.0 A
P2102	Throttle Valve Actuator Control Motor Circuit Short to Ground	Signal Voltage < 2.97 V
P2103	Throttle Valve Actuator Control Motor Circuit Short to Battery Voltage	Signal Current > 3.0 A
P2111	Throttle Valve Actuator Control Motor Circuit Stuck Open	Valve stuck open > 12%
P2112	Throttle Valve Actuator Control Motor Circuit Stuck Closed	Valve stuck open < 12 %
P2122	Accelerator Pedal Position Sensor Circuit Short to Ground	Signal voltage < 0.61 V
P2123	Accelerator Pedal Position Sensor Circuit Open or Short to Battery Voltage	Sensor 1 voltage > 4.79 V
P2127	Accelerator Pedal Position Sensor 2 Circuit Short to Ground	Signal voltage > 0.27 V
P2128	Accelerator Pedal Position Sensor 2 Circuit Open or Short to Battery Voltage	Signal voltage > 2.43 V
P2138	Accelerator Position Sensor 1 and 2 Circuit Rationality Check	Difference between app sensor 1 voltage and app sensor 2 voltage) V (tolerance 13% - 20%)
P2146	Fuel Injector Group “A” Supply Voltage Circuit Shorted Internally	Diagnostic signal in power stage = Failed
P2149	Fuel Injector Group “B” Supply Voltage Circuit Shorted Internally	Diagnostic signal in power stage = Failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P2183	Engine Coolant Temperature Sensor On Radiator Circuit Range / Performance Cross Check of Temperature Sensors (engine part) at Cold Start Conditions	• Temperature difference to at least 3 other temperature sensors at startup > 30° K • Temperature difference to at least 3 other temperature sensors during cold start > 20 K
P2184	Engine Coolant Temperature Sensor On Radiator Outlet Circuit Short to Ground	Signal Voltage < 0.15 V
P2185	Engine Coolant Temperature Sensor On Radiator Outlet Circuit Open or Short to Battery Voltage	Signal Voltage > 3.25 V
P2195	HO2 Sensor Signal Plausibility Check Stuck Lean	Deviation to oxygen concentration (while fuel cutoff) > 4,6 % vol/vol
P2196	HO2 Sensor Signal Plausibility Check Stuck Rich	Deviation to oxygen concentration (while fuel cutoff) < -6,3 % vol/vol
P2200	NOx Sensor Circuit Internal Continuity Checking / Monitoring	NOx sensor signal ratio of validity ≥ 0.50 [-]
P2201	NOx Sensor Circuit Range / Performance Monitoring of NOx Sensor Circuit Undershoot During Fuel Cut Off	• Average NOx offset during fuel cutoff < -30 ppm or > 50 ppm • NOx signal < -40 ppm
P2202	NOx Sensor Circuit Range Check Low	NOx sensor reading < -105 ppm
P2203	NOx Sensor Bank 1 Sensor 1 Circuit High	NOx sensor reading > 1655 ppm
P2209	NOx Sensor Heater Circuit Range / Performance	NOx control not active for > 180 s
P220A	NOx Sensor Circuit Supply Voltage Error	Difference between battery and sensor supply voltage > 1.5 V and/or < -16V
P2237	HO2 Sensor Control Circuit Dynamic Check pump current (IP)	Pump current (IP) < 0.005 [-]

DTC	Error Message	Malfunction Criteria and Threshold Value
P2243	HO2 Sensor Control Circuit Dynamic Check Nernst Voltage (UN)	• Nernst voltage (UN) internal resistance > 1104O • Internal signal voltage > 3 V
P2251	HO2 Sensor Control Circuit Dynamic Check virtual ground (VM)	• Virtual ground (VM) internal resistance > 1104 O • Internal signal voltage < 1.4 V and/or > 1.6 V
P2294	Fuel Pressure Metering Valve Circuit Open	Signal Current < 0.8 mA
P2295	Fuel Pressure Metering Valve Circuit Shorted to Ground	Signal Voltage < 2.0 V
P2296	Fuel Pressure Metering Valve Circuit Shorted to Battery Voltage	Signal Current > 3.0 A

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P240F	EGR System Dynamic Check	Calculated characteristics value: at positive air mass change > 20 [-]
P2413	EGR System / Fuel Mean Value Adaption	• Number of learning points at fuel mass adaptation limit ≥ 4 • At upper limit = 6 mg/stroke • At lower limit = -6 mg/stroke
P242A	Exhaust Gas Temperature Sensor 3 Circuit Open or Short to Battery Voltage	Signal voltage > 1.72 V
P242B	Exhaust Gas Temperature Sensor 3 Circuit Plausibility Check	• Comparison of upstream turbine exhaust gas temp vs modeled temperature < 45K • Temperature difference to other temperature sensors during cold start > 40 K
P242C	Exhaust Gas Temperature Sensor 3 Circuit Short to Ground	Signal voltage < 0.45 V
P244C	Exhaust Gas Temperature Sensors Circuit Feedback Check	• Time to activate control loop EGT Upstream turbine > 45 s • Time to activate control loop EGT Upstream particulate matter trap > 60 s

DTC	Error Message	Malfunction Criteria and Threshold Value
P2452	Exhaust Pressure Sensor Circuit Short to Battery Voltage	Signal voltage > 4.9 V
P2453	Exhaust Pressure Sensor Circuit Offset Detection During Afterrun	• Differential pressure signal > 200 hPa and/or < -150 hPa or • Differential pressure signal > 80 hPa and/or < -80 hPa • Offset corrected differential pressure signal > 10 hPa and < -10 hPa
P2454	Exhaust Pressure Sensor Circuit Short to Ground	Sensor voltage < 0.2
P2456	Exhaust Pressure Sensor Circuit Plausibility check	• Inverse change of differential pressure per time > 10 hPa/s • Inverse change of differential pressure per time > -10 hPa/s
P2457	Exhaust Gas Recirculation Cooling System Performance	Sensor temperature above threshold = 40° K
P2458	Diesel Particulate Matter Trap Incomplete Regeneration	Regeneration time > 90 mins.
P2459	Diesel Particulate Matter Trap Frequent Regeneration	PM trap loading (calculation from differential pressure) > dynamically rising threshold (soot emissions)
P2463	Diesel Particulate Filter Soot Accumulation	Calculated particulate matter trap loading > 40 g
P246E	Exhaust Gas Temperature Sensor 4 Circuit Open or Short to Battery Voltage	Signal voltage > 1.72 V
P246F	Exhaust Gas Temperature Sensor 4 Circuit Plausibility Check	• Sensor temperature < 230° C • Temperature difference to other temperature sensors during cold start > 40 K
P2470	Exhaust Gas Temperature Sensor 4 Circuit Short to Ground	Signal voltage < 0.45 V
P2478	Exhaust Gas Temperature Sensor 1 Circuit Out of Range	Control deviation > 40 K

DTC	Error Message	Malfunction Criteria and Threshold Value
P247A	Exhaust Gas Temperature Sensor 3 Circuit Out of Range	• Control deviation > limit from Map or • < limit from Map f (engine speed, torque
P2563	Charge Pressure Actuator Position Sensor Circuit Range / Performance Charge Pressure Actuator Position Sensor Circuit Desired Range (Closed)	• Signal voltage > 4.5 V and/or < 0.3 V • Signal voltage > 1.72 V and/ or < 0.3 V
P2564	Charge Pressure Actuator Position Sensor Circuit Short to Ground	Signal voltage < 0.15 V
P2565	Charge Pressure Actuator Position Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 4.85 V
P2610	ECM Internal Engine Off Timer Performance	Quantity time over threshold < 7.52 or > 8.48 Sec
P268A	Fuel Injectors Calibration Not Learned / Programmed	Accumulated global release time of zero fuel calibration but disabled by rail pressure deviation > 35 s

