

# 2014 Volkswagen CC

## Quick Reference Specification Book

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# DTC CHART

## Engine Codes CBFA

### Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake Camshaft Position Slow Response	Signal change > 8 CRK° for > 2.9 Sec. and adjustment angle $\geq 2.5^\circ$ CRK rev.
P0010	Intake Camshaft Position Actuator Circuit Open Bank 1	Signal voltage, > 4.7 - 5.4 V
P0011	Intake Camshaft Position Timing - Over-Advanced	Signal change > 8° CRK for > 2.9 Sec. and adjustment angle < 2.5° CRK rev.
P0016	Crankshaft Position – Camshaft Position Correlation	<ul style="list-style-type: none"> <li>• Permissible deviation &lt; -11 ° CRK</li> <li>or</li> <li>• Permissible deviation &gt; 11° CRK</li> </ul>
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
P0042	HO2S Heater Control Circuit Bank 1 Sensor 3	Heater voltage 2.34 to 3.59 V
P0043	HO2S Heater Control Circuit Low Bank 1 Sensor 3	Heater voltage < 2.34 V
P0044	HO2S Heater Control Circuit High Bank 1 Sensor 3	Heater voltage > 3.59 V
P0068	MAF vs Throttle Position Correlation	Plausibility with fuel system <ul style="list-style-type: none"> <li>• Load calculation &lt; -22%</li> <li>Plausibility with fuel system</li> <li>• Load calculation &gt; 22%</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temperature < -50° C
P0071	Ambient Air Temperature Sensor Range/Performance	<ul style="list-style-type: none"> <li>• Difference in value between ECT and AAT at engine start (depending on engine off time) &gt; 25 K</li> <li>and</li> <li>• Difference in value between AAT and IAT at engine start (depending on engine off time) &gt; 25 K</li> </ul>
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temperature > 77° C
P0087	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>• Fuel trim activity 0.90 - 1.15</li> <li>• Pressure controller activity &gt; 2 MPa</li> <li>• Difference between target and actual pressure &gt; -16.4</li> </ul>
P0100	Mass Air Flow Circuit Fault	MAF sensor signal 0 μs
P0101	Mass Air Flow Circuit Range/Performance	Mass air flow vs <ul style="list-style-type: none"> <li>• Upper threshold model &gt; 60 to 800 kg/h</li> <li>• Lower threshold model &lt; 0 to 400 kg/h</li> <li>• Load calculation &gt; 18%</li> <li>• Fuel system &lt; -18%</li> </ul>
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	<ul style="list-style-type: none"> <li>• Difference of boost pressure signal vs altitude sensor signal &gt; 230 hPa</li> <li>or</li> <li>• Difference of boost pressure signal vs altitude sensor signal &lt; -130 hPa</li> </ul>
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Difference in value IAT - ECT @ engine start (depending on engine off time) &gt; 25 °C</li> <li>• Difference in value IAT - AAT @ engine start &gt; 25 °C (depending on engine off time)</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	IAT > 141.0° C
P0113	Intake Air Temperature Sensor 1 Circuit High Input	IAT < -46° C
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<ul style="list-style-type: none"> <li>• No change on signal &lt; 2 K or</li> <li>• Signal in range &gt; 89° C with no change on signal 1.5° K</li> </ul>
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	<ul style="list-style-type: none"> <li>• TPS 1 - TPS 2 &gt; 6.30%</li> <li>• Actual TPS 1 calculated value &gt; TPS 2 calculated value</li> <li>• TPS 1 calc. value &gt; 9.00%</li> </ul>
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	HO2S Circuit Bank 1 Sensor 1	O2S ceramic temperature < 640° C
P0131	HO2S Circuit, Bank 1 Sensor 1 Low Voltage	VM < 1.75 V
		UN < 1.50 V
		IA or IP > 0.30 V
P0132	HO2S 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 <ul style="list-style-type: none"> <li>• O2S signal front vs. modeled O2S signal ratio &lt; 0.35 and &gt; 0.01</li> <li>• Lower value of both counters for area ratios L to R and R to L <math>\geq 5</math> times</li> </ul> Oscillation check <ul style="list-style-type: none"> <li>• Lambda amplitude signal &gt; 20%</li> <li>• Cycles &gt; 8</li> <li>• Time lambda &gt; lambda amplitude 400 m sec.</li> </ul> Delay check <ul style="list-style-type: none"> <li>• Delay modeled lambda signal minus measured signal &gt; 460 m sec.</li> <li>• Cycles &gt; 12</li> </ul>
P0135	HO2S Heater Circuit Bank 1 Sensor 1	<ul style="list-style-type: none"> <li>• Heater duty cycle, &gt; 100%</li> <li>• O2S ceramic temperature, &lt; 715 °C</li> <li>• Time after O2S heater on 40 Sec.</li> </ul>
P0136	HO2S Circuit Bank 1 Sensor 2 Malfunction	<ul style="list-style-type: none"> <li>• Delta voltage one step at heater switching &gt; 2.00 V</li> <li>• Number of checks <math>\geq 4</math></li> </ul>
P0137	HO2S Circuit Low Voltage Bank 1 Sensor 2	Cold condition <ul style="list-style-type: none"> <li>• Signal voltage, &lt; 0.06 V for 3 Sec.</li> </ul> Warm condition <ul style="list-style-type: none"> <li>• Signal voltage &lt; 0.01 V</li> <li>• Reaction at closed loop enrichment - no reaction</li> </ul>
P0138	HO2S Circuit High Voltage Bank 1 Sensor 2	Signal voltage > 1.08 V for > 5 Sec.
P0139	HO2S Circuit Slow Response Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>• EWMA filtered transient time at fuel cutoff &gt; 0.0 Sec.</li> <li>• In voltage range of 201 - 401 mV</li> <li>• Number of checks, <math>\geq 3</math></li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P013A	HO2S Circuit Slow Response Rich to Lean Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>EWMA filtered max differential transient time at fuel cutoff <math>\geq 0.65</math> s</li> <li>Number of checks <math>\geq 1</math></li> </ul>
P013B	HO2S Circuit Slow Transient Time Lean To Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>EWMA filtered max differential transient time at fuel cutoff <math>\geq 1.50</math> s</li> <li>Number of checks <math>\geq 1[-]</math></li> </ul>
P013E	HO2S Circuit Check of Delay Time Rich to Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>Arithmetic filtered max differential delay time at lean to rich transition = n.a.</li> </ul> or <ul style="list-style-type: none"> <li>EWMA filtered max differential delay time at lean to rich transition <math>&gt; 1.0</math> [s] and number of checks <math>\geq 3.00</math> [-]</li> </ul>
P013F	HO2S Circuit Check of Delay Time Lean to Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>Arithmetic filtered max differential delay time at lean to rich transition = n.a..</li> </ul> or <ul style="list-style-type: none"> <li>EWMA filtered max differential delay time at lean to rich transition <math>&gt; 1.5</math> [s] and number of checks <math>\geq 3.00</math> [-]</li> </ul>
P0140	HO2S Circuit No Activity Detected Bank 1 Sensor 2	Signal voltage <ul style="list-style-type: none"> <li>Signal voltage, 0.40 - 0.60 V for <math>&gt; 3</math> Sec.</li> </ul> Internal resistance <ul style="list-style-type: none"> <li><math>&gt; 40000</math> ohm</li> </ul>
P0141	HO2S Heater Circuit Bank 1 Sensor 2	Heater resistance, 702 - 5250 Ohm
P0142	HO2S Sensor Circuit Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>Delta voltage one step at heater <math>&gt; 2.0</math> V</li> <li>Number of checks, 4</li> </ul>
P0143	HO2S Sensor Circuit Low Voltage Bank 1 Sensor 3	Cold/Warm condition <ul style="list-style-type: none"> <li>Signal voltage <math>&lt; 0.06</math> V for <math>&gt; 3</math> Sec.</li> </ul>
P0144	HO2S Sensor Circuit High Voltage Bank 1 Sensor 3	Signal voltage $> 1.08$ V for $> 5$ Sec.
P0145	HO2S Sensor Circuit Slow Response Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>EWMA filtered transient time at fuel cutoff <math>&gt; 1.2</math> Sec.</li> <li>In voltage range of 201.2 - 401.4 mV</li> <li>Number of checks, 3</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0146	HO2S Sensor Circuit No Activity Detected Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>• Signal voltage 0.40 - 0.60 V for &gt; 3 Sec.</li> <li>• Internal resistance &gt; 40000 Ohm</li> </ul>
P0147	HO2S Sensor Heater Circuit Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>• Heater (ECM internal) resistance 792 - 4560 ohm</li> </ul>
P0169	Electronic Throttle Control Module Function Monitoring: Injection Time	<ul style="list-style-type: none"> <li>• Comparison with fuel quantity = incorrect</li> <li>• Internal check failed</li> </ul>
P0171	System Too Lean Bank 1	<p>At idle</p> <ul style="list-style-type: none"> <li>• Adaptive value &gt; 5.02%</li> </ul> <p>At part-load</p> <ul style="list-style-type: none"> <li>• Adaptive value &gt; 21%</li> </ul>
P0172	System Too Rich Bank 1	<p>At idle</p> <ul style="list-style-type: none"> <li>• Adaptive value &lt; -5.02%</li> </ul> <p>At part-load</p> <ul style="list-style-type: none"> <li>• Adaptive value &lt; -21%</li> </ul>
P0190	Fuel High Pressure Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 4.8 V
P0191	Fuel High Pressure Sensor Circuit Range / Performance	Actual pressure > 20.6 MPa
P0192	Fuel High Pressure Sensor Circuit Short to Ground	Signal voltage < 0.2 V
P0201	Injector Circuit Open - Cylinder 1	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0202	Injector Circuit Open - Cylinder 2	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0203	Injector Circuit Open - Cylinder 3	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0204	Injector Circuit Open - Cylinder 4	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0221	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>• TPS 1 - TPS 2 &gt; 6.30%</li> <li>• Actual TPS 2 calculated value &gt; TPS 1 calculated value</li> <li>• TPS 2 – calc. value &gt; 9.00%</li> </ul>
P0222	Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2 Circuit Short to Ground	Signal voltage < 0.20 V



DTC	Error Message	Malfunction Criteria and Threshold Value
P0223	Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2 Circuit Short to Battery Voltage	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 Short to Ground	Signal voltage < 0.2 V
P0238	Turbocharger Boost Sensor Circuit High	Signal voltage > 4.88 V
P0243	Turbocharger Wastegate Solenoid Circuit Open	Signal voltage > 5.6 - 4.4 V
P0245	Turbocharger Wastegate Solenoid Circuit Short to Ground	Signal voltage < 3.25 - 2.15 V
P0246	Turbocharger Wastegate Solenoid Circuit Short to Battery Voltage	Signal current > 2.2 to 4 A
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
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	Turbocharger Underboost	Difference of set boost pressure vs actual boost pressure value > 150 hPa

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
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
P2014	Intake Manifold Runner Position Sensor Circuit	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Deviation runner flap target position vs actual position &gt; 25%</li> <li>• Actual position 0 to 100%</li> </ul>
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	I-portion of 2nd lambda control < -0.040 [-]
P2097	Post-Catalyst Fuel Trim System Too Rich	I-portion of 2nd lambda control > 0.040 [-]
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 10° K

## Ignition System

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0300	Random Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>• Catalyst damage misfire rate (MR), &gt; 3% - 20%</li> </ul>
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>• Catalyst damage misfire rate (MR), &gt; 3% - 20%</li> </ul>
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>• Catalyst damage misfire rate (MR) &gt; 5.0 - 20.0%</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> <li>Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>Catalyst damage misfire rate (MR), &gt; 3% - 20%</li> </ul>
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> <li>Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>Catalyst damage misfire rate (MR), &gt; 3% - 20%</li> </ul>
P0321	Engine Speed Input Circuit Performance	<ul style="list-style-type: none"> <li>Comparison of counted teeth vs. reference = incorrect</li> <li>Monitoring reference gap failure</li> </ul>
P0322	Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> <li>Camshaft signal &gt; 3</li> <li>Engine speed, no signal</li> </ul>
P0324	Knock Control System Error	<ul style="list-style-type: none"> <li>Signal fault counter (combustion) &gt; 24</li> <li>or</li> <li>Signal fault counter (measuring window) &gt; 2.00</li> </ul>
P0327	Knock Sensor 1 Circuit Low	<ul style="list-style-type: none"> <li>Lower threshold &lt; -0.70 V or for signal range check</li> <li>Lower threshold &lt; 0 - 1.60 V</li> </ul>
P0328	Knock Sensor 1 Circuit High	<ul style="list-style-type: none"> <li>Upper threshold &gt; 1.00 V or for signal range check</li> <li>&gt; 15 - 115.87 V</li> </ul>
P0340	Camshaft Position Sensor Circuit	<p>Cam adaption values out of range</p> <ul style="list-style-type: none"> <li>&gt; 20° KW</li> <li>&lt; -20° KW</li> <li>Difference of adapted and actual values &gt; 9° KW</li> </ul>
P0341	Camshaft Position Sensor Circuit Performance	<ul style="list-style-type: none"> <li>Signal pattern incorrect</li> <li>Defect counter 12 [-]</li> </ul>
P0342	Camshaft Position Sensor Circuit Low	<ul style="list-style-type: none"> <li>Signal voltage low</li> <li>Crankshaft signals = 8 [-]</li> </ul>
P0343	Camshaft Position Sensor Circuit High	<ul style="list-style-type: none"> <li>Signal voltage high</li> <li>Crankshaft signals = 8 [-]</li> </ul>
P0351	Ignition Coil A Primary Circuit	<ul style="list-style-type: none"> <li>Signal current &lt; -0.25 to 2.0 mA</li> <li>Internal check failed</li> </ul>
P0352	Ignition Coil B Primary Circuit	<ul style="list-style-type: none"> <li>Signal current 0.25 to -2.0 mA</li> <li>Internal check failed</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0353	Ignition Coil C Primary Circuit	<ul style="list-style-type: none"> <li>• Signal current 0.25 to -2.0 mA</li> <li>• Internal check failed</li> </ul>
P0354	Ignition Coil D Primary Circuit	<ul style="list-style-type: none"> <li>• Signal current &lt; -0.25 to 2.0 mA</li> <li>• Internal check failed</li> </ul>

### Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0410	Secondary Air System Rationality Check	Diff. of measured AIR pressure before AIR injection vs. AIR pressure after AIR injection > 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 Short to Ground or Short to Battery Voltage	<ul style="list-style-type: none"> <li>• Signal voltage 0 to 3.25 V or</li> <li>• Signal current &gt; 2.20 A</li> </ul>
P0418	Secondary Air Injection System Control Circuit	Signal voltage 4.70 - 5.40 V
P0420	Catalyst System Efficiency Below Threshold	<p>Front:</p> <ul style="list-style-type: none"> <li>• Oxygen storage capacity (OSC) vs OSC of borderline catalyst &lt; 1.00</li> <li>• Front catalyst &lt; 1.50</li> <li>• Main catalyst &lt; 1.00</li> </ul> <p>Main:</p> <ul style="list-style-type: none"> <li>• Oxygen storage capacity (OSC) vs OSC of borderline catalyst &lt; 0.40</li> <li>• Front catalyst &lt; .90</li> <li>• While value for front catalyst &lt; 2.00</li> </ul>
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.

DTC	Error Message	Malfunction Criteria and Threshold Value
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	<ul style="list-style-type: none"> <li>• Short to B+ - Signal current &gt; 2.2 - 4.0 A</li> <li>• Short to Ground - Signal voltage &lt; 2.74 - 3.26 V</li> </ul>
P0455	Evaporative Emission System Leak Detected Gross Leak/ No Flow	Time for pressure drop < 1 Sec.
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 Flow Check During Catalyst Heating	<ul style="list-style-type: none"> <li>• Diff. of measured AIR pressure before AIR injection vs. AIR pressure after AIR injection <math>\leq 5.00</math> kPa</li> <li>• Case 1: blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled <math>\geq 0.10</math> [-] leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled <math>\geq 0.10</math> [-]</li> <li>• Case 2: blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled <math>\geq 0.60</math> [-] leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled <math>\geq 0.60</math> [-]</li> <li>• Case 3: average pressure difference between absolute value and filtered value while AIR valve closed n.a.</li> </ul>

## Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor Range/Performance	VSS signal < 6 km/h
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	Vehicle speed > 180 km/h
P0506	Idle Air 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
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%
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 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

DTC	Error Message	Malfunction Criteria and Threshold Value
P0638	Throttle Actuator Control Range/Performance	<ul style="list-style-type: none"> <li>• Time to close to reference point &gt; 0.6 Sec.</li> <li>and</li> <li>• Reference point 2.88%</li> <li>• TPS 1 signal 0.40 - 0.60 V</li> <li>• TPS 2 signal 4.20 - 4.60 V</li> <li>• TPS 1 and TPS 2 4.82 - 5.18 V</li> </ul>
P0641	Sensor Reference Voltage A Circuit Open	Signal voltage deviation > $\pm$ 0.3 V
P0651	Sensor Reference Voltage B Circuit Open	Signal voltage deviation > $\pm$ 0.3 V
P0657	Actuator Supply Voltage A Circuit Open	Signal voltage > 4.4 - 5.6 V
P0658	Actuator Supply Voltage A 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 > $\pm$ 0.3 V
P0698	Sensor Reference Voltage C Circuit Low	Signal voltage < 4.6 - 5.0 V
P0699	Sensor Reference Voltage C Circuit High	5V supply voltage > 4.99 - 5.41 V
P1609	Crash Detected - Airbag Deployed	Airbags activated
P062B	Injection Valves Communication	Internal logic failure
U0001	High Speed CAN Communication Bus	CAN message, no feedback
U0002	High Speed CAN Communication Bus Performance	Global 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
U0146	Lost Communication With Gateway A	CAN communication with gateway Time Out - no message

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	No CAN messages received
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	<ul style="list-style-type: none"> <li>• Speed sensor initialization failed</li> <li>• Speed sensor low voltage error failed</li> <li>• Implausible message received</li> </ul>
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
U102E	Fan Identification Sensor Implausible Signal	LIN message incorrect
U102F	Fan Identification Sensor No Communication	LIN communication time out
U1030	Local Data Bus Electrical Malfunction	LIN communication not active

### **Fuel and Air Ratios Control Module**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P1117	Bank 1 Sensor 2 Control Limit Reached	1 portion of 3rd lambda control loop > 0.030
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	<ul style="list-style-type: none"> <li>• Pressure control activity &gt; 0.25 MPa</li> <li>• Fuel trim activity &lt; 0.80</li> <li>• Difference between actual pressure vs target pressure -16.38 to 16.38 MPa</li> </ul>



DTC	Error Message	Malfunction Criteria and Threshold Value
P12A2	Fuel Rail Pressure Sensor Inappropriately High	<ul style="list-style-type: none"> <li>• Pressure control activity &lt; -0.05 MPa</li> <li>• Fuel trim activity &gt; 1.65</li> <li>• Difference between target pressure and actual pressure -16.38 to 16.38 MPa</li> </ul>
P12A4	Fuel Rail Pump Control Valve Stuck Closed	<ul style="list-style-type: none"> <li>• Fuel trim activity .90 to 1.15</li> <li>• Pressure control activity &lt; -6 MPa</li> <li>• System Deviation &lt; 16.38 MPa</li> </ul>
P13EA	Cold Start Ignition Timing Performance Off Idle	Difference between commanded spark timing vs. actual value > 40%
P150A	Engine Off Time Performance	Difference between engine off time and ECM after run time < -12 Sec. or > 12 Sec.
P2101	Throttle Actuator Control Motor Circuit Range/ Performance	<ul style="list-style-type: none"> <li>• Duty cycle &gt;80%</li> <li>• Deviation throttle value angles vs. calculated value 4 - 50%</li> <li>• ECM power stage no failure</li> </ul>
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	<ul style="list-style-type: none"> <li>• Signal current, &lt; 2.6 A</li> <li>or</li> <li>• Signal current &gt; 14.90 A</li> </ul>
P2149	Fuel Injector Group B Supply Voltage Circuit Open	<ul style="list-style-type: none"> <li>• Signal current, &lt; 2.6 A</li> <li>or</li> <li>• Signal current &gt; 14.90 A</li> </ul>
P2177	System Too Lean Off Idle	Adaptive value > 28%
P2178	System Too Rich Off Idle	Adaptive value < -21%

DTC	Error Message	Malfunction Criteria and Threshold Value
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	HO2S Sensor Signal Out of Range Lean Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop > 0.080 [-]
P2196	HO2S Sensor Signal Out of Range Rich Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop < -0.080 [-]
P2231	HO2S Sensor Bank 1 Sensor 1 Signal Circuit Shorted to Heater Circuit	Delta O2S signal front > 190 uA
P2237	HO2S Sensor Positive Current Control Circuit Open Bank 1 Sensor 1	<ul style="list-style-type: none"> <li>• O2S signal front 1.49 - 1.51 V</li> <li>• Delta lambda controller &gt; 0.10</li> </ul>
P2243	HO2S Sensor Reference Voltage Circuit Open Bank 1 Sensor 1	<ul style="list-style-type: none"> <li>• O2S signal front &gt; 3.25 V and Internal resistance &gt; 1000 Ohm</li> <li>• O2S signal front &lt; 0.30 V and Internal resistance &gt; 1000 Ohm</li> </ul>
P2251	O2 Sensor Negative Current Control Circuit Open Bank 1 Sensor 1	<ul style="list-style-type: none"> <li>• O2S signal front 1.47 to 1.53 V and internal resistance &gt; 1000 Ohm</li> </ul>
P2257	Secondary Air Injection Relay Control Circuit Short to Ground	Signal voltage 0 to 3.26 V
P2258	Secondary Air Injection Relay Control Circuit Short to Battery Voltage	Signal current .60 - 2.40 A
P2270	HO2S Sensor Signal Stuck Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>• O2S signal rear &lt; -2.00 mV</li> <li>• Enrichment after stuck lean 27.9%</li> </ul>
P2271	HO2S Sensor Signal Stuck Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>• Sensor voltage of <math>\geq</math> 0.15 V</li> <li>• After oxygen mass flow &gt; 3000 mg</li> <li>• Number of checks <math>\geq</math> 1</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P2274	HO2S Sensor Signal Stuck Lean Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>• O2S rear signal not oscillating at reference &lt; 0.62 to 0.65 V</li> <li>• Enrichment after stuck lean 27.9%</li> </ul>
P2275	HO2S Sensor Signal Stuck Rich Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>• O2S sensor voltage <math>\geq 0.15</math> V</li> <li>• After oxygen mass flow (fuel cutoff) &gt; 4500 mg</li> <li>• Number of checks <math>\geq 1</math></li> </ul>
P2279	Intake Air System Leak	<ul style="list-style-type: none"> <li>• Threshold to detect a defective system &gt; 1.33 - 1.60</li> </ul>
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> <li>• Difference between target pressure vs. actual pressure: &gt; 1.50 mPa</li> <li>or</li> <li>• &lt; -1.50 mPa</li> </ul>
P2294	Fuel Pressure Regulator 2 Control Circuit	<ul style="list-style-type: none"> <li>• Signal voltage 1.40 - 3.20 V</li> <li>or</li> <li>• Signal pattern incorrect</li> </ul>
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 mA
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

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

### **Additional Emissions Regulations**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
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 A
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.4 - 5.6 V
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Short to Ground	Signal voltage < 2.15 to 3.25 V
P2402	Evaporative Emission System Leak Detection Pump Control Circuit Short to Battery Voltage	Signal current > 3.0 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 Circuit Range/Performance	<ul style="list-style-type: none"> <li>• High signal voltage &gt; 12 Sec.</li> <li>• Number of checks = 30</li> <li>• Cumulative time of high signal voltage during pumping &gt; 10 s</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P2407	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>• Fluctuation of EVAP pump current during reference measurement engine off &gt; 2 mA</li> <li>• Or drop of EVAP pump current during pump phase of 3 sec &gt; 6 mA</li> </ul>
		<ul style="list-style-type: none"> <li>• Fluctuation of EVAP pump current during reference measurement engine on &gt; 2 mA</li> <li>• Or drop of EVAP pump current during pump phase of 3 sec &gt; 6 mA</li> </ul>
P2414	HO2S Sensor Exhaust Sample Error Bank 1, Sensor 1	Threshold 1 <ul style="list-style-type: none"> <li>• Signal voltage 3.1 - 4.81 V</li> </ul> Threshold 2 <ul style="list-style-type: none"> <li>• O2S signal 2.5 - 3.2 V</li> </ul>
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

DTC	Error Message	Malfunction Criteria and Threshold Value
P2440	Secondary Air Injection System Switching Valve Stuck Open	<ul style="list-style-type: none"> <li>• Diff. of measured AIR pressure before AIR injection vs. AIR pressure after AIR injection <math>\leq 5.00</math> kPa</li> <li>• Blockage: relative AIR pressure measured with AIR pressure sensor vs. modeled <math>\geq 0.60</math> [-]</li> <li>• Leakage: relative AIR pressure measured with AIR pressure sensor vs. modeled <math>\geq 0.60</math> [-]</li> <li>• Case 1: relative AIR pressure (measured with AIR pressure sensor vs. modeled) vs. relative AIR pressure (measured with AIR pressure sensor vs. modeled while AIR valve closed) <math>&gt; 1.20</math> [-]</li> <li>• Case 2: average pressure difference between absolute value and filtered value while AIR valve closed n.a.</li> </ul>
P2450	Evaporative Emission System Switching Valve Performance/ Stuck Open	<ul style="list-style-type: none"> <li>• Engine off EVAP pump current difference between reference measurement to idle <math>&lt; 3</math> mA</li> <li>• Engine on EVAP pump current difference between reference measurement to idle <math>&gt; 3</math> mA</li> </ul>
P2568	Direct Ozone Reduction Catalyst Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>• ID check failure</li> <li>• Temperature sensor functional check failure</li> </ul>
P2569	Direct Ozone Reduction Catalyst Temperature Sensor Circuit Low	Electrical error via LIN failure (grounded)
P2570	Direct Ozone Reduction Catalyst Temperature Sensor Circuit High	Electrical error via LIN failure (short to battery, open circuit)
P2626	HO2S Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	O2S signal front $> 4.81$ V

