



Repair Manual Golf R 2015 ➤

Generic Scan Tool

Engine ID	CYF B								
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Edition 04.2015





List of Workshop Manual Repair Groups

Repair Group

ST - Generic Scan Tool

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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ST – Generic Scan Tool

1 General Information

(Edition 04.2015)

Included in the contents of this Generic Scan Tool (GST) manual is a summary table of the vehicle specific OBD II Emission Related DTCs. The DTC table contains DTC Malfunction Criteria, Threshold Values, Secondary Parameters, Enabling Conditions, Monitoring Time Length, Frequency of Checks, and MIL Illumination information which can be used to accurately monitor and diagnose emissions related faults and perform functions required to run Modes 01 through 0A (if applicable) with a hand held scan tool.

This manual also contains the step by step procedures to accurately diagnose and repair a component or system once a DTC has been set. References to repair procedures and wiring diagrams can be found within the diagnostic test procedures.

- ◆ ⇒ [“1.1 Safety Precautions”, page 2](#)
- ◆ ⇒ [“1.2 Clean Working Conditions”, page 3](#)
- ◆ ⇒ [“1.3 High Voltage System General Warnings”, page 4](#)



1.1 Safety Precautions

Check for Technical Bulletins that may supersede any information included in this manual.



WARNING

Failure to follow these instructions may result in personal injury or possible death.

Check the Technical Bulletins for information, cautions and warnings that may supersede or supplement any information included in this manual.

When performing the drive cycle operation, pay strict attention to driving conditions and observe and obey all posted speed limits.

Test equipment must always be secured to the rear seat and operated by a second person. If test and measuring equipment is operated from the passenger seat, the person seated could be injured in the event of an accident involving deployment of the passenger-side airbag.

The fuel system is under pressure! Before opening the fuel system, place rags around the connection area. Then release pressure by carefully loosening the connection.

The engine section of the fuel system, after the high pressure pump, is under extremely high pressure! When working on engine or fuel injection system, fuel pressure must be relieved to residual pressure before opening high pressure components. Refer to the Service Manual for the proper procedure.

If the battery has not been disconnected, the fuel pump fuse must be removed before opening the fuel supply system as the fuel pump may be activated by the driver's door contact switch.

Testing of the EVAP and ORVR systems can result in the escape of explosive fuel vapor. Do not smoke while testing the EVAP system, and make sure the area you are working in is well ventilated.

Observe the following for all procedures, especially in the engine compartment due to lack of room:

- ◆ *Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- ◆ *Watch for sufficient clearance to all moving or hot components.*
- ◆ *Do not touch or disconnect the Ignition Coils, ignition wires, connecting parts or adapter cables when the ignition is on or the engine is running or turning at starting RPM.*
- ◆ *Only disconnect and reconnect wires for injection and ignition system, including test leads, when the ignition is turned off.*

When removing and installing components from full or partially full fuel tanks, observe the following:

- ◆ *The fuel tank must only be partially full. How much fuel can remain in the fuel tank may be read in the respective work description. Empty the fuel tank if necessary.*



◆ *Before starting work, switch on the exhaust extraction system and place an extraction hose close to the installation opening of the fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a radial fan (as long as motor is not in air flow) with a displacement greater than 15 m³/h can be used.*

◆ *Prevent fuel from contacting the skin! Wear fuel-resistant gloves!*

When servicing the engine control module (ECM), it may be necessary to use a heat gun. The heat gun, shear bolts, and parts of the protective housing will become extremely hot. Use extreme caution when working with or handling these parts to avoid personal injury.

Observe operating instructions when working with a heat gun. To prevent damage (burning) to the wiring and harness connections, insulation and the electronic components, perform outlined work steps exactly!

The cooling system is under pressure. To avoid scalding, use caution when opening the cooling system and servicing cooling system components!



Caution

The battery must only be disconnected and connected with the ignition switched off. Otherwise, the engine control module (ECM) can be damaged.

The use of nails, paper clips, or another unauthorized materials to back-probe harness connectors is strictly prohibited and may cause damage to the harness connectors, terminal ends or to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all harness connectors.

Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burned in the engine and will damage the oxygen sensors.

Secure all hose connections with the correct hose clips (the same as original equipment).