DTC CHART

Engine Codes CBTA, CBUA

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake Camshaft Position Slow Response Bank 1	• Difference between target and actual > 8° CRK for > 1.8 to 2.5 Sec. • Adjustment angle < 3° CRK rotation
P0010	Intake Camshaft Position Actuator Circuit Open Bank 1	Signal voltage > 4.70 - 5.40 V
P0011	Intake Camshaft Position Timing - Over-Advanced Bank 1	• Difference between target and actual > 8° CRK rotation • Adjustment angle < 3° CRK rotation
P0016	Camshaft Position Sensor Angular Offset Check	Permissible deviation < -13.49 or >13.49 CRK deg.
P0030	HO2S Heater Control Circuit Bank 1, Sensor 1	Heater voltage 4.70 to 5.40 V
P0031	HO2S Heater Control Circuit Low Bank 1, Sensor 1	Heater voltage 0 to 3.26 V
P0032	HO2S Heater Control Circuit High Bank 1, Sensor 1	Heater current > 5.50 A
P0036	HO2S Heater Control Circuit Bank 1, Sensor 2	Heater voltage 2.34 to 3.59 V
P0037	HO2S Heater Control Circuit Low Bank 1, Sensor 2	Heater voltage < 2.34 V
P0038	HO2S Heater Control Circuit High Bank 1, Sensor 2	Heater voltage > 3.59 A
P0042	O2 Sensor Heater Control Circuit Bank 1 Sensor 3 (CBUA ONLY)	Heater voltage 2.34 to 3.59 V
P0043	O2 Sensor Heater Control Circuit Bank 1 Sensor 3 Low (CBUA ONLY)	Heater voltage < 2.34 V
P0044	O2 Sensor Heater Control Circuit Bank 1 Sensor 3 High (CBUA ONLY)	Heater current > 3.59 A
P0070	Ambient Air Temperature	Ambient air temp < -50° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P0071	Ambient Air Temperature Sensor Range/Performance	Difference of ECT vs. IAT or IAT vs. AAT at start > 25 K (kelvin) or AAT vs. ECT at start < 25 K
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temp > 87° C
P0106	Manifold Absolute Pressure to Barometric Pressure Circuit Range/Performance	• Difference manifold pressure - lower threshold model < 0. Model range 45 to 845 hPa • Difference manifold pressure - upper threshold model > 0. Model range 640 - 1055 • Difference. altitude sensor signal vs. manifold pressure signal at engine start > 60 hPa
P0107	Manifold Absolute Pressure Circuit Low Input	Signal voltage < 0.20 V
P0108	Manifold Absolute Pressure Circuit High Input	Signal voltage > 4.86 V
P0111	Intake Air Temperature Circuit Range/Performance	• Difference of ECT vs. IAT or IAT vs. AAT at start > 25 K (kelvin) or AAT vs. ECT at start < 25 K
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	IAT > 130.0° C
P0113	Intake Air Temperature Sensor 1 Circuit High Input	IAT < -46° C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	• No change on signal 2° K • ECT signal stuck in range 75 - 105° C and no change in signal 2° K
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	ECT >140° C
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	ECT < -40° C
P0121	Accelerator Pedal Position Sensor A Circuit Range/ Performance	• TPS 1 - TPS 2 > 6.30% • TPS 1 calculated value > 9.00%
P0122	Accelerator Pedal Position Sensor A Circuit Low Input	Signal voltage < 0.20 V
P0123	Throttle/Pedal Position Sensor A Circuit High Input	Signal voltage > 4.81 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P013A	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	EWMA filtered max differential transient time at fuel cutoff ≥ 0.5 Sec. and number of checks ≥ 3
P0130	O2 Sensor Circuit Bank 1, Sensor 1	O2S ceramic temperature < 640° C
P0131	O2 Sensor Circuit Bank 1, Sensor 1 Low Voltage	Virtual mass < 1.75 V
		UN, < 1.50 V
		IA, < 0.30 V
P0132	O2 Sensor Circuit Bank 1, Sensor 1 High Voltage	Virtual mass > 3.25 V
		UN, > 4.40 V
		IA, > 7.0 V
P0133	O2 Circuit Slow Response Bank 1, Sensor 1	• Difference between R2L and L2R area ratio -0.40 to 0.40 • Counter cycles completed ≥ 4 times • Gradient ratio ≥ 0.25 or ≤ 0.40 and lower value of both ratios < 0.25
P0135	O2 Heater Circuit Bank 1, Sensor 1	• Heater duty cycle > 90% • O2S ceramic temperature, < 720° C or • O2S ceramic temp < 715° C • Time after O2 heater on, 35 Sec.
P0136	O2 Circuit (Bank 1, Sensor 2)	• Delta O2S rear signal > 2.00 V • Number of checks = 6
DTC	**Error Message**	**Malfunction Criteria and Threshold Value**
P0137	O2 Circuit Low Voltage Bank 1, Sensor 2	• Cold condition: Signal voltage < 0.06 V for > 3 Sec • Difference of sensor voltage with and without load pulse < 0.01 V
P0138	O2 Circuit High Voltage Bank 1, Sensor 2	Signal voltage > 1.08 V for > 5 Sec.
P0139	O2 Circuit Slow Response Bank 1 Sensor 2	• EWMA filtered transient time at fuel cut off > 0.6 Sec. • O2 voltage between 201 - 401 mV • O2S rear signal > 0.16 V during fuel cut off active

DTC	Error Message	Malfunction Criteria and Threshold Value
P0140	O2 Circuit No Activity Detected Bank 1, Sensor 2	• Signal voltage .40 to .60 V for > 3 Sec. • Voltage difference between load pulse and no load pulse ≥ 2.80 V • Internal resistance > 40 k and exhaust temp > 670 °C
P0141	O2 Heater Circuit (Bank 1, Sensor 2)	• Difference of sensor voltage with and without load pulse < 0.01 V • Internal heater resistance 1200 - 32400 Ω
P0142	O2 Sensor Circuit Bank 1 Sensor 3	• Delta voltage 1 step at heater switching > 2.00 V • Heater coupling ≥ 6 times
P0143	O2 Sensor Circuit Low Voltage Bank 1 Sensor 3	• Signal voltage .40 to .60 V for > 3 Sec. • Voltage difference between load pulse and no load pulse ≥ 2.80 V • Internal resistance > 40 k and exhaust temp > 670° C
P0144	O2 Sensor Circuit High Voltage Bank 1 Sensor 3	• Signal voltage > 1.08 V for > 5 Sec.
P0145	O2 Sensor Circuit Slow Response Bank 1 Sensor 3	• EWMA filtered transient time at fuel cut off > 1.5 Sec. • O2 voltage between 201 - 401 mV
P0146	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 3	• Signal voltage .40 to .60 V for > 3 Sec. • Voltage difference between load pulse and no load pulse ≥ 2.80 V • Internal resistance > 40 k and exhaust temp > 670° C
P0147	O2 Sensor Heater Circuit Bank 1 Sensor 3	Internal heater resistance 1200 - 32400 Ω
P0169	Incorrect Fuel Composition	Fuel quantity out of limit or incorrect
P0201	Injector Circuit Open Cylinder 1	• Low side signal voltage 4.50 - 5.50 V
P0202	Injector Circuit Open Cylinder 2	• Low side signal voltage 4.50 - 5.50 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0203	Injector Circuit Open Cylinder 3	• Low side signal voltage 4.50 - 5.50 V
P0204	Injector Circuit Open Cylinder 4	• Low side signal voltage 4.50 - 5.50 V
P0205	Injector Circuit Open Cylinder 5	Low side signal voltage 4.50 - 5.50 V
P0221	Accelerator Pedal Position Sensor B Circuit Range/ Performance	• TPS 1 to TPS 2, > 5.10 to 6.3% • TPS 2 – calc position > 9%
P0222	Accelerator Pedal Position Sensor B Circuit Low Input	Signal voltage < 0.20 V
P0223	Accelerator Pedal Position Sensor B Circuit High Input	Signal voltage > 4.81 V
P0261	Cylinder 1 Injector Circuit Low	Signal voltage < 3.00 V
P0262	Cylinder 1 Injector Circuit High	Signal current < 2.20 - 4.00 A
P0264	Cylinder 2 Injector Circuit Low	Signal voltage < 3.00 V
P0265	Cylinder 2 Injector Circuit High	Signal current < 2.20 - 4.00 A
P0267	Cylinder 3 Injector Circuit Low	Signal voltage < 3.00 V
P0268	Cylinder 3 Injector Circuit High	Signal current < 2.20 - 4.00 A
P0270	Cylinder 4 Injector Circuit Low	Signal voltage < 3.00 V
P0271	Cylinder 4 Injector Circuit High	Signal current < 2.20 - 4.00 A
P0273	Cylinder 5 Injector Circuit Low	Signal voltage < 3.00 V
P0274	Cylinder 5 Injector Circuit High	Signal current < 2.20 - 4.00 A
P2088	Camshaft Position Actuator Control Circuit Low Bank 1	Signal voltage 0.0 to 3.25 V
P2089	Camshaft Position Actuator Control Circuit High Bank 1	Signal current, > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Deviation lambda control < -0.03%
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Deviation lambda control > 0.03%
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 11 K

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.0 to 19%
P0301	Cylinder 1 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.0 to 19%
P0302	Cylinder 2 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.0 to 19%
P0303	Cylinder 3 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.0 to 19%
P0304	Cylinder 4 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.0 to 19%
P0305	Cylinder 5 Misfire Detected	• Emission threshold 1st interval misfire rate (200 rev Misfire Rate) > 2.5% • Emission threshold misfire rate (1000 rev Misfire Rate), > 2.0 to 19%
P0321	Engine Speed Input Circuit Range/Performance	• Comparison of counted teeth and number of teeth +/- 1 tooth • Loss of reference gap during normal operation • No reference gap during engine start