# DTC CHART

## Engine Codes CCTA

### Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Intake Camshaft Position Slow Response	Signal change > 8° CRK for > 2.9 s and adjustment angle < 2.5° CRK
P0010	Intake Camshaft Position Actuator Circuit Open Bank 1	Signal voltage, > 4.70 - 5.40 V
P0011	Intake Camshaft Position Timing - Over-Advanced	Signal change > 8° CRK for > 2.9 s and adjustment angle < 2.5° CRK
P0016	Crankshaft Position vs. Camshaft Position Correlation	<ul style="list-style-type: none"> <li>• Permissible deviation &lt; 11° CRK</li> <li>or</li> <li>• Permissible deviation &gt; 11° rCRK</li> </ul>
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, 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
P0042	HO2S Heater Control Circuit Bank 1 Sensor 3	Heater voltage 2.34 to 3.59 V
P0043	HO2S Heater Control Circuit Low Bank 1 Sensor 3	Heater voltage < 2.34 V
P0044	HO2S Heater Control Circuit High Bank 1 Sensor 3	Heater voltage > 3.59 V
P0068	MAF vs Throttle Position Correlation	Plausibility with fuel system <ul style="list-style-type: none"> <li>• Load calculation &lt; -22%</li> <li>Plausibility with fuel system</li> <li>• Load calculation &gt; 22%</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0070	Ambient Air Temperature Sensor Circuit	Ambient air temperature < -50° C
P0071	Ambient Air Temperature Sensor Range/Performance	<ul style="list-style-type: none"> <li>• Difference in value between ECT and AAT at engine start (depending on engine off time) &gt; 25 K</li> <li>and</li> <li>• Difference in value between AAT and IAT at engine start (depending on engine off time) &gt; 25 K</li> </ul>
P0072	Ambient Air Temperature Sensor Circuit Low	Ambient air temperature > 77° C
P0087	Fuel Rail/System Pressure - Too Low	<ul style="list-style-type: none"> <li>• Fuel trim activity 0.90 - 1.15</li> <li>• Output value rail pressure controller &gt; 2 MPa</li> <li>• Difference between target and actual pressure &gt; -16.4</li> </ul>
P0100	Mass Air Flow Circuit Faultt	MAF sensor signal 0 µs
P0101	Mass Air Flow Circuit Range/ Performance	Mass air flow vs. <ul style="list-style-type: none"> <li>• Upper threshold model &gt; 60 to 800 kg/h</li> <li>• Lower threshold model &lt; 0 to 400 kg/h</li> <li>• Load calculation &gt; 18%</li> <li>• Fuel system &lt; -18%</li> </ul>
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 Performance	<ul style="list-style-type: none"> <li>• Difference of boost pressure signal vs altitude sensor signal &gt; 230 hPa</li> <li>or</li> <li>• Difference of boost pressure signal vs altitude sensor signal &lt; -130 hPa</li> </ul>
P0111	Intake Air Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Difference in value IAT - ECT @ engine start (depending on engine off time) &gt; 25° C</li> <li>• Difference in value IAT - AAT @ engine start &gt; 25° C (depending on engine off time)</li> </ul>



DTC	Error Message	Malfunction Criteria and Threshold Value
P0112	Intake Air Temperature Sensor Circuit Low Input	IAT > 141.0° C
P0113	Intake Air Temperature Sensor 1 Circuit High Input	IAT < -46° C
P0116	Engine Coolant Temperature Sensor 1 Circuit Performance	<ul style="list-style-type: none"> <li>• No change on signal &lt; 2° K or</li> <li>• Signal in range &gt; 89° C with no change on signal 1.5° K</li> </ul>
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 / Accelerator Pedal Position Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>• TPS 1 - TPS 2 &gt; 6.30%</li> <li>• Actual TPS 1 calculated value &gt; TPS 2 calculated value</li> <li>• TPS 1 calc. value &gt; 9.00%</li> </ul>
P0122	Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2 Circuit Low Input	Signal voltage < 0.20 V
P0123	Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2 Circuit High Input	Signal voltage > 4.81 V
P0130	HO2S Circuit Bank 1 Sensor 1	O2S ceramic temperature < 640° C
P0131	HO2S Circuit, Bank 1 Sensor 1 Low Voltage	VM < 1.75 V
		UN < 1.50 V
		IA or IP > 0.30 V
P0132	HO2S Circuit, Bank 1 Sensor 1 High Voltage	VM > 3.25 V
		UN > 4.40 V
		IA or IP > 7.0 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0133	HO2S Circuit Slow Response Bank 1 Sensor 1	Signal dynamic slope check <ul style="list-style-type: none"> <li>• O2S signal front vs. modeled O2S signal ratio &lt; 0.35 and &gt; 0.01</li> <li>• Lower value of both counters for area ratios L to R and R to L <math>\geq 5</math> times</li> </ul> Oscillation check <ul style="list-style-type: none"> <li>• Lambda amplitude signal &gt; 20%</li> <li>• Cycles &gt; 8</li> <li>• Time lambda &gt; lambda amplitude 400 m sec.</li> </ul> Delay check <ul style="list-style-type: none"> <li>• Delay modeled lambda signal minus measured signal &gt; 460 m sec.</li> <li>• Cycles &gt; 12</li> </ul>
P0135	HO2S Heater Circuit Bank 1 Sensor 1	<ul style="list-style-type: none"> <li>• Heater duty cycle, &gt;100%</li> <li>• O2S ceramic temperature, &lt; 715° C</li> <li>• Time after O2S heater on 40 Sec.</li> </ul>
P0136	HO2S Circuit Bank 1 Sensor 2 Malfunction	<ul style="list-style-type: none"> <li>• Delta voltage one step at heater switching &gt; 2.00 V</li> <li>• Number of checks <math>\geq 4</math></li> </ul>
P0137	HO2S Circuit Low Voltage Bank 1 Sensor 2	Cold condition <ul style="list-style-type: none"> <li>• Signal voltage &lt; 0.06 V for time &gt; 3 Sec.</li> </ul> Warm condition <ul style="list-style-type: none"> <li>• Signal voltage &lt; 0.01 V</li> <li>• Reaction at closed loop enrichment - no reaction</li> </ul>
P0138	HO2S Circuit High Voltage Bank 1 Sensor 2	Signal voltage 1.08 V for > 5 Sec.
P0139	OHO2S Circuit Slow Response Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>• EWMA filtered transient time at fuel cutoff &gt; 0.0 s</li> <li>• In voltage range of 201 - 401 mV</li> <li>• Number of checks, <math>\geq 3</math></li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P013A	HO2S Circuit Slow Response Rich to Lean Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>EWMA filtered max differential transient time at fuel cutoff <math>\geq</math> 0.65 s</li> <li>Number of checks, <math>\geq</math> 1</li> </ul>
P013B	HO2S Circuit Slow Transient Time Lean to Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>EWMA filtered max differential transient time at fuel cutoff <math>\geq</math> 1.50 s</li> <li>Number of checks, <math>\geq</math> 1</li> </ul>
P013E	HO2S Circuit Check of Delay Time Rich to Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>Arithmetic filtered max differential delay time at lean to rich transition = n.a.</li> </ul> or <ul style="list-style-type: none"> <li>EWMA filtered max differential delay time at lean to rich transition <math>&gt;</math> 1.0 [s] and number of checks <math>\geq</math> 3.00 [-]</li> </ul>
P013F	HO2S Circuit Check of Delay Time Lean To Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>Arithmetic filtered max differential delay time at lean to rich transition = n.a.</li> </ul> or <ul style="list-style-type: none"> <li>EWMA filtered max differential delay time at lean to rich transition <math>&gt;</math> 1.5 [s] and number of checks <math>\geq</math> 3.00 [-]</li> </ul>
P0140	HO2S Circuit No Activity Detected Bank 1 Sensor 2	Signal voltag <ul style="list-style-type: none"> <li>Signal voltage 0.40 - 0.60 V</li> </ul> Internal resistance <ul style="list-style-type: none"> <li><math>&gt;</math> 40000 ohm</li> </ul>
P0141	HO2S Heater Circuit Bank 1 Sensor 2	Heater resistance, 702 - 5250 Ohm
P0142	HO2S Sensor Circuit Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>Delta voltage one step at heater <math>&gt;</math> 2.0 V</li> <li>Number of checks, 4</li> </ul>
P0143	HO2S Sensor Circuit Low Voltage Bank 1 Sensor 3	Cold/Warm condition <ul style="list-style-type: none"> <li>Signal voltage <math>&lt;</math> 0.06 V for <math>&gt;</math> 3 s</li> </ul>
P0144	HO2S Sensor Circuit High Voltage Bank 1 Sensor 3	Signal voltage $>$ 1.08 V for $>$ 5 s
P0145	HO2S Sensor Circuit Slow Response Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>EWMA filtered transient time at fuel cutoff <math>&gt;</math> 1.2 s</li> <li>In voltage range of 201.2 - 401.4 mV</li> <li>Number of checks, 3</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0146	HO2S Sensor Circuit No Activity Detected Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>• Signal voltage 0.40 - 0.60 V for &gt; 3 s</li> <li>• Internal resistance &gt; 40000 Ohm</li> </ul>
P0147	HO2S Sensor Heater Circuit Bank 1 Sensor 3	Heater (ECM internal) resistance 792 - 4560 ohm
P0169	Electronic Throttle Control Module Function Monitoring: Injection Time	<ul style="list-style-type: none"> <li>• Comparison with fuel quantity = incorrect</li> <li>• Internal check failed</li> </ul>
P0171	System Too Lean Bank 1	At idle <ul style="list-style-type: none"> <li>• Adaptive value &gt; 5.02%</li> </ul> At part-load <ul style="list-style-type: none"> <li>• Adaptive value &gt; 21%</li> </ul>
P0172	System Too Rich Bank 1	At idle <ul style="list-style-type: none"> <li>• Adaptive value &lt; -5.02%</li> </ul> At part-load <ul style="list-style-type: none"> <li>• Adaptive value &lt; -21%</li> </ul>
P0190	Fuel High Pressure Sensor Circuit Open or Short to Battery Voltage	Signal voltage > 4.8 V
P0191	Fuel High Pressure Sensor Circuit Range / Performance	Actual pressure > 20.6 MPa
P0192	Fuel High Pressure Sensor Circuit Short to Ground	Signal voltage < 0.2 V
P0201	Injector Circuit Open Cylinder 1	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0202	Injector Circuit Open Cylinder 2	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0203	Injector Circuit Open Cylinder 3	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0204	Injector Circuit Open Cylinder 4	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0221	Accelerator Pedal Position Sensor 1/Accelerator Pedal Position Sensor 2 Circuit Range/Performance	<ul style="list-style-type: none"> <li>• TPS 1 - TPS 2 &gt; 6.30%</li> <li>• Actual TPS 2 calculated value &gt; TPS 1 calculated value</li> <li>• TPS 2 – calc. value &gt; 9.00%</li> </ul>
P0222	Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2 Circuit Short to Ground	Signal voltage < 0.20 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0223	Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2 Circuit Short to Battery Voltage	Signal voltage > 4.81 V
P0234	Turbocharger Overboost Condition	Difference of set value boost pressure vs altitude sensor signal > 200 - 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 Short to Ground	Signal voltage < 0.2 V
P0238	Turbocharger Boost Sensor Circuit High	Signal voltage > 4.88 V
P0243	Turbocharger Wastegate Solenoid Circuit Open	Signal voltage > 5.6 - 4.4 V
P0245	Turbocharger Wastegate Solenoid Circuit Short to Ground	Signal voltage < 3.25 - 2.15 V
P0246	Turbocharger Wastegate Solenoid Circuit Short to Battery Voltage	Signal current > 2.2 to 4 A
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
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	Low side signal current < 2.1 A
P0271	Cylinder 4 Injector Circuit High	Signal current > 14.70 A
P0299	Turbocharger Underboost	Difference of set boost pressure vs. actual boost pressure value > 150 hPa

DTC	Error Message	Malfunction Criteria and Threshold Value
P2008	Intake Manifold Runner Control Circuit Open	Signal voltage 4.70 - 5.40 V
P2009	Intake Manifold Runner Control Circuit Low	Signal voltage 0.0 to 3.25 V
P2010	Intake Manifold Runner Control Circuit High	Signal current > 2.20 A
P2014	Intake Manifold Runner Position Sensor Circuit	Signal voltage > 4.75 V
P2015	Intake Manifold Runner Position Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Deviation runner flap target position vs actual position &gt; 25%</li> <li>• Actual position 0 to 100%</li> </ul>
P2016	Intake Manifold Runner Position Sensor Circuit Low	Signal voltage < 0.25 V
P2088	A Camshaft Position Actuator Control Circuit Low	Signal voltage, < 0.0 - 3.25 V
P2089	A Camshaft Position Actuator Control Circuit High	Signal current > 2.2 A
P2096	Post Catalyst Fuel Trim System Too Lean	I-portion of 2nd lambda control < -0.040 [-]
P2097	Post Catalyst Fuel Trim System Too Rich	I-portion of 2nd lambda control > 0.040 [-]
P3043	Fuel Pump Mechanical Malfunction	-
P3044	Fuel Pump "A" Control Circuit Low	Signal voltage 2.15 - 3.25 V
P3081	Engine Temperature Too Low	Difference between ECT and modeled ECT > 10° K