DTC	Error Message	Malfunction Criteria and Threshold Value
P0322	Engine Speed Input Circuit No Signal	• No engine speed signal but CMP signals > 5 cam shaft revs • Engine speed = no signal
P0324	Knock Control System Error	• Signal fault counter (combustion) > 24 or • Signal fault counter measuring window > 2.00
P0327	Knock Sensor 1 Circuit Low Input	• Lower threshold < - 0.70 V • Signal range check < 0.55 to 5.60 V
P0328	Knock Sensor 1 Circuit High Input	• Upper threshold > 1 V • Signal range check > 16.50 to 92 V
P0332	Knock Sensor 2 Circuit Low Input	• Lower threshold < - 0.70 V • Signal range check < 0.55 to 5.60 V
P0333	Knock Sensor 2 Circuit High Input	• Upper threshold > 1 V • Signal range check > 16.50 to 92 V
P0341	Camshaft Position Sensor A Circuit Range/Performance	• Signal pattern incorrect • Defect counter = 8
P0342	Camshaft Position Sensor A Circuit Low Input	• Signal voltage permanently low • Crankshaft signal = 8
P0343	Camshaft Position Sensor A Circuit High Input	• Signal voltage permanently high • Crankshaft signals = 8
P0351	Ignition Coil A Primary/ Secondary Circuit	• Signal current 0.25 to 2.0 mA • Crankshaft signal = 8
P0352	Ignition Coil B Primary/ Secondary Circuit	• Signal current 0.25 to 2.0 mA • Internal check failed
P0353	Ignition Coil C Primary/ Secondary Circuit	• Signal current 0.25 to 2.0 mA • Internal check failed
P0354	Ignition Coil D Primary/ Secondary Circuit	• Signal current 0.25 to 2.0 mA • Internal check failed
P0355	Ignition Coil E Primary/ Secondary Circuit	• Signal current 0.25 to -2.0 mA • Internal check failed

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Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air Injection System	Deviation SAI pressure > 50 hPa
P0413	Secondary Air Injection System Switching Valve Circuit Open	Signal voltage 9.25 to 11.25 V
P0414	Secondary Air Injection System Switching Valve Circuit Shorted	• Signal voltage > 6.0 V or • Signal current > 2.20 A
P0418	Secondary Air Injection System Control Circuit	Signal voltage 4.70 to 5.40 V
P0420	Catalyst System Efficiency Below Threshold	• Oxygen storage capacity (OSC) vs OSC value of borderline catalyst < 1.00
P043E	Evaporative Emission System Leak Detection Reference Orifice Low Flow	EVAP pump current during reference measurement > 40 mA
P043F	Evaporative Emission System Leak Detection Reference Orifice High Flow	EVAP pump current during reference measurement < 15 mA
P0441	Evaporative Emission System Incorrect Purge Flow - Stuck Closed	Drop of pump current > 1.0 mA
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.9 Sec
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage 4.70 - 5.40 V
P0447	Evaporative Emission System Vent Control Circuit Open	Signal voltage > 4.70 - 5.40 V
P0448	Evaporative Emission System Vent Control Circuit Shorted	• Signal current > 2.2 to 4 A or • Signal voltage < 2.74 to 3.26 V
P0455	Evaporative Emission System Leak Detected (Gross Leak)	Time for pressure drop < 1 Sec.
P0456	Evaporative Emission System Leak Detected (Very Small Leak)	Time for pressure drop < 5.8 Sec
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage 0 to 3.26 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A
P0491	Secondary Air System Insufficient Flow	• SAI pressure vs. modeled SAI < 50 - 72% or • Absolute deviation of raw pressure signal from filtered signal mean value < 8.98 hPa

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor Range/ Performance	Vehicle speed < 4 km/h
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	Vehicle speed > 325 km/h
P0506	Idle Air Control System - RPM Lower Than Expected	• Engine speed deviation > 100 RPM • RPM controller torque value ≥ calculated max value.
P0507	Idle Air Control System - RPM Higher Than Expected	• Engine speed deviation < -100 RPM • RPM controller torque value ≤ calculated min. value.
P050A	Idle Air Control System Out of Range	• Engine speed deviation > 100 RPM • RPM controller torque value ≥ calculated max. value. or • Engine speed deviation < -100 RPM • RPM controller torque value ≤ calculated min. value.
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing vs. actual value > 20%
P052A	Cold Start Camshaft Position Timing Over-Advanced	Difference between actual and target position > 10° CRK rev

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0606	ECM/PCM Processor	• Internal hardware/voltage check - failed • Communication CPU - Sensor IC - failed • EEPROM Check failed
P0627	Fuel Pump Control Circuit Open/Shorted to Ground	• Signal voltage 4.50 to 5.50 V (open circuit) • Signal voltage < 3.00 V (grounded circuit)
P0629	Fuel Pump Control Circuit High	Signal current 0.60 to 1.20 A
P0638	Throttle Actuator Control Range/Performance Bank 1	• Time to close to reference point > 0.6 Sec. and reference point = 2.88% or • TPS 1 signal voltage, not 0.40 - 0.80 V • TPS 2 signal voltage, not (4.20 - 4.60) V
P0641	Sensor Reference Voltage A Circuit/Open	Signal voltage deviation > ± 0.3 V
P0651	Sensor Reference Voltage B Circuit/Open	Signal voltage deviation > ± 0.3 V
P0697	Sensor Reference Voltage C Circuit/Open	Signal voltage deviation > ± 0.3 V
U0001	High Speed CAN Communication Bus	CAN message = no feedback
U0002	High Speed CAN Communication Bus	Global time out, no messages received
U0101	Lost Communication with TCM	Time out, no message received
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	No CAN messages received
U0146	Lost Communication With Gateway “A”	No CAN messages received
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	No CAN messages received
U0302	Software Incompatibility with Transmission Control Module	Manual transmission coded ECM but automatic transmission messages received from TCM

DTC	Error Message	Malfunction Criteria and Threshold Value
U0402	Invalid Data Received From Transmission Control Module	Implausible data message received
U0415	Invalid Data Received From Body Control Module	• Sensor signal failure • None, or implausible information • CAN 1 VSS signal incorrect > 327.08 km/h
U0422	Invalid Data Received From Body Control Module	Ambient temperature value initialization = 00h
U0423	Invalid Data Received From Instrument Panel Control (IPC) Module	AAT sensor reading from cluster to ECM implausible or no message
U0447	Invalid Data Received From Gateway Module	CAN message incorrect

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P117A	Fuel System Out of Range	I - portion of 3rd lambda control loop > 0.03
P150A	Engine Off Timer Performance	Comparison of engine off time from Instrument Cluster control unit with ECM engine after run timer < -12 or > 12 Sec.
P1609	Crash Shut(Off was Deployed	Airbags activated
P169A	Vehicle In Transport Mode	Transport mode active
P2101	Throttle Actuator A Control Motor Circuit Range/ Performance	• Duty cycle >80% • Deviation throttle value angles vs calculated value 4 to 50% • ECM driver = no fault
P2106	Throttle Actuator Control System - Forced Limited Power	Internal check failure
P2122	Accelerator Pedal Position Sensor D Circuit Low Input	Signal voltage < 0.61 V
P2123	Accelerator Pedal Position Sensor D Circuit High Input	Signal voltage > 4.79 V
P2127	Accelerator Pedal Position Sensor E Circuit Low Input	Signal voltage < 0.27 V
P2128	Accelerator Pedal Position Sensor E Circuit High Input	Signal voltage > 2.43 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2138	Accelerator Pedal Position Sensor D / E Voltage Correlation	Signal voltage sensor 1 vs. 2 > 0.17 to 0.70 V
P2177	System Too Lean Off Idle	Adaptive value > 28%
P2178	System Too Rich Off Idle	Adaptive value < -20%
P2181	Cooling System Performance	ECT too low after sufficient mass air flow interval < 70-73° C
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	ECT outlet > 140° C
P2185	Engine Coolant Temperature Sensor 2 Circuit High	ECT outlet < -40° C
P2187	System Too Lean at Idle Bank 1	Adaptive value > 5.02%
P2188	System Too Rich at Idle Bank 1	Adaptive value < -5.02%
P2195	O2 Sensor Signal Biased/ Stuck Lean Bank 1, Sensor 1	Delta lambda of 2nd lambda control loop > 0.07
P2196	O2 Sensor Signal Biased/ Stuck Rich Bank 1, Sensor 1	Delta lambda of 2nd lambda control loop < -0.07
P219C	Cylinder 1 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for dedicated engine roughness increase
P219D	Cylinder 2 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for dedicated engine roughness increase
P219E	Cylinder 5 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for dedicated engine roughness increase
P219F	Cylinder 4 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for dedicated engine roughness increase
P21A0	Cylinder 5 Air-Fuel Ratio Imbalance	Individual cylinder fuel correction based on measured enleanment for dedicated engine roughness increase

DTC	Error Message	Malfunction Criteria and Threshold Value
P2237	O2 Sensor Positive Current Control Circuit/Open Bank 1, Sensor 1	• O2S signal front 1.49 to 1.51 V • Fuel cutoff > 3 Sec. • Delta lambda controller > 0.10
P2243	O2 Sensor Reference Voltage Circuit/Open Bank 1, Sensor 1	• O2S signal front > 4.70 V and Internal resistance > 950 Ω • O2S signal front < 0.20 V And Internal resistance > 950 Ω
P2251	O2 Sensor Negative Current Control Circuit Open	O2S signal front 1.47 to 1.53 V and > 950 Ω
P2257	Secondary Air Injection System Control Circuit Low	Signal voltage 0 to 3.26 V
P2258	Secondary Air Injection System Control Circuit High	Signal current .60 to 2.40 A
P2270	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	O2S signal rear not oscillating at reference < 598 mV and enrichment after stuck lean 20%
P2271	O2 Sensor Signal Stuck Rich Bank 1, Sensor 2	O2S signal rear not oscillating at reference > 598 mV and enrichment after stuck rich 15%
P2274	O2 Sensor Signal Stuck Lean Bank 1 Sensor 3	O2S rear not oscillating at reference < 0.64 to 0.65 V and enrichment after stuck lean 20%
P2275	O2 Sensor Signal Stuck Rich Bank 1 Sensor 3	• O2S rear not oscillating at reference > 0.64 to 0.65 V and enrichment after stuck rich 15% or • Sensor voltage of ≥ 0.15 V after oxygen mass flow (after fuel cutoff) > 3500 mg with ≥ 1 check
P2279	Intake Air System Leak	Offset value throttle mass flow > 13 kg/h

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P2300	Ignition Coil A Primary Control Circuit Low	Signal current > 24 mA
P2301	Ignition Coil A Primary Control Circuit High	Signal current > 5.1 - 7.0 mA

DTC	Error Message	Malfunction Criteria and Threshold Value
P2303	Ignition Coil B Primary Control Circuit Low	Signal current > 24.0 mA
P2304	Ignition Coil B Primary Control Circuit High	Signal current > 5.1 - 7.0 mA
P2306	Ignition Coil C Primary Control Circuit Low	Signal current > 24.0 mA
P2307	Ignition Coil C Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA
P2309	Ignition Coil D Primary Control Circuit Low	Signal current > 24.0 mA
P2310	Ignition Coil D Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA
P2312	Ignition Coil E Primary Control Circuit Low	Signal current > 24 mA
P2313	Ignition Coil E Primary Control Circuit High	Signal voltage > 5.1 - 7.0 mA

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P240A	Evaporative Emission System Leak Detection Pump Heater Control Circuit Open	Signal voltage > 4.7 to 5.4 V
P240B	Evaporative Emission System Leak Detection Pump Heater Control Circuit Low	Signal voltage < 2.74 to 3.26 V
P240C	Evaporative Emission System Leak Detection Pump Heater Control Circuit High	Signal current > 2.2 to 4 A
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > Signal voltage > 4.70 to 5.40 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Signal voltage < 2.74 to 3.26 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Signal voltage > 4.00 or >1.80 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Low signal voltage > .5 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	• High signal voltage > 12 Sec. and number of checks = 30 • Cumulative time of high signal voltage during pumping > 10 Sec.
P2407	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic	• Fluctuation of EVAP pump current during reference measurement > 1 mA • Drop of EVAP pump current during pump phase > 6 mA for ≥ 3 Sec.
P2414	O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	• Threshold 1 • Signal voltage 3.1 to 4.77 V • Threshold 2 • Signal Voltage 2.5 to 3.06 V
P2431	Secondary Air Injection System Air Flow Pressure Sensor Circuit Range/ Performance	Difference between SAI pressure and ambient pressure NOT -60 to 60 hPa
P2432	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low	Signal voltage < 0.5 V
P2433	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High	Signal voltage > 4.5 V
P2440	Secondary Air Injection System Switching Valve Stuck Open	SAI pressure sensor measured with SAI pressure vs. modeled while SAI valve closed < 64.8%
P2450	Evaporative Emission System Switching Valve Performance/ Stuck Open	EVAP pump current difference between reference measurement to idle < 3 mA
P2626	O2 Sensor Pumping Current Trim Circuit Open (Bank 1 Sensor 1)	O2S signal front > 4.77 V (lean)

DTC CHART

Engine Code CDVB

Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake Camshaft Position Slow Response Bank 1	• Difference between target and actual position >12 to 40° CRK for > 3 Sec. • Adjustment angle ≥ 3° CRK
P000B	Exhaust Camshaft Position Slow Response Bank 1	• Difference between target and actual position >10 to 22° CRK for > 2 to 3 Sec • Adjustment angle ≥ 3° CRK
P0010	Intake Camshaft Position Actuator Circuit / Open (Bank 1)	Signal voltage, > 4.7 - 5.4 V
P0011	Intake Camshaft Position Timing - Over-Advanced (Bank 1)	• Difference between target and actual position >12 to 40° CRK for > 3 Sec. • Adjustment angle < 3° CRK
P0013	Exhaust Camshaft Position - Actuator Circuit (Bank 1)	Signal voltage, > 4.4 - 5.6 V
P0014	Exhaust Camshaft Position - Timing Over-Advanced or System Performance Bank 1	• Difference between target and actual position >10 to 22° CRK for > 2 to 3 Sec. • Adjustment angle ≥ 3° CRK
P0016	Crankshaft Position Sensor A Camshaft Position Correlation (Bank 1)	• Deviation in camshaft position to crankshaft position < -11.01 degrees of crank rotation or • Deviation in camshaft position to crankshaft position > 11.01 degrees of crank rotation
P0017	Crankshaft Position Sensor B Exhaust Camshaft Position Correlation (Bank 1)	• Deviation in camshaft position to crankshaft position < -11.01 degrees of crank rotation or • Deviation in camshaft position to crankshaft position > 11.01 degrees of crank rotation
P0030	HO2S Heater Control Circuit Low (Bank 1, Sensor 1)	Heater voltage 4.70 - 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0031	HO2S Heater Control Circuit Short to Ground, (Bank 1, Sensor 1)	Heater voltage 0.00 to 3.26 V
P0032	HO2S Heater Control Circuit Short to Battery Plus, (Bank 1, Sensor 1)	Heater voltage > 5.50 A
P0036	HO2S Heater Control Circuit Open Circuit (Bank 1, Sensor 2)	Heater voltage 2.34 - 3.59 V
P0037	O2S Heater Control Circuit Short to Ground, (Bank 1, Sensor 2)	Heater voltage < 2.34 V
P0038	HO2S Heater Control Circuit Open or Short to Battery Plus (Bank 1, Sensor 2)	Heater voltage > 3.59 V
P0040	O2 Sensor Signals Swapped (Bank 1 Sensor 1/ Bank 2 Sensor 1)	Lambda controllers exceed thresholds in opposite directions: Case 1: • Lambda control value bank 1 < 0.80 and • Lambda control value bank 2 > 1.20 Case 2: • Lambda control value bank 1 > 1.20 and • Lambda control value bank 2 < 0.80
P0050	O2 Sensor Heater Control Circuit Open Circuit, (Bank 2, Sensor 1)	Heater voltage 4.70 - 5.40 V
P0051	O2 Sensor Heater Control Circuit Short to Ground, (Bank 2, Sensor 1	Heater voltage 0.00 to 3.26 V
P0052	O2 Sensor Heater Control Circuit Short to Battery Plus, (Bank 2, Sensor 1)	Heater voltage > 5.50 A
P0056	O2 Sensor Heater Control Circuit Open circuit, (Bank 2, Sensor 2)	Heater voltage 2.34 - 3.59 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0057	O2 Sensor Heater Control Circuit Shorted to Ground, (Bank 2, Sensor 2)	Heater voltage < 2.34 V
P0058	O2 Sensor Heater Control CircuitOpen or Short to Battery Plus, (Bank 2, Sensor 2)	Heater voltage > 3.59 V
P0068	MAF – Throttle Position Correlation	Plausibility with fuel system • Load calculation < -35% • Load calculation > 35%
P0070	Ambient Air Temperature Sensor Short to Battery / Open Circuit	CAN communication with Ambient Air Temperature Sensor failure
P0071	Ambient Air Temperature Sensor Range/Performance	• Difference in value between ECT vs IAT at engine start (depending on engine off time) > 24.8 K and • Difference in value between AAT vs ECT at engine start (depending on engine off time) > 24.8 K
P0072	Ambient Air Temperature Sensor Short to Ground	CAN communication with Ambient Air Temperature Sensor failure
P0087	Fuel Rail System Pressure - Too Low	• Pressure control activity > 2.20 MPa and • Fuel trim activity > 0.80 to 1.20 and • Difference between target vs. actual pressure > 2.20 MPa
P0089	Fuel Pressure Regulator 1 Performance	• Difference between target vs. actual pressure > 200 kPa • Difference between target vs. actual pressure >150 kPa • Feedback control loop < -300 or > 225 kPa
P008A	Low Pressure Fuel System Pressure Out of Range Low	Actual pressure < 40 kPa
P008B	Low Pressure Fuel System Pressure Out of Range High	Actual pressure > 780 kPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P0100	Mass Air Flow Circuit	• MAF sensor signal 0 µs • MAF signal temp correction < 40 mSec. • MAF signal temp correction < 40 and > 65 mSec.
P0101	Mass Air Flow Circuit Out of Range Low	• Air mass too low < -10 kg/h
	Out of Range High	• Air mass too high > 1100 kg/h
	Rationality Check Mass Air Flow	• Mass air flow vs lower threshold model < 0 to 580 kg/h
	Rationality Check Load Survey	or • Mass air flow vs. upper threshold model > 30.0 to 1100 kg/h
	Rationality check load survey	• Load calculation > 20.00% and • Fuel system (mult.) > 20.00% or • Load calculation < -20.00% and • Fuel system (mult.) > 20.00%
P0102	Mass Air Flow Circuit Low Input	• MAF sensor signal < 66 µs or • MAF Sensor signal temp correction < 40 mSec.
P0103	Mass Air Flow Circuit High Input	• MAF sensor signal > 910.0 µs or • MAF Sensor signal temp correction > 65 mSec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0111	Intake Air Temperature Circuit Range/Performance	• Difference in value between ECT vs IAT at engine start (depending on engine off time) > 24.8 K and • Difference in value between IAT vs AAT at engine start (depending on engine off time) > 24.8 K and • Difference in value between AAT vs ECT at engine start (depending on engine off time) < 24.8 K
P0112	Intake Air Temperature Sensor Circuit Short to Ground	IAT > 130 °C
P0113	Intake Air Temperature Sensor Circuit Short to Battery / Open Circuit	IAT < -45.0 °C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance, Cross Check	• Difference ECT vs. IAT at engine start > 24.8 K (depending on engine off time) and • Difference IAT vs. AAT at engine start < 24.8 K (depending on engine off time) and • Difference AAT vs. ECT at engine start > 24.8 K (depending on engine off time)
	Stuck High / Low - No Change	• Difference max ECT vs. min ECT < 1.50 K
	Stuck in Range	• ECT @ start ≥ 78.0° C and • ECT @ start ≤ 137° C
P0117	Engine Coolant Temperature Sensor 1 Circuit, Short to Ground	ECT >137° C
P0118	Engine Coolant Temperature Sensor 1 Circuit Short to Battery / Open Circuit	ECT < -44° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P011F	Engine Coolant Temperature 2 / Ambient Air Temperature Correlation	• Difference in value between ECT vs IAT at engine start (depending on engine off time) > 24.8 K and • Difference in value between AAT vs ECT at engine start (depending on engine off time) > 24.8 K
P0121	Accelerator Pedal Position Sensor 1 Circuit Range/ Performance	• TPS 1 - TPS 2 > 5.10 to 6.30% and • Actual TPS 1 calculated value > TPS 2 calculated value or • TPS 2 calculated value > 9.0%
P0122	Accelerator Pedal Position Sensor 1 Out of Range Low	Signal voltage < 0.20 V
P0123	Accelerator Pedal Position Sensor 1 Out of Range High	Signal voltage > 4.81 V
P0130	O2 Sensor Circuit Malfunction (Bank 1, Sensor 1)	O2S ceramic temperature < 640° C
P0131	O2 Sensor Circuit Low Voltage (Bank 1, Sensor 1)	Short to Ground: • Virtual Mass (VM) < 1.75 V or • Nernst voltage (UN) < 1.50 V or • Adjustment voltage (IA) < 0.30 V or • Adjustment voltage (IP) < 0.30 V
P0132	O2 Sensor Circuit High Voltage (Bank 1, Sensor 1)	Short to Battery: • Virtual Mass (VM) > 3.25 V or • Nernst voltage (UN) > 4.40 V or • Adjustment voltage (IA) > 7.00 V or • Adjustment voltage (IP) > 7.00 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1	Sysmmetric Fault: • O2S signal front vs. modeled O2S signal ratio -0.30 to 0.30 • Max value of both counters for area ratio ≥ 3 times Delay Time: • Gradient ratio ≥ 0.27 • Lower value of both area ratios < 0.15 Transient Time: • Gradient ratio ≥ 0.27 • Gradient ratio ≤ 0.65 • Lower value of both area ratios < 0.15 or • Lower value of both gradient ratios < 0.27 Asymmetric Fault: • O2S signal front vs. modeled O2S signal ratio <-0.30 to > 0.30 • Values of both counters for area ≥ 3 times Delay Time: • Gradient ratio ≥ 0.27 • Gradient ratio < 0.25 Transient Time: • Gradient ratio ≥ 0.27 • Gradient ratio ≤ 0.65 • Lower value of both area ratios < 0.25 or • Lower value of both gradient < 0.27
P0135	O2 Sensor Heater Circuit Out of Range High (Bank 1, Sensor 1) Rationality Check (sensor heating up)	• O2S ceramic temperature, < 685° C • Heater duty cycle, > 90% or • O2S ceramic temp < 715° C • Time after O2S heater on 40 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0137	O2 Circuit Short to Ground (Bank 1, Sensor 2)	• Signal voltage, < 0.40 V for > 3.0 Sec. and • Difference of sensor voltage with load pulse and without (mean value of 3 measurements) < 0.01 V
P0138	O2 Circuit Short to battery voltage (Bank 1, Sensor 2)	• Signal voltage > 1.08 V • For time > 5.0 Sec.
P0139	O2 Circuit Slow Response (Bank 1 Sensor 2)	• EWMA filtered transient time at fuel cutoff > 0.5 Sec. • In voltage range 201.20 - 401.40 mV • Number of checks ≥ 1
P013A	O2 Sensor Slow Response - Rich to Lean (Bank 1, Sensor 2)	• Arithmetic filtered max differential transient time at fuel cut off ≥ 0.75 Sec. • EWMA filtered max differential transient time at fuel cutoff n.a. • Number of checks ≥ 1.00
P013B	O2 Sensor Slow Response - Lean to Rich (Bank 1, Sensor 2)	• Arithmetic filtered max differential transient time at fuel cut off ≥1.50 Sec. • EWMA filtered max differential transient time at fuel cutoff n.a. • Number of checks ≥ 1.00
P013C	O2 Sensor Slow Response - Rich to Lean (Bank 2, Sensor 2)	• Arithmetic filtered max differential transient time at fuel cut off ≥ 0.75 Sec. • EWMA filtered max differential transient time at fuel cutoff n.a. • Number of checks ≥ 1.00
P013D	O2 SensorSlow Response - Lean to Rich (Bank 2 Sensor 2)	• Arithmetic filtered max differential transient time at fuel cut off ≥1.50 Sec. • EWMA filtered max differential transient time at fuel cutoff n.a. • Number of checks ≥ 1.00