## Ignition System

DTC	Error Message	Malfunction Criteria and Threshold Value
P0300	Random Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>• Catalyst damage misfire rate (MR), &gt; 3% - 20%</li> </ul>
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>• Catalyst damage misfire rate (MR), &gt; 3% - 20%</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> <li>Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>Catalyst damage misfire rate (MR), &gt; 3% - 20%</li> </ul>
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> <li>Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>Catalyst damage misfire rate (MR), &gt; 3% - 20%</li> </ul>
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> <li>Emission threshold 1st interval Misfire Rate (MR), &gt; 2.65%</li> <li>Catalyst damage misfire rate (MR), &gt; 3% - 20%</li> </ul>
P0321	Engine Speed Input Circuit Performance	<ul style="list-style-type: none"> <li>Comparison of counted teeth vs. reference = incorrect</li> <li>Monitoring reference gap failure</li> </ul>
P0322	Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> <li>Camshaft signal &gt; 3</li> <li>Engine speed, no signal</li> </ul>
P0324	Knock Control System Error	<ul style="list-style-type: none"> <li>Signal fault counter (combustion) &gt; 24</li> <li>or</li> <li>Signal fault counter (measuring window) &gt; 2.00</li> </ul>
P0327	Knock Sensor 1 Circuit Low Input	<ul style="list-style-type: none"> <li>Lower threshold &lt; -70 V or for signal range check</li> <li>Lower threshold &lt; 0 -1.60 V</li> </ul>
P0328	Knock Sensor 1 Circuit High Input	<ul style="list-style-type: none"> <li>Upper threshold &gt; 1.00 V or for signal range check</li> <li>&gt; 15 - 115.87 V</li> </ul>
P0340	Camshaft Position Sensor Circuit	<p>Cam adaption values out of range</p> <ul style="list-style-type: none"> <li>&gt; 20° KW</li> <li>&lt; -20° KW</li> <li>Difference of adapted and actual values &gt; 9° KW</li> </ul>
P0341	Camshaft Position Sensor Circuit Performance	<ul style="list-style-type: none"> <li>Signal pattern incorrect</li> <li>Defect counter 12 [-]</li> </ul>
P0342	Camshaft Position Sensor Circuit Low Input	<ul style="list-style-type: none"> <li>Signal voltage low</li> <li>Crankshaft signals = 8 [-]</li> </ul>
P0343	Camshaft Position Sensor Circuit High Input	<ul style="list-style-type: none"> <li>Signal voltage high</li> <li>Crankshaft signals = 8 [-]</li> </ul>
P0351	Ignition Coil A Primary/ Secondary Circuit	<ul style="list-style-type: none"> <li>Signal current 0.25 to -2.0 mA</li> <li>Internal check failed</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0352	Ignition Coil B Primary/ Secondary Circuit	<ul style="list-style-type: none"> <li>• Signal current 0.25 to -2.0 mA</li> <li>• Internal check failed</li> </ul>
P0353	Ignition Coil C Primary/ Secondary Circuit	<ul style="list-style-type: none"> <li>• Signal current 0.25 to -2.0 mA</li> <li>• Internal check failed</li> </ul>
P0354	Ignition Coil D Primary/ Secondary Circuit	<ul style="list-style-type: none"> <li>• Signal current 0.25 to -2.0 mA</li> <li>• Internal check failed</li> </ul>

### Additional Exhaust Regulation

DTC	Error Message	Malfunction Criteria and Threshold Value
P0420	Catalyst System Efficiency Below Threshold	Front: <ul style="list-style-type: none"> <li>• Oxygen storage capacity (OSC) vs OSC of borderline catalyst &lt; 1.00</li> <li>• Front catalyst &lt; 1.50</li> <li>• Main catalyst &lt; 1.00</li> </ul> Main: <ul style="list-style-type: none"> <li>• Oxygen storage capacity (OSC) vs OSC of borderline catalyst &lt; 0.40:</li> <li>• Front catalyst &lt; .90</li> <li>• While value for front catalyst &lt; 2.00</li> </ul>
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 s
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	<ul style="list-style-type: none"> <li>• Short to B+ - Signal current &gt; 2.2 - 4.0 A</li> <li>• Short to Ground - Signal voltage &lt; 2.74 - 3.26 V</li> </ul>
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 0.00 - 3.25 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.2 A

### Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor Range/Performance	VSS signal < 6 km/h
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	Vehicle speed > 180 MPH
P0506	Idle Air 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
P050A	Cold Start Idle Air Control System Performance	Out of range low • Engine speed deviation < -80 RPM • Engine speed deviation > 80 RPM
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing and actual spark timing > 20%
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
P0638	Throttle Actuator Control Range/Performance	<ul style="list-style-type: none"> <li>• Time to close to reference point &gt; 0.6 Sec.</li> <li>and</li> <li>• Reference point 2.88%</li> <li>• TPS 1 signal 0.40 - 0.60 V</li> <li>• TPS 2 signal 4.20 - 4.60 V</li> <li>• TPS 1 and TPS 2 4.82 - 5.18 V</li> </ul>
P0641	Sensor Reference Voltage A Circuit Open	Signal voltage deviation > $\pm$ 0.3 V
P0651	Sensor Reference Voltage B Circuit	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 > $\pm$ 0.3 V
U0001	High Speed CAN Communication Bus	CAN message, no feedback
U0002	High Speed CAN Communication Bus Performance	Global 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
U0146	Lost Communication With Gateway A	CAN communication with gateway Time Out
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	<ul style="list-style-type: none"> <li>Speed sensor initialization failed</li> <li>Speed sensor low voltage error failed</li> <li>Implausible message received</li> </ul>
U0422	Invalid Data Received From Body Control Module (Cluster)	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 incorrect
U102E	Fan Identification Sensor Implausible Signal	LIN message incorrect
U102F	Fan Identification Sensor No Communication	LIN communication time out
U1030	Local Data Bus Electrical Malfunction	LIN communication not active

### Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P117A	Bank 1 Sensor 2 Control Limit Reached	1 portion of 3rd lambda control loop > 0.030 [-]
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	<ul style="list-style-type: none"> <li>Pressure control activity &gt; 2.50 MPa</li> <li>Fuel trim activity &lt; 0.80</li> <li>Difference between actual pressure vs target pressure -16.38 to 16.38 MPa</li> </ul>
P12A2	Fuel Rail Pressure Sensor Inappropriately High	<ul style="list-style-type: none"> <li>Pressure control activity &lt; -0.05 MPa</li> <li>Fuel trim activity &gt; 1.65</li> <li>Difference between target pressure and actual pressure -16.38 to 16.38 MPa</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P12A4	Fuel Rail Pump Control Valve Stuck Closed	<ul style="list-style-type: none"> <li>• Fuel trim activity .90 to 1.15</li> <li>• Pressure control activity &lt; -6 MPa</li> <li>• System Deviation &lt; 16.38 MPa</li> </ul>
P13EA	Cold Start Ignition Timing Performance Off Idle	Difference between commanded spark timing vs. actual value > 40%
P150A	Engine Off Timer Performance	Difference between engine off time and ECM after run time < -12 s or > 12 s
P2101	Throttle Actuator Control Motor Circuit Range/ Performance	<ul style="list-style-type: none"> <li>• Duty cycle &gt;80%</li> <li>• Deviation throttle value angles vs. calculated value 4 - 50%</li> <li>• ECM power stage no failure</li> </ul>
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 A Supply Voltage Circuit Open	<ul style="list-style-type: none"> <li>• Signal current, &lt; 2.6 A</li> <li>or</li> <li>• Signal current &gt; 14.90 A</li> </ul>
P2149	Fuel Injector B Supply Voltage Circuit Open	<ul style="list-style-type: none"> <li>• Signal current, &lt; 2.6 A</li> <li>or</li> <li>• Signal current &gt; 14.70 A</li> </ul>
P2177	System Too Lean Off Idle	Adaptive value > 28%
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

DTC	Error Message	Malfunction Criteria and Threshold Value
P2185	Engine Coolant Temperature Sensor 2 Circuit High	ECT outlet < -43° C
P2187	Fuel System Too Lean At Idle	Adaptation value > 5.02%
P2188	Fuel System Too Rich At Idle	Adaptation value < -5.02%
P2195	HO2S Sensor Signal Out of Range Lean Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop > 0.080 [-]
P2196	HO2S Sensor Signal Out of Range Rich Bank 1 Sensor 1	Delta lambda of 2nd lambda control loop < -0.080 [-]
P2231	O2 Sensor Bank 1 Sensor 1 Signal Circuit Shorted to Heater Circuit	Delta O2S signal front > 190 uA
P2237	HO2S Sensor Positive Current Control Circuit Open Bank 1 Sensor 1	<ul style="list-style-type: none"> <li>• O2S signal front 1.49 - 1.51 V</li> <li>• Delta lambda controller &gt; 0.10</li> </ul>
P2243	HO2S Sensor Reference Voltage Circuit Open Bank 1 Sensor 1	<ul style="list-style-type: none"> <li>• O2S signal front &gt; 3.25 V and Internal resistance &gt; 1000 Ohm</li> <li>• O2S signal front &lt; 0.30 V and Internal resistance &gt; 1000 Ohm</li> </ul>
P2251	HO2S Sensor Negative Current Control Circuit Open Bank 1 Sensor 1	O2S signal front 1.47 to 1.53 V and internal resistance > 1000 Ohm
P2270	HO2S Sensor Signal Stuck Lean Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>• O2S signal rear &lt; -2.00 mV</li> <li>• O2S signal rear &lt; -2.00 mV</li> </ul>
P2271	HO2S Sensor Signal Stuck Rich Bank 1 Sensor 2	<ul style="list-style-type: none"> <li>• Sensor voltage of <math>\geq 0.15</math> V</li> <li>• After oxygen mass flow &gt; 3000 mg</li> <li>• Number of checks <math>\geq 1</math></li> </ul>
P2274	HO2S Sensor Signal Stuck Lean Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>• O2S rear signal not oscillating at reference &lt; 0.62 to 0.65 V</li> <li>• Enrichment after stuck lean 27.9%</li> </ul>
P2275	HO2S Sensor Signal Stuck Rich Bank 1 Sensor 3	<ul style="list-style-type: none"> <li>• O2S sensor voltage <math>\geq 0.15</math> V</li> <li>• After oxygen mass flow (fuel cutoff) &gt; 4500 mg</li> <li>• Number of checks <math>\geq 1</math></li> </ul>
P2279	Intake Air System Leak	Threshold to detect a defective system > 1.33 - 1.60

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> <li>• Difference between target pressure vs. actual pressure: &gt; 1.50 mPa</li> <li>or</li> <li>• &lt; -1.50 mPa</li> </ul>
P2294	Fuel Pressure Regulator 2 Control Circuit	<ul style="list-style-type: none"> <li>• Signal voltage 1.40 - 3.20 V</li> <li>or</li> <li>• Signal pattern incorrect</li> </ul>
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**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
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 mA
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

### **Additional Emissions Regulations**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P240A	Evaporative Emission System Leak Detection Pump Heater Control Circuit/Open	Signal voltage > 4.70 - 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
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 A
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	Signal voltage > 4.4 - 5.6 V
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 Circuit Range/Performance	<ul style="list-style-type: none"> <li>• High signal voltage &gt; 12 s</li> <li>• Number of checks = 30</li> <li>• Cumulative time of high signal voltage during pumping &gt; 10 s</li> </ul>
P2407	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic	<ul style="list-style-type: none"> <li>• Fluctuation of EVAP pump current during reference measurement engine off &gt; 2mA</li> <li>• Or drop of EVAP pump current during pump phase of 3 sec &gt; 6mA</li> </ul>
		<ul style="list-style-type: none"> <li>• Fluctuation of EVAP pump current during reference measurement engine on &gt; 2mA</li> <li>• Or drop of EVAP pump current during pump phase of 3 sec &gt; 6mA</li> </ul>
P2414	HO2S Sensor Exhaust Sample Error Bank 1, Sensor 1	Threshold 1 <ul style="list-style-type: none"> <li>• Signal voltage 3.1 - 4.81 V</li> </ul> Threshold 2 <ul style="list-style-type: none"> <li>• O2S signal 2.5 - 3.2 V</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
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
P2568	Direct Ozone Reduction Catalyst Temperature Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>• ID check failure</li> <li>• Temperature sensor functional check failure</li> </ul>
P2569	Direct Ozone Reduction Catalyst Temperature Sensor Circuit Low	Electrical error via LIN failure (grounded)
P2570	Direct Ozone Reduction Catalyst Temperature Sensor Circuit High	Electrical error via LIN failure (short to battery, open circuit)
P2626	HO2S Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	O2S signal front > 4.81 V