DTC	Error Message	Malfunction Criteria and Threshold Value
P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)	• Arithmetic filtered max differential delay time at rich to lean transition > 0.80 Sec • EWMA filtered max differential delay time at lean to rich transition n.a. • Number of checks ≥ 3.00
P013F	O2 Sensor Delayed Response - Lean to Rich (Bank 1, Sensor 2)	• Arithmetic filtered max differential delay time at lean to rich transition > 1.00 Sec. and • Number of checks ≥ 3.00
P0140	O2 Sensor Circuit Continuity, Sensor Signal Line Open Circuit, (Bank 1, Sensor 2) Continuity, Sensor Ground Line Open Circuit, (Bank 1, Sensor 2)	• Signal voltage, 0.40 - 0.60 V • For time > 3.0 Sec. and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V • Internal resistance > 120,000 O and • Exhaust temperature > 600° C
P0141	O2 Heater Circuit Malfunction, (Bank 1, Sensor 2)	Heater resistance > 600.0 to 15000.0 O
P014A	O2 Sensor Delayed Response - Rich to Lean (Bank 2, Sensor 2)	• Arithmetic filtered max differential delay time at rich to lean transition > 0.80 Sec. or • EWMA filtered max differential delay time at lean to rich transition n.a. and • Number of checks ≥ 3.00
P014B	O2 Sensor Delayed Response - Lean to Rich (Bank 2, Sensor 2)	• Arithmetic filtered max differential delay time at lean to rich transition 1.00 Sec. or • EWMA filtered max differential delay time at lean to rich transition n.a. and • Number of checks ≥ 3.00

DTC	Error Message	Malfunction Criteria and Threshold Value
P0150	2 Sensor Circuit Malfunction (Bank 2, Sensor 1)	O2S ceramic temp < 640° C
P0151	O2 Sensor Circuit Low Voltage (Bank 2, Sensor 1)	Short to Ground: • Virtual Mass (VM) < 1.75 V or • Nernst voltage (UN) < 1.50 V or • Adjustment voltage (IA) < 0.30 V or • Adjustment voltage (IP) < 0.30 V
P0152	O2 Sensor CircuitHigh Voltage (Bank 2, Sensor 1)	Short to Battery: • Virtual Mass (VM) > 3.25 V or • Nernst voltage (UN) > 4.40 V or • Adjustment voltage (IA) > 7.00 V or • Adjustment voltage (IP) > 7.00 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0153	O2 Sensor Circuit Slow Response (Bank 2, Sensor 1)	Sysmmetric Fault: • O2S signal front vs. modeled O2S signal ratio -0.30 to 0.30 • Max value of both counters for area ratio ≥ 3 times Delay Time: • Gradient ratio ≥ 0.27 • Lower value of both area ratios < 0.15 Transient Time: • Gradient ratio ≥ 0.27 • Gradient ratio ≤ 0.65 • Lower value of both area ratios < 0.15 or • Lower value of both gradient ratios < 0.27 Asymmetric Fault: • O2S signal front vs. modeled O2S signal ratio <-0.30 to > 0.30 • Values of both counters for area ≥ 3 times Delay Time: • Gradient ratio ≥ 0.27 • Gradient ratio < 0.25 Transient Time: • Gradient ratio ≥ 0.27 • Gradient ratio ≤ 0.65 • Lower value of both area ratios < 0.25 or • Lower value of both gradient < 0.27
P0155	O2 Sensor Heater Circuit Out of range high (Bank 2, Sensor 1) Rationality Check (sensor heating up)	• O2S ceramic temperature, < 685 °C • Heater duty cycle, > 90% or • O2S ceramic temp < 715° C • Time after O2S heater on 40 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0157	O2 Sensor Circuit Short to ground (Bank 2, Sensor 2)	• Signal voltage, < 40 mV for > 3 Sec. • Difference of sensor voltage with load pulse and without (mean value of 3 measurements) < 0.01 V
P0158	O2 Sensor Circuit High Voltage (Bank 2, Sensor 2)	• Signal voltage > 1.08 V • For time > 5.0 Sec.
P0159	O2 Sensor Circuit Slow Response (Bank 2, Sensor 2)	• EWMA filtered transient time at fuel cutoff> 0.5 Sec. • In voltage range 201.20 - 401.40 mV • Number of checks >= 1
P0160	O2 Sensor Circuit Continuity, Sensor Signal Line Open Circuit, (Bank 2, Sensor 2) Continuity, Sensor Ground Line Open Circuit, (Bank 2, Sensor 2)	Signal voltage • Signal voltage, 0.40 - 0.60 V • For time > 3.0 Sec. and • Difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) ≥ 2.80 V • Internal resistance > 120,000 ohm • Exhaust temperature > 600° C
P0161	O2 Sensor Heater Circuit Malfunction, (Bank 2, Sensor 2)	Heater resistance > 600.0 to 15000.0 O
P0169	Incorrect Fuel Composition	Comparison with fuel quantity = incorrect.
P0171	Fuel trim, System Too Lean (Bank 1)	At idle • Adaptive value > 5.02% At part-load • Adaptive value 21% or • Low pass filtered lambda controller output > 20.00 % for time > 40.0 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0172	Fuel Trim, System Too Rich (Bank 1)	At idle • Adaptive value < -5.02% At part-load • Adaptive value < -21% • Low pass filtered lambda controller output < 20.00% for time > 40.0 Sec.
P0174	Fuel trim, System Too Lean (Bank 2)	Low pass filtered lambda controller output > 20.00% for time > 40.0 Sec.
P0175	Fuel trim, System Too Rich (Bank 2)	At idle • Adaptive value < -5.02% At part-load • Adaptive value < -21% • Low pass filtered lambda controller output < 20.00% for time > 40.0 Sec.
P0190	Fuel Rail Pressure Sensor Circuit Signal Range Check	Signal voltage > 4.8 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Actual pressure > 14.60 MPa or < 0.005 MPa
P0192	Fuel Rail Pressure Sensor CircuitSignal Range Check	Signal voltage < 0.20 V
P0201	Injector Circuit - Cylinder 1 Open or Monitoring booster-time	• Signal current < 2.10 A • Internal logic failure
P0202	Injector Circuit - Cylinder 2 Open or Monitoring booster-time	• Signal current < 2.10 A • Internal logic failure
P0203	Injector Circuit - Cylinder 3 Open or Monitoring booster-time	• Signal current < 2.10 A • Internal logic failure
P0204	Injector Circuit - Cylinder 4 Open or Monitoring booster-time	• Signal current < 2.10 A • Internal logic failure
P0205	Injector Circuit - Cylinder 5 Open or Monitoring booster-time	• Signal current < 2.10 A • Internal logic failure
P0206	Injector Circuit - Cylinder 6 Open or Monitoring booster-time	• Signal current < 2.10 A • Internal logic failure

DTC	Error Message	Malfunction Criteria and Threshold Value
P0221	Accelerator Pedal Position Sensor Circuit Range/ Performance	• TPS 1 - TPS 2 > 5.10 to 6.30% and • Actual TPS 2 calculated value > TPS 1 calculated value or • TPS 2 calculated value > 9%
P0222	Accelerator Pedal Position Sensor 2 Out of Range Low	Signal voltage < 0.20 V
P0223	Accelerator Pedal Position Sensor 2 Out of Range High	Signal voltage > 4.81 V
P025A	Fuel Pump Module Control Circuit/Open	Signal voltage 4.40 - 5.60 V
P025C	Fuel Pump Module Control Circuit Short to Ground	Signal voltage 2.15 - 3.25 V
P025D	Fuel Pump Module Control Circuit Short to Battery Plus	Signal current > 1.10 A
P0261	Cylinder 1 Injector Circuit Short to Ground	Low side signal current < 2.10 A
P0262	Cylinder 1 Injector Circuit Short to Battery Plus	Low side signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Short to Battery Plus (low side)	Low side signal current < 2.10 A
P0265	Cylinder 2 Injector Circuit Short to Battery Plus (low side)	Low side signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Short to Battery Plus (low side)	Low side signal current < 2.10 A
P0268	Cylinder 3 Injector Circuit Short to Battery Plus (low side)	Low side signal current > 14.70 A
P0270	Cylinder 4 Injector Circuit Short to Battery Plus (low side)	Low side signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit Short to Battery Plus (low side)	Low side signal current > 14.70 A
P0273	Cylinder 5 Injector Circuit Short to Battery Plus (low side)	Low side signal current < 2.10 A
P0274	Cylinder 5 Injector Circuit Short to Battery Plus (low side)	Low side signal current > 14.70 A
P0276	Cylinder 6 Injector Circuit Short to Battery Plus (low side)	Low side signal current < 2.10 A
P0277	Cylinder 6 Injector Circuit Short to Battery Plus (low side)	Low side signal current > 14.70 A

DTC	Error Message	Malfunction Criteria and Threshold Value
P2088	A Camshaft Position Actuator Control Circuit Short to Ground (Bank 1)	Signal voltage 0.0 - 3.25 V
P2089	Camshaft Position Actuator A Control Circuit Open or Short to Battery Plus (Bank 1)	Signal current > 2.2 A
P2090	Camshaft Position Actuator B Control Circuit short to ground (Bank 1)	Signal voltage 0.0 to 3.25 V
P2091	Camshaft Position Actuator B Control Circuit short to battery plus (Bank 1)	Signal current > 2.20 A
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	I portion of 2nd lambda control loop < -0.035
P2097	Post-Catalyst Fuel Trim System Too Rich (Bank 1)	I portion of 2nd lambda control loop > 0.035
P2098	Post Catalyst Fuel Trim System (Bank 2) Too Lean	I portion of 2nd lambda control loop < -0.035
P2099	Post Catalyst Fuel Trim System (Bank 2) Too Rich	I portion of 2nd lambda control loop > 0.035
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 9.8 °K

Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	• Emission threshold misfire rate (MR) > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.50%
P0301	Cylinder 1 Misfire Detected	• Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.50%
P0302	Cylinder 2 Misfire Detected	• Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.50%

DTC	Error Message	Malfunction Criteria and Threshold Value
P0303	Cylinder 3 Misfire Detected	• Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.50%
P0304	Cylinder 4 Misfire Detected	• Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.50%
P0305	Cylinder 5 Misfire Detected	• Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.50%
P0306	Cylinder 6 Misfire Detected	• Emission threshold Misfire Rate (MR), > 1.9% • Catalyst damage misfire rate (MR), > 1.05% - 13.50%
P0321	Engine Speed Input Circuit Range/Performance	• Comparison of counted teeth vs reference = incorrect or • Monitoring reference gap, failure
P0322	Engine Speed Input Circuit No Signal	• Camshaft signal > 3 • Engine speed, no signal
P0324	Knock Control System Error	• Signal fault counter (combustion) > 28 or • Signal fault counter (measuring window) > 5
P0325	Knock Sensor 1 Circuit Malfunction	Signal voltage < 1.80 V or > 3.20 V
P0327	Knock Sensor 1 Short to ground (Bank 1) Signal Range Check	• Lower threshold -0.07 V • Lower threshold <-0.05 to 2.50 V
P0328	Knock Sensor 1 Short to battery plus Input (Bank 1) Signal Range Check	• Upper threshold > 1.00 V • Signal range upper threshold < 50 to 110.15 V
P0330	Knock Sensor 2 Circuit	Signal voltage < 1.80 V or > 3.20 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0332	Knock Sensor 2 Short to Ground (Bank 2) Signal Range Check	• Lower threshold -0.07 V • Lower threshold <-0.05 to 2.50 V
P0333	Knock Sensor 2 Short to Battery Plus Input (Bank 2) Signal Range Check	• Upper threshold > 1.00 V • Signal range upper threshold > 163 to 240 V
P0340	Camshaft Position Sensor A Circuit Bank 1	Cam adaption values out of range • > 20° KW • < -20° KW • Difference of adapted and actual values > 9° KW
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1)	• Signal pattern not alternating • Defect counter = 12
P0342	Camshaft Position Sensor A Circuit Low Input (Bank 1)	• Signal voltage permanently low • Crankshaft signals = 8
P0343	Camshaft Position Sensor A Circuit High Input (Bank 1)	• Signal voltage permanently high • Crankshaft signals = 8
P0351	Ignition Coil A Primary/ Secondary Circuit Open circuit	• Signal current 0.25 to -2.0 mA or • Internal check failed
P0352	Ignition Coil B Primary/ Secondary Circuit Open circuit	• Signal current 0.25 to -2.0 mA or • Internal check failed
P0353	Ignition Coil C Primary/ Secondary Circuit Open circuit	• Signal current 0.25 to -2.0 mA or • Internal check failed
P0354	Ignition Coil D Primary/ Secondary Circuit Open circuit	• Signal current 0.25 to -2.0 mA or • Internal check failed
P0355	Ignition Coil E Primary/ Secondary Circuit Open circuit	• Signal current 0.25 to -2.0 mA or • Internal check failed
P0356	Ignition Coil F Primary/ Secondary Circuit Open circuit	• Signal current 0.25 to -2.0 mA or • Internal check failed