# DTC CHART

## Engine Codes CNNA

### Fuel and Air Mixture, Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P000A	Camshaft Adjustment Valve 1 Slow Response (Bank 1)	<ul style="list-style-type: none"> <li>• Difference between target and actual position &gt;12 to 40 °CRK for &gt; 3 Sec.</li> <li>• Adjustment angle <math>\geq 3</math> °CRK</li> </ul>
P000B	Exhaust Camshaft Adjustment Valve 1 Slow Response (Bank 1)	<ul style="list-style-type: none"> <li>• Difference between target and actual position &gt;10 to 22 °CRK for &gt; 2 to 3 Sec</li> <li>• Adjustment angle <math>\geq 3</math> °CRK</li> </ul>
P0010	Camshaft Adjustment Valve 1 Actuator Circuit / Open (Bank 1)	Signal voltage, > 4.7 - 5.4 V
P0011	Camshaft Adjustment Valve 1 Timing Over-Advanced (Bank 1)	<ul style="list-style-type: none"> <li>• Difference between target and actual position &gt;12 to 40° CRK for &gt; 3 Sec.</li> <li>• Adjustment angle &lt; 3 °CRK</li> </ul>
P0013	Exhaust Camshaft Adjustment Valve 1 Actuator Circuit (Bank 1)	Signal voltage, > 4.4 - 5.6 V
P0014	Exhaust Camshaft Adjustment Valve 1 Timing Over-Advanced or System Performance (Bank 1)	<ul style="list-style-type: none"> <li>• Difference between target and actual position &gt;10 to 22 °CRK for &gt; 2 to 3 Sec.</li> <li>• Adjustment angle <math>\geq 3</math> °CRK</li> </ul>
P0016	Engine Speed Sensor, Exhaust Camshaft Adjustment Valve 1 Position Correlation (Bank 1)	<ul style="list-style-type: none"> <li>• Deviation in camshaft position to crankshaft position &lt; -11.01 degrees of crank rotation</li> <li>or</li> <li>• Deviation in camshaft position to crankshaft position &gt; 11.01 degrees of crank rotation</li> </ul>
P0017	Engine Speed Sensor, Exhaust Camshaft Adjustment Valve 1 Position Correlation (Bank 1)	<ul style="list-style-type: none"> <li>• Deviation in crankshaft position to camshaft position &lt; -11.01 degrees of crank rotation</li> <li>or</li> <li>• Deviation in crankshaft position to camshaft position &gt; 11.01 degrees of crank rotation</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0030	Oxygen Sensor Heater Control Circuit (Bank 1, Sensor 1)	Heater voltage 4.70 - 5.40 V
P0031	Oxygen Sensor Heater Control Circuit Short to ground (Bank 1, Sensor 1)	Heater voltage 0.00 to 3.26 V
P0032	Oxygen Sensor Heater After Three Way Catalytic Converter Control Circuit Open or Short To Battery Voltage (Bank 1, Sensor 1)	Heater voltage > 5.50 V
P0036	Oxygen Sensor Heater After Catalytic Converter, Control Circuit (Bank 1, Sensor 2)	Heater voltage 2.34 - 3.59 V
P0037	Oxygen Sensor Heater After Three Way Catalytic Converter Control Circuit Short to ground (Bank 1, Sensor 2)	Heater voltage < 2.34 V
P0038	Oxygen Sensor Heater After Three Way Catalytic Converter Control Circuit Open or Short To Battery Voltage (Bank 1, Sensor 2)	Heater voltage > 3.59 V
P0040	O2 Sensor Signals Swapped (Bank 1 Sensor 1/ Bank 2 Sensor 1)	<ul style="list-style-type: none"> <li>• Lambda controllers exceed thresholds in opposite directions</li> <li>Case 1</li> <li>• Lambda control value bank 1 &lt; 0.80</li> <li>and</li> <li>• Lambda control value bank 2 &gt; 1.20</li> <li>Case 2</li> <li>• Lambda control value bank 1 &gt;1.20</li> <li>and</li> <li>• Lambda control value bank 2 &lt; 0.80</li> </ul>
P0050	Oxygen Sensor 2 Heater Control Circuit (Bank 2 Sensor 1)	Heater voltage 4.70 - 5.40 V

DTC	Error Message	Malfunction Criteria and Threshold Value
P0051	Oxygen Sensor 2 Heater Control Circuit Short to ground (Bank 2 Sensor 1)	Heater voltage 0.00 to 3.26 V
P0052	Oxygen Sensor 2 Heater Control Circuit (Bank 2 Sensor 1) High	Heater voltage > 5.50 A
P0056	Heater for Oxygen Sensor 2 After Catalytic Converter Control Circuit (Bank 2 Sensor 2)	Heater voltage 2.34 - 3.59 V
P0057	Heater for Oxygen Sensor 2 After Catalytic Converter Control Circuit Short to ground (Bank 2 Sensor 2)	Heater voltage < 2.34 V
P0058	Heater for Oxygen Sensor 2 After Catalytic Converter Control Circuit (Bank 2 Sensor 2) High	Heater voltage > 3.59 V
P0068	MAP/MAFvs Throttle Position Correlation	Load survey below threshold • Load calculation < -35% Load survey above threshold • Load calculation > 35%
P0070	Outside Air Temperature Sensor Circuit	• Ambient air temperature < -50 °C or • Outside Air Temperature Sensor signal: short to battery / open circuit.
P0071	Outside 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	Outside Air Temperature SensorCircuit Short to Ground	• Ambient air temperature > 87° C or • Outside Air Temperature Sensor signal short to ground

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0087	Fuel Rail System Pressure - Too Low	<ul style="list-style-type: none"> <li>• Pressure control activity &gt; 2.20 MPa</li> <li>and</li> <li>• Fuel trim activity &gt; 0.80 to 1.20</li> <li>and</li> <li>• Difference between target vs. actual pressure &gt; 2.20 MPa</li> </ul>
P0089	Fuel Pressure Regulator 1 Performance	<ul style="list-style-type: none"> <li>• Difference between target vs. actual pressure &lt; 150 kPa or &gt; 200 kPa</li> <li>• Feedback control loop &lt; -300 or &gt; 225 kPa</li> </ul>
P008A	Low Pressure Fuel System Pressure - Too Low	Actual pressure < 40 kPa
P008B	Low Pressure Fuel System Pressure - Too High	Actual pressure > 780 kPa
P0100	Mass Airflow Sensor Mass Air Flow Circuit	<ul style="list-style-type: none"> <li>• MAF sensor signal 0 <math>\mu</math>s</li> <li>• MAF signal temp correction &lt; 40 mSec.</li> <li>• MAF signal temp correction &lt; 40 and &gt; 65 mSec.</li> </ul>
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	• MAF vs lower threshold model < 0 to 580 kg/h
	Rationality Check Mass Air Flow	• MAF vs. upper threshold model > 30 to 1100 kg/h
	Rationality Check Load Survey High	<ul style="list-style-type: none"> <li>• Load calculation &gt; 20%</li> <li>• Fuel system (mult.) &lt; -20%</li> </ul>
	Rationality Check Load Survey Low	<ul style="list-style-type: none"> <li>• Load calculation &lt; -20%</li> <li>• Fuel system (mult.) &gt; 20%</li> </ul>
P0102	Mass Air Flow Circuit Input Low	<ul style="list-style-type: none"> <li>• MAF sensor signal &lt; 66 <math>\mu</math>s</li> <li>• MAF Sensor signal temp.-correction &lt; 40 mSec.</li> </ul>
P0103	Mass Air Flow Circuit Input High	<ul style="list-style-type: none"> <li>• MAF sensor signal &gt; 910 <math>\mu</math>s</li> <li>• MAF Sensor signal temp.-correction &gt; 65 mSec.</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0111	Intake Air Temperature Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Difference in value between ECT vs IAT at engine start &gt; 24.8° K (depending on engine off time)</li> <li>and</li> <li>• Difference in value between Outside Air Temperature Sensor vs ECT at engine start (depending on engine off time) &gt; 24.8° K</li> <li>• Difference in value between ECT vs IAT at engine start (depending on engine off time) &lt; 24.8° K</li> </ul>
P0112	Intake Air Temperature Sensor Circuit Input Low	IAT > 130° C
P0113	Intake Air Temperature Sensor Circuit Input High	IAT < -45.0° C
P0116	Engine Coolant Temperature Sensor Circuit Range/ Performance Cross Check	<ul style="list-style-type: none"> <li>• Difference ECT vs. IAT at engine start &gt; 24.8° K (depending on engine off time)</li> <li>or</li> <li>• Difference IAT vs. Outside Air Temperature Sensor at engine start &lt; 24.8° K (depending on engine off time)</li> <li>and</li> <li>• Difference Outside Air Temperature Sensor vs. ECT at engine start &gt; 24.8° K (depending on engine off time)</li> </ul>
	Stuck high / low - no change on signal	<ul style="list-style-type: none"> <li>• Difference max ECT vs. min ECT &lt; 1.5° K</li> </ul>
	Stuck in range	<ul style="list-style-type: none"> <li>• ECT @ start ≥ 78° C</li> <li>and</li> <li>• ECT @ start ≤ 137° C</li> </ul>
P0117	Engine Coolant Temperature Sensor Circuit Input Low	ECT > 137° C
P0118	Engine Coolant Temperature Sensor Circuit Input High	ECT < -44° C

DTC	Error Message	Malfunction Criteria and Threshold Value
P011F	Engine Coolant Temperature 2/ Ambient Air Temperature Rationality Check	<ul style="list-style-type: none"> <li>• Difference in value between ECT vs IAT at engine start (depending on engine off time) &gt; 24.8° K</li> <li>and</li> <li>• Difference in value between Outside Air Temperature Sensor vs ECT at engine start (depending on engine off time) &gt; 24.8° K</li> </ul>
P0121	Accelerator Pedal Position Sensor Circuit Range/ Performance	<ul style="list-style-type: none"> <li>• TPS 1 - TPS 2 &gt; 5.10 to 6.30% and</li> <li>• Actual TPS 1 calculated value &gt; actual TPS 2 calculated value</li> <li>or</li> <li>• TPS 1 calculated value &gt; 9.0%</li> </ul>
P0122	Accelerator Pedal Position Sensor Out of Range Low	Signal voltage < 0.20 V
P0123	Accelerator Pedal Position Sensor Out of Range High	Signal voltage > 4.81 V
P0130	Oxygen Sensor Malfunction (Bank 1, Sensor 1)	O2S ceramic temp. < 640° C
P0131	Oxygen Sensor Internal Check or short to Ground (Bank 1 - Sensor 1)	Virtual mass < 1.75V (VM)
		Nernst voltage < 1.50 V (UN)
		Adjustment voltage < 0.30 V (IA)
		Adjustment voltage < 0.30 V (IP)
P0132	O2 Sensor Circuit (Bank 1, Sensor 1) High Voltage	Virtual mass > 3.25 V (VM)
		Nernst voltage > 4.40 V (UN)
		Adjustment voltage > 7 V (A)
		Adjustment voltage > 7 V (IP)