DTC	Error Message	Malfunction Criteria and Threshold Value
P0366	Camshaft Position Sensor B Circuit Range/Performance	• Signal pattern incorrect • Crankshaft signals = 8
P0367	Camshaft Position Sensor B Circuit (Bank 1) Low Input	• Signal voltage permanently low • Crankshaft signals = 8 revolutions
P0368	Camshaft Position Sensor B Circuit (Bank 1) High Input	• Signal voltage permanently high • Crankshaft signals = 8 revolutions
P2300	Ignition Coil A Primary Control Circuit Short to Ground	Signal current > 24 mA
P2301	Ignition Coil A Primary Control Circuit Short to Battery Plus	Signal current > 5.10 - 7.0 mA
P2303	Ignition Coil B Primary Control Circuit Short to Ground	Signal current > 24 mA
P2304	Ignition Coil B Primary Control Circuit Short to Battery Plus	Signal current > 5.10 - 7.0 mA
P2306	Ignition Coil C Primary Control Circuit Short to Ground	Signal current > 24 mA
P2307	Ignition Coil C Primary Control Circuit Short to Battery Plus	Signal voltage > 5.10 - 7.0 mA
P2309	Ignition Coil D Primary Control Circuit Short to Ground	Signal current > 24.0 mA
P2310	Ignition Coil D Primary Control Circuit Short to Battery Plus	Signal voltage > 5.10 - 7.0 mA
P2312	Ignition Coil E Primary Control Circuit Short to Ground	Signal current > 24 mA
P2313	Ignition Coil E Primary Control Circuit Short to Battery Plus	Signal voltage > 5.10 to 7.0 V
P2315	Ignition Coil F Primary Control Circuit Short to Ground	Signal current > 24 mA
P2316	Ignition Coil F Primary Control Circuit Short to Battery Plus	Signal voltage > 5.10 to 7.0 V

Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0420/ P0430	Catalyst System Efficiency Below Threshold Bank 1 (P0420) or Bank 2 (P0430)	• Measured oxygen storage capacity (OSC) < 1.00 HC correlated • Measured oxygen storage capacity (OSC) catalyst system < 1.00 NOx correlated
P043E	EVAP Leak Detection Pump Out of Range High	During Engine Off: • EVAP pump current during reference measurement > 40.0 mA During Engine On: • EVAP pump current during reference measurement > 40.0 mA
P043F	EVAP Leak Detection Pump Out of Range Low	During Engine Off: • EVAP pump current during reference measurement < 15.0 mA During Engine On: • EVAP pump current during reference measurement < 15.0 mA
P0441	Evaporative Emission Valve Incorrect Purge Flow Evaporative Emission Valve Functional Check: Stuck Close	• Deviation lambda control < 5.00 to 5.51% • Drop of EVAP pump current < 1.0 mA within time 12.0 Sec.
P0442	Evaporative Emission System Leak Detected (Small Leak) Pressure Check	• Time for pressure drop < 1.5 - 1.7 Sec. or • Modeled pressure from pump current < 0.90 kPa
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V
P0447	EVAP Leak Detection Pump Valve Open or short to battery plus	Signal voltage > 4.7 to 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0448	EVAP Leak Detection Pump Valve Open or Short to Battery Plus EVAP Leak Detection Pump Valve Short to Ground	• Signal current > 2.20 to 4.00 A • Signal voltage < 2.74 to 3.26 V
P0455	Evaporative Emission System Leak Detected (gross leak/no flow)	Time for pressure drop < 1.1 - 1.3 Sec.
P0456	Evaporative Emission System Leak Detected (Very Small Leak)	General: • Time for pressure drop, < 4.8 - 6.0 Sec. Rationality Check: • EVAP-system leakage area calculated from pump current curve > 0.17 mm²
P0458	Evaporative Emission System Purge Control Valve Short to Ground	Signal voltage 0 to 3.26 V
P0459	Evaporative Emission System Purge Control ValveCircuit Open or Shorted to Battery	Signal current > 2.20 A
P0496	EVAP Purge Valve Functional Check: Stuck Open	Actual EVAP pump current difference between reference measurement to idle > 1.40 divided by pump current difference from the last leak detection phase during engine off

Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor A Range/Performance	Speed sensor signal: plausibility error
P0502	Vehicle Speed Sensor Shorted to Ground	Vehicle speed sensor signal failure
P0506	Idle Air Control System RPM Out of Range Low	• Engine speed Deviation > 100 RPM and • RPM controller torque value ≥ calculated max value.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0507	Idle Air Control System RPM Out of Range High	• Idle speed Deviation < -100 RPM and • Idle controller at min value -4.98%
P050A	Cold Start Idle Air Control Out of Range Low Out of Range High	• Engine speed deviation > 100 RPM • RPM controller torque value ≥ calculated max value. or • Engine speed deviation < -200 RPM and • RPM controller torque value ≤ calculated min value. or • Integrated number of fuel cut off transitions ≥ n.a.
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing and actual value > 22%
P052A	Cold Start “A” Camshaft Position Timing Over-Advanced Bank 1	Difference between target position vs. actual position > 12 to 40° CRK
P053F	Cold Start Fuel Pressure Performance	Difference between target pressure vs actual pressure: > 1.50 MPa or < -1.50 MPa
P054A	Cold Start “B” Camshaft Position Timing Over-Advanced Bank 1	Difference between target position vs. actual position > 10 to 22° CRK

Control Module and Output Signals

DTC	Error Message	Malfunction Criteria and Threshold Value
P0601	Internal Control Module Memory Check Sum Error	ECM internal checksum incorrect
P0604	Internal Control Module Random Access Memory (RAM) Error	Write ability check, failed
P0606	ECM/PCM Processor Error	Signal gradient is > 14.00 or < -14.00 kPa Sec

DTC	Error Message	Malfunction Criteria and Threshold Value
P062B	Internal ECM Fuel Injector Control Performance	SPI communications check Identifier failure
P0638	Throttle Actuator Control Rationality Check Close Movement Signal Range Check @ Mechanical Stop Low	• Time to close to reference point > 0.6 Sec. and • Reference point 2.88% • TPS 1 signal voltage 'NOT 0.40 to 0.80 V or • TPS 2 signal voltage 'NOT 4.20 to 4.60 V
P0641	Sensor Reference Voltage A Circuit Open	Signal voltage deviation > ± 0.3 V
P0651	Sensor Reference Voltage B Circuit Open	Signal voltage deviation > ± 0.3 V
P0657	Actuator Supply Voltage A Circuit Open	Signal voltage > 4.4 - 5.6 V
P0685	ECM/PCM Power Relay Control Circuit Open	Control voltage > 0.7 V
P0686	ECM/PCM Power Relay Control Circuit Low	Control voltage < 0.51 V
P0687	ECM/PCM Power Relay Control Circuit High	Control voltage > 4.0 V
P0688	ECM/PCM Power Relay Sense Circuit	• Sense voltage < 3.0 V
P0697	Sensor Reference Voltage C Circuit Open	Signal voltage deviation > ± 0.3 V
U0001	High Speed CAN Reading Back Sent Message	CAN message = no feedback
U0002	High Speed CAN Communication Bus Performance	Global Time Out failure. No module communication on CAN.
U0101	High Speed CAN Lost Communication with TCM	CAN communication with TCM no message received.
U0121	High Speed CAN Lost Communication with Anti-Lock Brake System (ABS) Control Module	CAN communication with ABS no message received.
U0146	High Speed CAN Lost Communication with Gateway	CAN communication with gateway no message received.

DTC	Error Message	Malfunction Criteria and Threshold Value
U0155	Lost Communication with Instrument Panel Cluster (IPC) Control Module	CAN communication with IPC no message.
U0302	Software Incompatibility with Transmission Control Module	AT vehicle, ECM coded as MT vehicle
U0402	Invalid Data Received From Gear Shift Control Module	CAN communication with TCM received implausible message.
U0415	CAN Communication with ABS Error	• Speed sensor signal: out of range = 202.8 MPH or • Speed sensor signal: sensor error = 203.4 MPH • Speed sensor signal: low voltage error = 203.4 MPH or • Speed sensor signal: initialisation error = 203.4 MPH
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	CAN message incorrect.

Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	• Pressure control activity > 0.13 MPa and • Fuel trim activity < 0.78 and • Difference between target pressure vs actual pressure n.a.
P12A2	Fuel Rail Pressure Sensor Inappropriately High	• Pressure control activity < -0.13 MPa and • Fuel trim activity > 1.21 and • Difference between target pressure vs actual pressure n.a.

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A4	Fuel Rail Pump Control Valve Stuck Closed	• Pressure control activity < -4.0 MPa and • Fuel trim activity .80 to 1.20 and • Difference between target and actual pressure < -4.00 MPa
P150A	Engine Off Time Performance	• Difference between engine off time and ECM after run time < -8 Sec. or • Difference between engine off time and ECM after run time > 8 Sec.
P1609	Safety Measures Due to Crash with Airbag Activation	Airbag(s) activated
P160A	Vehicle In Transport Mode	Transport mode active
P2101	Throttle Actuator Control Motor Circuit Signal Range/ Performance Rationality Check	• Duty cycle >80% and • ECM power stage no failure • Deviation throttle value angles vs. calculated value: 4 to 50%
P2106	Throttle Actuator Control System Open Circuit Short To Battery Plus/ Short to Ground Temperature / Current Monitoring Functional Check	Internal check failed
P2108	Throttle Actuator Control Module Performance	Time to close under reference point > 0.60 Sec. and reference point 11.56%
P2122	Accelerator Pedal Position Sensor 1 Out of Range Low	Signal voltage < 0.61 V
P2123	Accelerator Pedal Position Sensor 1 Out of Range High	Signal voltage > 4.79 V
P2127	Accelerator Pedal Position Sensor 2 Out of Range Low	Signal voltage < 0.27 V
P2128	Accelerator Pedal Position Sensor 2 Out of Range High	Signal voltage > 2.43 V
P2138	Accelerator Pedal Position Sensor 1 / 2 Voltage Correlation	Signal voltage: Difference between signal APP1 and APP2 > 0.17 to 0.70 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2146	Fuel Injector Group A Supply Voltage Circuit Open or Short to Ground or Short to Battery Plus	• High side signal current, < 2.60 A or • High side signal current > 14.90 A
P2149	Fuel Injector Group B Supply Voltage Circuit Open or Short to Ground or Short to Battery plus	• High side signal current, < 2.60 A or • High side signal current > 14.90 A
P2152	Fuel Injector Group “C” Supply Voltage Circuit Open or Short to Ground or Short to Battery plus	• High side signal current, < 2.30 A or • High side signal current > 18.60 A
P2155	Fuel Injector Group “D” Supply Voltage Circuit Open or Short to Ground or Short to Battery plus	• High side signal current, < 2.60 A or • High side signal current > 14.90 A
P2177	Fuel System Too Lean Off Idle, (Bank 1)	Fuel adaptive value > 30%
P2178	Fuel System Too Rich Off Idle, (Bank 1)	Fuel adaptive value < -30%
P2179	Fuel System Too lean off idle, (Bank 2)	Fuel adaptive value > 30%
P2180	Fuel System Too rich off idle, (Bank 2)	Fuel adaptive value < -30%
P2181	Cooling System Performance	Cooling system temperature too low after a sufficient mass air flow integral < 61.0 to 70.0° C
P2184	Engine Coolant Temperature Sensor 2 Circuit Shorted to Ground	Signal voltage < 0.20 V
P2185	Engine Coolant Temperature Sensor 2 Circuit Open or Shorted to Battery Voltage	Signal voltage > 4.95 V
P2187	Fuel System Too Lean at Idle, (Bank 1)	Fuel adaptive value > 6%
P2188	Fuel System Too Rich at Idle, (Bank 1)	Fuel adaptive value < -6%

DTC	Error Message	Malfunction Criteria and Threshold Value
P2189	Fuel System Too Lean at Idle, (Bank 2)	Fuel adaptive value > 6%
P2190	Fuel System Too Rich at Idle, (Bank 2)	Fuel adaptive value < -6%
P2195	O2 Sensor Signal Stuck Lean - (Bank 1, Sensor 1)	Delta lambda of 2nd lambda control loop > 0.059
P2196	O2 Sensor Signal Stuck Rich (Bank 1, Sensor 1)	Delta lambda of 2nd lambda control loop < -0.059
P2197	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 1)	Delta lambda of 2nd lambda control loop > 0.059
P2198	O2 Sensor Signal Stuck Rich (Bank 2 Sensor 1)	Delta lambda of 2nd lambda control loop < -0.059
P2237	O2 Sensor Positive Current Control Circuit / Open (Bank 1, Sensor 1)	• O2S signal front 1.49 to 1.51 V and • Delta lambda controller > 0.07 or • Lambda control at min or max limit • O2S signal front 1.49 to 1.51 V and • No reaction on commanded stepwise change of lambda setpoint <> 1
P2240	O2 Sensor Positive Current Control Circuit Bank 2 Sensor 1 Open	• O2S signal front 1.49 - 1.51 V • Delta lambda controller > 0.07
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1, Sensor 1)	• O2S signal front < 0.2 to > 4.70 V and • Internal resistance > 950.0 O
P2247	O2 Sensor Reference Voltage Circuit Open (Bank 2 Sensor 1)	• O2S signal front < 0.2 to > 4.70 V and • Internal resistance > 950.0 O
P2251	O2 Sensor Negative Current Control CircuitOpen (Bank 1 Sensor 1)	• O2S signal front 1.47 - 1.52 V and • Internal resistance > 950 ohms

DTC	Error Message	Malfunction Criteria and Threshold Value
P2254	O2 Sensor Negative Current Control Circuit Open (Bank 2, Sensor 1)	• O2S signal front 1.47 - 1.52 V and • Internal resistance > 950 ohms
P2270	O2 Sensor Signal Stuck Lean (Bank 1 Sensor 2)	Sensor voltage of < 0.75 V
P2271	O2 Sensor Signal Stuck Rich (Bank 1, Sensor 2)	• Sensor voltage of ≥ 0.15 V
P2272	O2 Sensor Signal Stuck Lean (Bank 2 Sensor 2)	• Sensor voltage of < 0.75 V
P2273	O2 Sensor Signal Stuck Rich (Bank 2, Sensor 2)	• Sensor voltage of ≥ 0.15 V
P2279	Intake Air System Leak Rationality	• Threshold to detect a defective system > 2.10 and • Ratio of the tie system defective during the measurement window to the whole duration of the measurement window > 0.80
P2293	Fuel Pressure Regulator 2 Performance	Difference between target pressure vs actual pressure: > 1.50 MPa or < -1.50 MPa
P2294	Fuel Pressure Regulator 2 Control Circuit Open Circuit or Rationality Check	• Signal voltage 1.40 - 3.20 V Signal pattern incorrect
P2295	Fuel Pressure Regulator 2 Control Circuit Short to Ground	Signal voltage < 1.40 V
P2296	Fuel Pressure Regulator 2 Control Circuit Open or Short to Battery Voltage	Signal voltage > 3.20 V

Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.7 - 5.4 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P2401	Evaporative System Leak Detection Pump Control Circuit Shorted to Ground	Signal voltage < 2.74 to 3.26 V
P2402	Evaporative System Leak Detection Pump Control Circuit Open or Shorted to Battery	Signal current > 4.00 to 1.80 V
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Low signal voltage > 0.50 Sec.
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	• High signal voltage > 12 Sec. • Number of checks = 30 • Cumulative time of high signal voltage during pumping > 20 Sec.
P2407	EVAP Leak Detection Pump Signal Check	During Engine Off: • Fluctuation of EVAP pump current during reference measurement > 2.0 mA or • Drop of EVAP pump current during pump phase > 6.0 mA for time ≥ 3.0 Sec. During Engine On: • Fluctuation of EVAP pump current during reference measurement > 2.0 mA or • Drop of EVAP pump current during pump phase > 6.0 mA for time ≥ 3.0 Sec.
P240A	EVAP Leak Detection Pump Heater Open Circuit	Signal voltage > 4.7 to 5.40 V
P240B	EVAP Leak Detection Pump Heater Short to Ground	Signal voltage < 2.74 to 3.26 V
P240C	EVAP Leak Detection Pump Heater Short to Battery Plus	Signal current > 2.20 to 4.00 A
P2414	O2 Sensor Exhaust Sample Error (Bank 1, Sensor 1)	Threshold 1 • Signal voltage 3.70 - 4.81 V Threshold 2 • Signal voltage 2.51 - 3.00 V • Depending on gain factor, that actual is used for sensor characteristic, the threshold is switched

DTC	Error Message	Malfunction Criteria and Threshold Value
P2415	02 Sensor Exhaust Sample Error, (Bank 2, Sensor 1)	Threshold 1 • Signal voltage 3.70 - 4.81 V Threshold 2 • Signal voltage 2.51 - 3.00 V • Depending on gain factor, that actual is used for sensor characteristic, the threshold is switched
P2450	EVAP Leak Detection Pump Signal Check	During Engine Off: • EVAP pump current difference between reference measurement to idle ≤ 3.0 mA During Engine On: • EVAP pump current difference between reference measurement to idle ≤ 3.0 mA
P2539	Low Pressure Fuel System Sensor Circuit Open Circuit or Short to Battery	Signal voltage > 4.80 V
P2541	Low Pressure Fuel System Sensor Circuit Short to Ground	Signal voltage < 0.20 V
P2600	Coolant Pump Control Circuit/ Open	Signal voltage 4.50 - 5.50 V
P2602	Coolant Pump Control Circuit Low	Signal voltage < 3.0 V
P2603	Coolant Pump Control Circuit High	Signal current 0.60 - 1.20 A
P2626	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	O2S signal front > 4.81 V
P2629	O2 Sensor Pumping Current Trim Circuit/Open Bank 2, Sensor 1	O2S signal front > 4.81 V

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