DTC	Error Message	Malfunction Criteria and Threshold Value
P0133	Oxygen Sensor Circuit Slow Response (Bank 1, Sensor 1)	<p>Symmetric Fault:</p> <ul style="list-style-type: none"> <li>• Difference of R2L area ratio vs. L2R area ratio <math>-0.30</math> to <math>0.30</math></li> <li>• Max value of both counters for area ratio R2L and L2R <math>\geq 3</math> times.</li> </ul> <p>Delay Time:</p> <ul style="list-style-type: none"> <li>• Gradient ratio <math>\geq 0.27</math></li> <li>• Lower value of both area ratios R2L and L2R <math>&lt; 0.15</math></li> </ul> <p>Transient Time:</p> <ul style="list-style-type: none"> <li>• Gradient ratio <math>\geq 0.27</math></li> <li>• Gradient ratio <math>\leq 0.65</math></li> <li>• Lower value of both area ratios R2L and L2R <math>&lt; 0.15</math></li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>• Lower value of both gradient ratios R2L and L2R <math>&lt; 0.27</math></li> </ul> <p>Asymmetric Fault:</p> <ul style="list-style-type: none"> <li>• Difference of R2L area ratio vs. L2R area ratio <math>&lt; -0.30</math>; <math>&gt; 0.30</math></li> <li>• Values of both counters for area ratio R2L and L2R <math>\geq 3</math> times</li> </ul> <p>Delay Time:</p> <ul style="list-style-type: none"> <li>• Gradient ratio <math>\geq 0.27</math></li> <li>• Lower value of both area ratios R2L and L2R <math>&lt; 0.25</math></li> </ul> <p>Transient Time:</p> <ul style="list-style-type: none"> <li>• Gradient ratio <math>\geq 0.27</math></li> <li>• Gradient ratio <math>\leq 0.65</math></li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>• Lower value of both gradient ratios R2L and L2R <math>&lt; 0.27</math></li> </ul>
P0135	Oxygen Sensor Heater Circuit Out Of Range High (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>• Heater duty cycle, <math>&gt; 90\%</math></li> <li>• O2S ceramic temperature, <math>&lt; 685^{\circ}\text{C}</math></li> </ul> <p>or</p>
	Rationality Check (Sensor Heating Up)	<ul style="list-style-type: none"> <li>• O2S ceramic temp <math>&lt; 715^{\circ}\text{C}</math></li> <li>• Time after O2S heater on 40 Sec.</li> </ul>
P0137	Oxygen Sensor After Three Way Catalytic Converter Out Of Range Low (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>• Signal voltage, <math>&lt; 40\text{ mV}</math> for <math>&gt; 3\text{ Sec.}</math></li> <li>• Difference of sensor voltage with load pulse and without <math>&lt; 0.01\text{ V}</math></li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0138	Oxygen Sensor After Three Way Catalytic Converter Out Of Range High (Bank 1, Sensor 2)	Signal voltage > 1.08 V for time > 5 Sec.
P0139	Oxygen Sensor After Three Way Catalytic Converter Circuit Slow Response (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>• EWMA filtered transient time at fuel cutoff &gt; 0.5 Sec.</li> <li>or</li> <li>• In voltage range 201.20 - 401.40 mV</li> <li>and</li> <li>• Number of checks ≥ 1</li> </ul>
P013A	Oxygen Sensor After Three Way Catalytic Converter Slow Response Rich to Lean (Bank 1 Sensor 2)	<ul style="list-style-type: none"> <li>• Arithmetic filtered max differential transient time at fuel cut off ≥ 0.75 Sec.</li> <li>• EWMA filtered max differential transient time at fuel cutoff n.a.</li> <li>• Number of checks ≥ 1.0</li> </ul>
P013B	Oxygen Sensor After Three Way Catalytic Converter Slow Response Lean to Rich (Bank 1 Sensor 2)	<ul style="list-style-type: none"> <li>• Arithmetic filtered max differential transient time at fuel cut off ≥ 0.75 Sec.</li> <li>• EWMA filtered max differential transient time at fuel feed restart n.a</li> <li>• Number of checks ≥ 1.0</li> </ul>
P013C	Oxygen Sensor 2 After Three Way Catalytic Converter Sensor Slow Response Rich to Lean (Bank 2 Sensor 2)	<ul style="list-style-type: none"> <li>• EWMA filtered max differential transient time at fuel cutoff ≥ 0.75 Sec</li> <li>or</li> <li>• EWMA filtered max differential transient time at fuel cut off n.a.</li> <li>• Number of checks ≥ 1.0</li> </ul>
P013D	Oxygen Sensor 2 After Three Way Catalytic Converter Sensor Slow Response Lean to Rich (Bank 2 Sensor 2)	<ul style="list-style-type: none"> <li>• Arithmetic filtered max differential transient time at fuel feed restart ≥ 1.50 Sec.</li> <li>• EWMA filtered max differential transient time at fuel feed restart, n.a..</li> <li>• Number of checks ≥ 1.0</li> </ul>



DTC	Error Message	Malfunction Criteria and Threshold Value
P013E	Oxygen Sensor After Three Way Catalytic Converter Sensor Delayed Response Rich to Lean (Bank 1 Sensor 2)	<ul style="list-style-type: none"> <li>• Arithmetic filtered max differential delay time at rich to lean transition &gt; 0.8 Sec</li> <li>• EWMA filtered max differential transient time at rich to lean transition &gt;n.a. Sec.</li> <li>• Number of checks <math>\geq 3</math></li> </ul>
P013F	Oxygen Sensor After Three Way Catalytic Converter Delayed Response Lean to Rich (Bank 1 Sensor 2)	<ul style="list-style-type: none"> <li>• Arithmetic filtered max differential delay time at lean to rich transition &gt; 1.0 Sec</li> <li>• EWMA filtered max differential transient time at lean to rich transition &gt; n.a. Sec</li> <li>• Number of checks <math>\geq 3</math></li> </ul>
P0140	Oxygen Sensor After Three Way Catalytic Converter Sensor signal line open (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>• Signal voltage, 0.40 to 0.60 V</li> <li>• For time &gt; 3.0 Sec</li> <li>and</li> <li>• Difference of signal voltage with load pulse and without <math>\geq 2.80</math> V</li> </ul>
	O2 Sensor ground line open (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>• Internal resistance &gt; 120,000 ohm</li> <li>and</li> <li>• Exhaust temperature &gt; 600° C</li> </ul>
P0141	Oxygen Sensor Heater After Catalytic Converter Out of Range (Bank 1, Sensor 2)	<ul style="list-style-type: none"> <li>• Heater resistance, 416 to 3600 Ohm</li> <li>or</li> <li>• Heater resistance, 600 to 15000 Ohm</li> </ul>
P014A	Oxygen Sensor 2 After Three Way Catalytic Converter Sensor Delayed Response Rich to Lean (Bank 2 Sensor 2)	<ul style="list-style-type: none"> <li>• Arithmetic filtered max differential delay time at lean to rich transition &gt; 0.8 Sec</li> <li>or</li> <li>• EWMA filtered max differential delay time at rich to lean transition &gt; n.a.</li> <li>• Number of checks <math>\leq 3.0</math></li> </ul>
P014B	Oxygen Sensor 2 After Three Way Catalytic Converter Sensor Delayed Response Lean to Rich (Bank 2 Sensor 2)	<ul style="list-style-type: none"> <li>• arithmetic filtered max differential delay time at lean to rich transition &gt; 1.0 Sec</li> <li>or</li> <li>• EWMA filtered max differential delay time at lean to rich transition &gt; n.a.</li> <li>• Number of checks <math>\leq 3.0</math></li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0150	Oxygen Sensor 2 Circuit Malfunction (Bank 2 Sensor 1)	<ul style="list-style-type: none"> <li>• O2S ceramic temp. &lt; 640° C</li> </ul>
P0151	Oxygen Sensor Internal Check or short to Ground (Bank 2 Sensor 1)	<ul style="list-style-type: none"> <li>• Virtual Mass &lt; 1.75 V (VM)</li> <li>or</li> <li>• Nernst voltage &lt; 1.50 V (UN)</li> <li>or</li> <li>• Adjustment voltage &lt; 0.30 V (IA)</li> <li>or</li> <li>• Adjustment voltage &lt; 0.30 V (IP)</li> </ul>
P0152	Oxygen Sensor Internal Check, Open circuit or Short to Battery Voltage (Bank 2 Sensor 1)	<ul style="list-style-type: none"> <li>• Virtual Mass &gt; 3.25 V (VM)</li> <li>or</li> <li>• Nernst voltage &gt; 4.40 V (UN)</li> <li>or</li> <li>• Adjustment voltage &gt; 7.0 V (IA)</li> <li>or</li> <li>• Adjustment voltage &gt; 7.0 V (IP)</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P0153	Oxygen Sensor 2 Circuit Slow Response (Bank 2 Sensor 1)	<p>Symmetric Fault:</p> <ul style="list-style-type: none"> <li>• Difference of R2L area ratio vs. L2R area ratio <math>-0.30</math> to <math>0.30</math></li> <li>• Max alue of both counters for area ratio R2L and L2R <math>\geq 3</math> times.</li> </ul> <p>Delay Time:</p> <ul style="list-style-type: none"> <li>• Gradient ratio <math>\geq 0.27</math></li> <li>• Lower value of both area ratios R2L and L2R <math>&lt; 0.15</math></li> </ul> <p>Transient Time:</p> <ul style="list-style-type: none"> <li>• Gradient ratio <math>\geq 0.27</math></li> <li>• Gradient ratio <math>\leq 0.65</math></li> <li>• Lower value of both area ratios R2L and L2R <math>&lt; 0.15</math></li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>• Lower value of both gradient ratios R2L and L2R <math>&lt; 0.27</math></li> </ul> <p>Asymmetric Fault:</p> <ul style="list-style-type: none"> <li>• Difference of R2L area ratio vs. L2R area ratio <math>&lt; -0.30</math>; <math>&gt; 0.30</math></li> <li>• Values of both counters for area ratio R2L and L2R <math>\geq 3</math> times</li> </ul> <p>Delay Time:</p> <ul style="list-style-type: none"> <li>• Gradient ratio <math>\geq 0.27</math></li> <li>• Lower value of both area ratios R2L and L2R <math>&lt; 0.25</math></li> </ul> <p>Transient Time:</p> <ul style="list-style-type: none"> <li>• Gradient ratio <math>\geq 0.27</math></li> <li>• Gradient ratio <math>\leq 0.65</math></li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>• Lower value of both gradient ratios R2L and L2R <math>&lt; 0.27</math></li> </ul>
P0155	O2 Sensor Heater Circuit Bank 2 Sensor 1 Malfunction	<ul style="list-style-type: none"> <li>• Heater duty cycle, <math>&gt; 90\%</math></li> <li>• O2S ceramic temperature, <math>&lt; 685^{\circ}\text{C}</math></li> </ul> <p>or</p>
	Rationality Check (Sensor Heating Up)	<ul style="list-style-type: none"> <li>• O2S ceramic temp <math>&lt; 715^{\circ}\text{C}</math></li> <li>• Time after O2S heater on 40 Sec.</li> </ul>
P0157	Oxygen Sensor 2 After Three Way Catalytic Converter Out Of Range Low (Bank 2 Sensor 2)	<ul style="list-style-type: none"> <li>• Signal voltage, <math>&lt; 40\text{ mV}</math> for <math>&gt; 3\text{ Sec.}</math></li> <li>• Difference of sensor voltage with load pulse and without <math>&lt; 0.01\text{ V}</math></li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0158	Oxygen Sensor 2 After Three Way Catalytic Converter Out Of Range High (Bank 2 Sensor 2))	<ul style="list-style-type: none"> <li>• Signal voltage, &gt; 1.08 V</li> <li>• For time &gt; 5.0 Sec.</li> </ul>
P0159	Oxygen Sensor 2 After Three Way Catalytic Converter Sensor Circuit Slow Response (Bank 2 Sensor 2)	<ul style="list-style-type: none"> <li>• EWMA filtered transient time at fuel cutoff &gt; 0.5 Sec.</li> <li>• In voltage range 201.20 - 401.40 mV</li> <li>• Number of checks ≥ 1</li> </ul>
P0160	Oxygen Sensor 2 After Three Way Catalytic Converter Sensor Signal Line Open (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>• Signal voltage, 0.40 to 0.60 V</li> <li>• For time &gt; 3.0 Sec</li> </ul> and <ul style="list-style-type: none"> <li>• Difference of signal voltage with load pulse and without ≥ 2.80 V</li> </ul>
	O2 Circuit Sensor Ground Line Open (Bank 2, Sensor 2)	<ul style="list-style-type: none"> <li>• Internal resistance &gt; 120,000 ohm</li> </ul> and <ul style="list-style-type: none"> <li>• Exhaust temperature &gt; 600° C</li> </ul>
P0161	Oxygen Sensor 2 After Three Way Catalytic Converter Heater Sensor Circuit Malfunction (Bank 2 Sensor 2)	<ul style="list-style-type: none"> <li>• Heater resistance, 416 - 3600 Ohm</li> </ul> or <ul style="list-style-type: none"> <li>• Heater resistance, 600 to 15000 Ohm</li> </ul>
P0169	Incorrect Fuel Composition	Comparison with fuel quantity = incorrect
P0171	Fuel Trim, System Too Lean (Bank 1)	<ul style="list-style-type: none"> <li>• Low pass filtered lambda controller output &lt; 20.00%</li> <li>• For time &gt; 40.0 Sec.</li> </ul>
P0172	Fuel Trim, System Too Rich (Bank 1)	<ul style="list-style-type: none"> <li>• Low pass filtered lambda controller output &gt; 20.00%</li> <li>• For time &gt; 40.0 Sec.</li> </ul>
P0174	Fuel Trim, System Too Lean (Bank 2)	<ul style="list-style-type: none"> <li>• Low pass filtered lambda controller output &lt; 20.00%</li> <li>• For time &gt; 40.0 Sec.</li> </ul>
P0175	Fuel Trim, System Too Rich (Bank 2)	<ul style="list-style-type: none"> <li>• Low pass filtered lambda controller output &gt; 20.00%</li> <li>• For time &gt; 40.0 Sec.</li> </ul>
P0190	Fuel Rail Pressure Sensor A Circuit	Signal voltage > 4.8 V
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	Actual pressure > 14.60 MPa or < 0.005 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	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0202	Injector Circuit/Open - Cylinder 2	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0203	Injector Circuit/Open - Cylinder 3	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0204	Injector Circuit/Open - Cylinder 4	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0205	Injector Circuit Open - Cylinder 5	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0206	Injector Circuit Open - Cylinder 6	<ul style="list-style-type: none"> <li>• Low side signal current &lt; 2.1 A</li> <li>• Internal logic failure</li> </ul>
P0221	Accelerator Pedal Position Sensor Circuit Range/Performance	<ul style="list-style-type: none"> <li>• TPS 1 - TPS 2 &gt; 5.10 to 6.30% and</li> <li>• Actual TPS 2 calculated value &gt; actual TPS 1 calculated value</li> <li>or</li> <li>• TPS 2 calculated value &gt; 9%</li> </ul>
P0222	Accelerator Pedal Position Sensor Circuit Low Input	Signal voltage < 0.20 V
P0223	Accelerator Pedal Position Sensor Circuit High Input	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 Low	Signal voltage 2.15 - 3.25 V
P025D	Fuel Pump Module Control Circuit High	Signal current > 1.10 A
P0261	Cylinder 1 Injector Circuit Low	Low side signal current < 2.10 A
P0262	Cylinder 1 Injector Circuit High	Low side signal current > 14.70 A
P0264	Cylinder 2 Injector Circuit Low	Low side signal current < 2.10 A
P0265	Cylinder 2 Injector Circuit High	Low side signal current > 14.70 A
P0267	Cylinder 3 Injector Circuit Low	Low side signal current < 2.10 A
P0268	Cylinder 3 Injector Circuit High	Low side signal current > 14.70 A

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0270	Cylinder 4 Injector Circuit Low	Low side signal current < 2.10 A
P0271	Cylinder 4 Injector Circuit High	Low side signal current > 14.70 A
P0273	Cylinder 5- Injector Circuit Low	Low side signal current < 2.10 A
P0274	Cylinder 5- Injector Circuit High	Low side signal current > 14.70 A
P0276	Cylinder 6- Injector Circuit Low	Low side signal current < 2.10 A
P0277	Cylinder 6- Injector Circuit High	Low side signal current > 14.70 A
P2088	A Camshaft Position Actuator Control Circuit Low (Bank 1)	Signal voltage 0.0 - 3.25 V
P2089	A Camshaft Position Actuator Control Circuit High (Bank 1)	Signal current > 2.2 A
P2090	"B" Camshaft Position Actuator Control Circuit Low (Bank 1)	Signal voltage 0.0 to 3.25 V
P2091	Camshaft Adjustment Valve 1 "B" Control Circuit High (Bank 1)	Signal current > 2.20 A
P2096	Oxygen Sensor After Three Way Catalytic Converter Post Catalyst Fuel Trim System (Bank 1) Too Lean	l portion of 2nd lambda control loop < -0.035
P2097	Oxygen Sensor After Three Way Catalytic Converter Post Catalyst Fuel Trim System Too Rich (Bank 1)	l portion of 2nd lambda control loop > 0.035
P2098	Oxygen Sensor 2 After Catalytic Converter Post Catalyst Fuel Trim System (Bank 2) Too Lean	l portion of 2nd lambda control loop < -0.035
P2099	Oxygen Sensor 2 After Catalytic Converter Post Catalyst Fuel Trim System (Bank 2) Too Rich	l 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	<ul style="list-style-type: none"> <li>• Emission threshold Misfire Rate (MR), &gt; 1.90%</li> <li>• Catalyst damage misfire rate (MR), &gt; 1.10% - 13.5%</li> </ul>
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold Misfire Rate (MR), &gt; 1.9%</li> <li>• Catalyst damage misfire rate (MR), &gt; 1.05% - 13.33%</li> </ul>
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold Misfire Rate (MR), &gt; 1.9%</li> <li>• Catalyst damage misfire rate (MR), &gt; 1.05% - 13.33%</li> </ul>
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold Misfire Rate (MR), &gt; 1.9%</li> <li>• Catalyst damage misfire rate (MR), &gt; 1.05% - 13.33%</li> </ul>
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold Misfire Rate (MR), &gt; 1.9%</li> <li>• Catalyst damage misfire rate (MR), &gt; 1.05% - 13.33%</li> </ul>
P0305	Cylinder 5 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold Misfire Rate (MR), &gt; 1.9%</li> <li>• Catalyst damage misfire rate (MR), &gt; 1.05% - 13.33%</li> </ul>
P0306	Cylinder 6 Misfire Detected	<ul style="list-style-type: none"> <li>• Emission threshold Misfire Rate (MR), &gt; 1.9%</li> <li>• Catalyst damage misfire rate (MR), &gt; 1.05% - 13.33%</li> </ul>
P0321	Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Comparison of counted teeth vs reference = incorrect</li> <li>• Monitoring reference gap failure</li> </ul>
P0322	Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> <li>• Camshaft signal &gt; 3</li> <li>• Engine speed no signal</li> </ul>
P0324	Knock Control System Error	<ul style="list-style-type: none"> <li>• Signal fault counter (combustion) &gt; 28.0</li> <li>or</li> <li>• Signal fault counter (measuring window) &gt; 5.0</li> </ul>
P0325	Knock Sensor 1 Circuit Malfunction	Signal voltage < 1.80 V or > 3.20 V

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0327	Knock Sensor 1 Short To Ground	• Lower threshold -0.07 V
	Signal Range Check	• Signal range lower threshold < 0.30 to 2.50 V
P0328	Knock Sensor 1 Open or Short To Battery Voltage	• Upper threshold > 1.00 V
	Signal Range Check	• Signal range upper threshold > 163.0 to 240.0 V
P0330	Knock Sensor 2 Circuit	Signal voltage < 1.80 V or > 3.20 V
P0332	Knock Sensor 2 Out of Range Low (Bank 2)	• Lower threshold -0.07 V • Signal range lower threshold < 0.30 to 2.50 V
	Short To Ground	• Lower threshold < -0.07 V
	Signal Range Check	• Signal range lower threshold < 0.50 to 2.50 V
P0333	Knock Sensor 2 Circuit High Input Short to Battery Plus Port B	• Upper threshold > 1.00 V
	Short to Battery Plus Port A	• Upper threshold > 1.00 V
	Short Range Check	• Signal range upper threshold > 163.0 to 240.0 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 incorrect • Defect counter = 12
P0342	Camshaft Position Sensor A Circuit Low Input (Bank 1)	• Signal voltage permanently high and • Crankshaft signals = 8 revolutions
P0343	Camshaft Position Sensor A Circuit High Input (Bank 1)	• Signal voltage high • Crankshaft signals = 8 revolutions
P0351	Ignition Coil A Primary/ Secondary Circuit	• Signal current 0.25 to -2.0 mA or • Internal check failed



DTC	Error Message	Malfunction Criteria and Threshold Value
P0352	Ignition Coil B Primary/ Secondary Circuit	<ul style="list-style-type: none"> <li>• Signal current 0.25 to -2.0 mA</li> <li>or</li> <li>• Internal check failed</li> </ul>
P0353	Ignition Coil C Primary/ Secondary Circuit	<ul style="list-style-type: none"> <li>• Signal current 0.25 to -2.0 mA</li> <li>or</li> <li>• Internal check failed</li> </ul>
P0354	Ignition Coil D Primary/ Secondary Circuit	<ul style="list-style-type: none"> <li>• Signal current 0.25 to -2.0 mA</li> <li>• Internal check failed</li> </ul>
P0355	Ignition Coil E Primary/ Secondary Circuit	<ul style="list-style-type: none"> <li>• Signal current 0.25 to -2.0 mA</li> <li>or</li> <li>• Internal check failed</li> </ul>
P0356	Ignition Coil F Primary/ Secondary Circuit	<ul style="list-style-type: none"> <li>• Signal current 0.25 to -2.0 mA</li> <li>or</li> <li>• Internal check failed</li> </ul>
P0366	Crankshaft Position Sensor A Circuit Range/Performance	<ul style="list-style-type: none"> <li>• Signal pattern incorrect</li> <li>and</li> <li>• Defect counter = 12.0</li> </ul>
P0367	Camshaft Position Sensor "B" Circuit (Bank 1) Low Input	<ul style="list-style-type: none"> <li>• Signal voltage permanently low</li> <li>• Crankshaft signals = 8 revolutions</li> </ul>
P0368	Camshaft Position Sensor "B" Circuit (Bank 1) High Input	<ul style="list-style-type: none"> <li>• Signal voltage permanently high</li> <li>• Crankshaft signals = 8 revolutions</li> </ul>
P2300	Cylinder 1 Ignition Coil Primary Control Circuit Short To Ground	Signal current > 24.0 mA
P2301	Cylinder 1 Ignition Coil Primary Control Circuit Open or Short To Battery Voltage	Signal current > 5.10 - 7.0 mA
P2303	Cylinder 2 Ignition Coil Primary Control Circuit Short To Ground	Signal current > 24.0 mA
P2304	Cylinder 2 Ignition Coil Primary Control Circuit Open or Short To Battery Voltage	Signal current > 5.10 - 7.0 mA
P2306	Cylinder 3 Ignition Coil Primary Control Circuit Short To Ground	Signal current > 24.0 mA
P2307	Cylinder 3 Ignition Coil Primary Control Circuit Open or Short To Battery Voltage	Signal voltage > 5.10 - 7.0 mA

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P2309	Cylinder 4 Ignition Coil Primary Control Circuit Short To Ground	Signal current > 24.0 mA
P2310	Cylinder 4 Ignition Coil Primary Control Circuit Open or Short To Battery Voltage	Signal voltage > 5.10 - 7.0 mA
P2312	Cylinder 5 Ignition Coil Primary Control Circuit Short To Ground	Signal current > 24 mA
P2313	Cylinder 5 Ignition Coil Primary Control Circuit Open or Short To Battery Voltage	Signal voltage > 5.10 to 7.0 V
P2315	Cylinder 6 Ignition Coil Primary Control Circuit Short To Ground	Signal current > 24 mA
P2316	Cylinder 6 Ignition Coil Primary Control Circuit Open or Short To Battery Voltage	Signal voltage > 5.10 to 7.0 V

### **Additional Exhaust Regulation**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P0420/ P0430	Catalyst System Efficiency Below Threshold Bank 1 (P0420) or Bank 2 (P0430)	<ul style="list-style-type: none"> <li>• Measured oxygen storage capacity (OSC) &lt; 1.00 HC correlated</li> <li>• Measured oxygen storage capacity (OSC) catalyst system &lt; 1.00 NOx correlated</li> </ul>
P0441	Evaporative Emission System Incorrect Purge Flow	<ul style="list-style-type: none"> <li>• Deviation lambda control &lt; 5.00 to 5.51%</li> <li>• Deviation idle control &lt; 30.0%</li> </ul>
P0442	Evaporative Emission System Leak Detected (Small Leak)	Time for pressure drop < 1.50 - 1.70 Sec.
P0444	Evaporative Emission System Purge Control Valve Circuit Open	Signal voltage > 4.70 - 5.40 V
P0455	Evaporative Emission System Leak Detected (gross leak/no flow)	Time for pressure drop < 1.1 - 1.3 Sec.

DTC	Error Message	Malfunction Criteria and Threshold Value
P0456	Evaporative Emission System Leak Detected (very small leak)	Time for pressure drop, < 4.8 - 6.0 Sec.
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Signal voltage 0 to 3.26 V
P0459	Evaporative Emission System Purge Control Valve Circuit High	Signal current > 2.20 A

### Speed and Idle Control

DTC	Error Message	Malfunction Criteria and Threshold Value
P0501	Vehicle Speed Sensor A Range/Performance	<ul style="list-style-type: none"> <li>• Speed sensor signal: plausibility error failure.</li> <li>or</li> <li>• VSS signal &lt; 2.5 mph</li> </ul>
P0502	Vehicle Speed Sensor "A" Circuit Low Input	Speed sensor signal electrical error failure
P0506	Idle Air Control System RPM Lower Than Expected	Engine speed Deviation > 100 RPM and Idle controller at max value
P0507	Idle Air Control System RPM Higher Than Expected	<ul style="list-style-type: none"> <li>• Engine speed Deviation &lt; -100 RPM</li> <li>and</li> <li>• RPM controller torque value ≤ calculated min. value</li> <li>or</li> <li>• Integrated number of fuel cut off transitions ≥ n.a.</li> </ul>
P050A	Cold Start Idle Air Control System Performance Out of Range Low	<ul style="list-style-type: none"> <li>• Engine speed deviation &gt; 100 RPM</li> <li>• RPM controller torque value ≥ calculated max. value</li> <li>or</li> </ul>
	Out of Range High	<ul style="list-style-type: none"> <li>• Engine speed deviation &lt; -200 RPM</li> <li>• RPM controller torque value ≤ calculated min. value</li> </ul>
P050B	Cold Start Ignition Timing Performance	Difference between commanded spark timing and actual value > 22.0%

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P052A	Camshaft Adjustment Valve 1 Cold Start "A", Timing Over-Advanced (Bank 1)	Difference between target position vs. actual position > 12 to 40° CRK
P053F	Cold Start Fuel Pressure Performance	<ul style="list-style-type: none"> <li>• Difference between target pressure vs actual pressure: &gt; 1.50 MPa</li> <li>or</li> <li>• Difference between target pressure vs actual pressure: &lt; -1.50 MPa</li> </ul>
P054A	Camshaft Adjustment Valve 1 Cold Start "B", Timing Over-Advanced (Bank 1)	Difference between target position vs. actual position > 10 to 22 °CRK

### **Control Module and Output Signals**

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
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 Processor Fault	ECM internal check failure
P062B	Internal ECM Fuel Injector Control Performance	Internal logic failure
P0638	Throttle Actuator Control Range Performance Rationality Check Close Movement	<ul style="list-style-type: none"> <li>• Time to close to reference point &gt; 0.6 Sec.</li> <li>and</li> <li>• Reference point 2.88%</li> </ul>
	Signal Range Check @ Mechanical Stop Low	<ul style="list-style-type: none"> <li>• TPS 1 signal voltage 'NOT 0.40 to 0.80 V</li> <li>or</li> <li>• TPS 2 signal voltage 'NOT 4.20 to 4.60 V</li> </ul>
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

DTC	Error Message	Malfunction Criteria and Threshold Value
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 > $\pm 0.3$ V
U0001	High Speed CAN Communication Bus	CAN message = no feedback
U0002	High Speed CAN Communication Bus Performance	Global Time Out failure. No module communication on CAN
U0101	Lost Communication with TCM	Time Out failure. No message received by ECM from TCM > 5 Sec
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN communication with ABS Time Out.
U0146	Lost Communication With Gateway A	CAN communication with gateway Time Out
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	CAN communication with IPC timed out.
U0302	Software Incompatibility with Transmission Control Module	AT vehicle, ECM coded as MT vehicle
U0402	Invalid Data Received From Gear Shift Control Module	Transmission Data Length Code incorrect or invalid information.
U0415	CAN Communication With ABS Error	<ul style="list-style-type: none"> <li>• Speed sensor initialization failed</li> <li>• Speed sensor low voltage error failed</li> <li>• Speed sensor &gt; 326 km/h</li> </ul>
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	CAN message incorrect.
U1103	Vehicle in Production Mode	Production mode active.

## Fuel and Air Ratios Control Module

DTC	Error Message	Malfunction Criteria and Threshold Value
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	<ul style="list-style-type: none"> <li>• Pressure control activity &gt; 0.13 MPa</li> <li>and</li> <li>• Fuel trim activity &lt; 0.78</li> <li>and</li> <li>• Difference between target pressure vs actual -16 to 16.38 MPa</li> </ul>
P12A2	Fuel Rail Pressure Sensor Inappropriately High	<ul style="list-style-type: none"> <li>• Pressure control activity &lt; -0.13 MPa</li> <li>• Fuel trim activity &gt; 1.21</li> <li>• Difference between target pressure vs actual -16 to 16.38 MPa</li> </ul>
P12A4	Fuel Rail Pump Control Valve Stuck Closed	<ul style="list-style-type: none"> <li>• Fuel trim activity .80 to 1.20</li> <li>and</li> <li>• Pressure control activity &lt; -4.0 MPa</li> <li>and</li> <li>• Difference between target and actual pressure &lt; -4.00 MPa</li> </ul>
P150A	Engine Off Time Performance	<ul style="list-style-type: none"> <li>• Difference between engine off time and ECM after run time &lt; -8 Sec</li> <li>• Difference between engine off time and ECM after run time &gt; -8 Sec.</li> </ul>
P169A	ECM In Transport Mode	Transport mode active
P2101	Throttle Actuator Control Motor Circuit Range/ Performance Signal Range Check	<ul style="list-style-type: none"> <li>• Duty cycle &gt;80%</li> <li>• ECM power stage, no failure or</li> </ul>
	Rationality Check	<ul style="list-style-type: none"> <li>• Deviation throttle valve angles vs. calculated value 4.0 - 50.0%</li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P2106	Throttle Actuator Control System - Forced Limited Power Open or Short to Battery Voltage	Internal check failed
	Short to Battery Voltage or Short to Ground	Internal check failed
	Temperature / Current Monitoring	Internal check failed
	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 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
P2138	Accelerator Pedal Position Sensor D / E Voltage Correlation	Signal voltage: Difference between signal APP1 and APP2 > 0.17 to 0.70 V
P2146	Fuel Injector Group A Supply Voltage Circuit Open	<ul style="list-style-type: none"> <li>• High side signal current, &lt; 2.60 A</li> <li>or</li> <li>• High side signal current &gt; 14.90 A</li> </ul>
P2149	Fuel Injector Group B Supply Voltage Circuit Open	<ul style="list-style-type: none"> <li>• High side signal current, &lt; 2.60 A</li> <li>or</li> <li>• High side signal current &gt; 14.90 A</li> </ul>
P2152	Fuel Injector Group "C" Supply Voltage Circuit Open	<ul style="list-style-type: none"> <li>• High side signal current, &lt; 2.60 A</li> <li>or</li> <li>• High side signal current &gt; 14.90 A</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P2155	Fuel Injector Group "D" Supply Voltage Circuit/Open	<ul style="list-style-type: none"> <li>• High side signal current, &lt; 2.60 A</li> <li>or</li> <li>• High side signal current &gt; 14.90 A</li> </ul>
P2177	System too lean off idle, (Bank 1)	Fuel adaptive value > 30%
P2178	System too rich off idle, (Bank 1)	Fuel adaptive value < -30%
P2179	System too lean off idle, (Bank 2)	Fuel adaptive value > 30%
P2180	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 to 70° C
P2184	Engine Coolant Temperature Sensor On Radiator Outlet Circuit Low	Signal voltage < 0.20 V
P2185	Engine Coolant Temperature Sensor On Radiator Outlet 2 Circuit High	Signal voltage > 4.95 V
P2187	System Too Lean At Idle, (Bank 1)	Fuel adaptive value > 6.0%
P2188	System Too Rich At Idle, (Bank 1)	Fuel adaptive value < -6.0%
P2189	System Too Lean At Idle, (Bank 2)	Fuel adaptive value > 6.0%
P2190	System Too Rich At Idle, (Bank 2)	Fuel adaptive value < -6.0%
P2195	Heated Oxygen Sensor Stuck Lean (Bank 1, Sensor 1)	• Delta lambda of 2nd lambda control loop > 0.059
P2196	O2 Sensor Signal Biased/ 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



DTC	Error Message	Malfunction Criteria and Threshold Value
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>• O2S signal front 1.49 - 1.51 V and</li> <li>• Difference between maximum and minimum value of O2S voltage signal front n.a.</li> </ul> or <ul style="list-style-type: none"> <li>• Delta lambda controller &gt; 0.07</li> </ul> or <ul style="list-style-type: none"> <li>• Lambda control at min or max limit</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• O2S signal front 1.49 - 1.51 V and</li> <li>• Difference between maximum and minimum value of O2S voltage signal front n.a.</li> </ul> and <ul style="list-style-type: none"> <li>• No reaction on commanded stepwise change of lambda setpoint &lt;&gt; 1</li> </ul>
P2240	Heated Oxygen Sensor 2 Positive Current Control Circuit open (Bank 2 Sensor 1)	<ul style="list-style-type: none"> <li>• O2S signal front 1.49 to 1.51 V and</li> <li>• Difference between maximum and minimum value of O2S voltage signal front n.a.</li> </ul> and <ul style="list-style-type: none"> <li>• Delta lambda controller &gt; 0.07</li> </ul> or <ul style="list-style-type: none"> <li>• Delta lambda controller &gt; 0.07</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• O2S voltage signal front 1.49 to 1.51</li> </ul> and <ul style="list-style-type: none"> <li>• Difference between maximum and minimum value of O2S voltage signal front n.a.</li> </ul> and <ul style="list-style-type: none"> <li>• No reaction on commanded stepwise change of lambda setpoint &lt;&gt; 1</li> </ul>
P2243	Heated Oxygen Sensor Reference Voltage Circuit / Open (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>• O2S signal front &gt; 4.70 V and Internal resistance &gt; 950 Ohms</li> <li>• O2S signal front &lt; 0.20 V and Internal resistance &gt; 950 Ohms</li> </ul>

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P2247	Heated Oxygen Sensor 2 Reference Voltage Circuit Open (Bank 2 Sensor 1)	<ul style="list-style-type: none"> <li>• O2S signal front &gt; 4.70 V and Internal resistance &gt; 950 Ohms</li> <li>• O2S signal front &lt; 0.20 V and Internal resistance &gt; 950 Ohms</li> </ul>
P2251	Heated Oxygen Sensor Negative Current Control Circuit Open (Bank 1 Sensor 1)	<ul style="list-style-type: none"> <li>• O2S signal front 1.47 - 1.52 V</li> <li>• and internal resistance &gt; 950 ohms</li> </ul>
P2254	Heated Oxygen Sensor 2 Negative Current Control Circuit open (Bank 2 Sensor 1)	<ul style="list-style-type: none"> <li>• O2S signal front 1.47 - 1.52 V</li> <li>• and internal resistance &gt; 950 ohms</li> </ul>
P2270	Oxygen Sensor After Three Way Catalytic Converter Sensor Signal Stuck Lean (Bank 1 Sensor 2)	<ul style="list-style-type: none"> <li>• O2S signal rear not oscillating at reference &lt; 0.65 V</li> <li>• Enrichment after stuck lean 25%</li> </ul>
		<ul style="list-style-type: none"> <li>• Signal voltage of <math>\geq 0.15</math> V after oxygen mass &gt; 1100 to 1800 mg</li> <li>• Number of checks <math>\geq 1</math></li> </ul>
P2271	Oxygen Sensor After Three Way Catalytic Converter Sensor Signal Stuck Rich (Bank 1 Sensor 2)	<ul style="list-style-type: none"> <li>• Sensor voltage of <math>\geq 0.15</math> V after oxygen mass &gt; 1100 to 1800 mg</li> <li>• Number of checks <math>\geq 1</math></li> </ul>
P2272	Oxygen Sensor 2 After Catalytic Converter Sensor Signal Stuck Lean (Bank 2 Sensor 2)	<ul style="list-style-type: none"> <li>• O2S signal rear not oscillating at reference &lt; 0.65 V</li> <li>• Enrichment after stuck lean 25%</li> </ul>
		<ul style="list-style-type: none"> <li>• Signal voltage of <math>\geq 0.15</math> V after oxygen mass &gt; 1100 to 1800 mg</li> <li>• Number of checks <math>\geq 1</math></li> </ul>
P2273	Oxygen sensor 2 After Catalytic Converter Sensor Signal Stuck Rich (Bank 2 Sensor 2)	<ul style="list-style-type: none"> <li>• Sensor voltage of <math>\geq 0.15</math> V after oxygen mass &gt; 1100 to 1800 mg</li> <li>• Number of checks <math>\geq 1</math></li> </ul>

DTC	Error Message	Malfunction Criteria and Threshold Value
P2279	Intake Air System Leak	<ul style="list-style-type: none"> <li>• Threshold to detect a defective system 2.10 and</li> <li>• Ratio of the tie system defective during the measurement window to the whole duration of the measurement window 0.80</li> </ul>
P2293	Fuel Pressure Regulator 2 Performance	<ul style="list-style-type: none"> <li>• Difference between target pressure vs. actual pressure: &gt; 1.50 mPa</li> <li>or</li> <li>• Difference between target pressure vs actual pressure: &lt; -1.50 MPa</li> </ul>
P2294	Fuel Pressure Regulator 2 Control Circuit	• Signal voltage 1.40 - 3.20 V
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

### Additional Emissions Regulations

DTC	Error Message	Malfunction Criteria and Threshold Value
P2400	Evaporative System Leak Detection Pump Control Circuit Open or Short To Battery Voltage	Signal voltage 4.40 - 5.60 V
P2401	Evaporative System Leak Detection Pump Control Circuit Short To Ground	Signal voltage < 2.15 to 3.25 V
P2402	Evaporative System Leak Detection Pump Sense Circuit Open or Short To Battery Voltage	Signal current > 3.0 A
P2403	Evaporative System Leak Detection Pump Sense Circuit Open or Short To Battery Voltage	Low signal voltage > 0.50 Sec.

<b>DTC</b>	<b>Error Message</b>	<b>Malfunction Criteria and Threshold Value</b>
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<ul style="list-style-type: none"> <li>• High signal voltage &gt; 12 Sec.</li> <li>• Number of checks 30</li> <li>• Cumulative time of high signal voltage during pumping &gt; 20 Sec.</li> </ul>
P2414	O2 Sensor Exhaust Sample Error (Bank 1, Sensor 1)	Threshold 1 <ul style="list-style-type: none"> <li>• Signal voltage 3.70 - 4.81 V</li> </ul> Threshold 2 <ul style="list-style-type: none"> <li>• Signal voltage 2.51 - 3.00 V</li> </ul> Depending on gain factor, that is used for sensor characteristic, the threshold is switched
P2415	O2 Sensor Exhaust Sample Error, (Bank 2 Sensor 1)	Threshold 1 <ul style="list-style-type: none"> <li>• Signal voltage 3.70 - 4.81 V</li> </ul> Threshold 2 <ul style="list-style-type: none"> <li>• Signal voltage 2.51 - 3.00 V</li> </ul> Depending on gain factor, that is used for sensor characteristic, the threshold is switched
P2539	Low Pressure Fuel System Sensor Out of Range High	Signal voltage > 4.80 V
P2541	Low Pressure Fuel System Sensor Out of Range Low	Signal voltage < 0.20 V
P2600	Coolant Pump Control Open or Short To Battery Voltage	Signal voltage 4.5 - 5.5 V
P2602	Coolant Pump Control Circuit Short To Ground	Signal voltage < 3.0 V
P2603	Coolant Pump Control Circuit Open or Short To Battery Voltage	Signal current 0.60 - 1.20 A
P2626	Oxygen Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1)	O2S signal front > 4.81 V
P2629	Oxygen Sensor 2 Pumping Current Trim Circuit/Open (Bank 2, Sensor 1)	O2S signal front > 4.81 V

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