If engine is to be cranked without starting (for example; as part of a compression test), remove the fuses for the voltage supply of ignition coils and the fuel injectors.

An electrostatic charge can lead to functional problems of electrical components of the engine, transmission and selector lever mechanism. Touch a grounded object, e.g. a water pipe or a hoist, before working on electrical components.

Do not make direct contact with harness connector terminals.

Use only gold-plated terminals when servicing any component with gold-plated harness connector terminals.

1.2 Clean Working Conditions

Even minor contaminations can lead to malfunctions in the fuel injection system. When working on the fuel supply/injection system, pay careful attention to the following rules of cleanliness:

- ◆ Thoroughly clean all connections and the surrounding area before disconnecting.



- ◆ Place removed parts on a clean surface and cover. Use lint-free cloths.
- ◆ Carefully cover opened components or seal, if repairs are not performed immediately.
- ◆ When the system is open, do not work with compressed air. Do not move vehicle unless absolutely necessary.
- ◆ Install clean components: Remove the parts being replaced immediately prior to installation of the new parts. Do not use parts that have been stored unpacked (e.g. in tool boxes etc.).
- ◆ Electrical connectors that have been disconnected: Protect from dirt and moisture. Make sure connections are clean and dry when reconnecting.

1.3 High Voltage System General Warnings

Before performing any work on the high voltage system, always check with the importer if there are any questions regarding the terms “technician trained in electrical systems”, “high voltage technician”, “high voltage expert”, “high voltage systems”, or “hybrid systems”. Qualifications necessary for most of these terms are also provided below ⇒ [page 9](#) .

Before beginning work on the high voltage system, a high voltage technician ⇒ [page 9](#) , must de-energize the high voltage system. Refer to appropriate repair manual for high voltage system de-energizing.

For a list of work procedures requiring the high voltage system to be de-energized, refer to the tables listed below in: Working on the High Voltage System, Conventional Work Near High Voltage Components, and General Work ⇒ [page 6](#) .



WARNING

Read and follow the information below when de-energizing the high voltage system to reduce the risk of fatal injury.

- ◆ *Only a qualified technician (high voltage technician) should disable the high voltage system.*
- ◆ *The high voltage technician (HVT) makes sure the system is de-energized and cannot be re-energized again.*
- ◆ *The high voltage technician assures that the system cannot be re-energized again by safely storing the key, the High Voltage System Maintenance Connector - TW- and the pilot line connector.*
- ◆ *The high voltage technician (HVT) puts a sign on the vehicle saying the voltage is disabled.*
- ◆ *Only hybrid electrically instructed persons may perform all work (maintenance, tire changing, Convenience System) on vehicles with a high voltage system. If there is any uncertainty, discuss with the responsible high voltage technician.*
- ◆ *A high voltage technician must disable the system before any work can be performed on the high voltage electrical system or any other service work to the body.*
- ◆ *Only a high voltage expert (HVE) may perform repairs to the vehicle if it is not possible to disable the high voltage electrical system.*
- ◆ *Individuals with electrical medical equipment must not work on vehicles with a high voltage electrical system. Examples of electrical medical equipment include pain medication pumps, implanted heart defibrillators, pacemakers, insulin pumps and hearing aids.*



WARNING

Working with high voltage cables:

- ◆ *Do not support yourself or lay tools on the high voltage cables or on any of its components.*
- ◆ *When working near high voltage components and high voltage cables, do not use tools that generate heat, that have sharp edges or that are used for cutting or shaping, such as welding, soldering, hot air or thermal adhesive equipment.*
- ◆ *When working near high voltage components and high voltage cables, do not use tools that generate heat such as welding, soldering, hot air or thermal adhesive equipment.*
- ◆ *Do not excessively bend or flex high voltage cables.*
- ◆ *Always contact a high voltage technician (HVT) if there are questions or if something is not clearly understood.*

Check the contact surfaces on the potential equalization cables before installation.

The contact surfaces must be clean. There must be no rust or grease on them.

Follow all guidelines for clean working conditions.





Observe the following precautions when working on the high voltage system:

- ◆ Only technicians who are trained in electrical systems should work on high voltage system (hybrid) vehicles.
- ◆ When working on a hybrid vehicle, always inspect the hybrid components in the area where the work is being performed.
- ◆ Do not excessively bend or flex high voltage cables.
- ◆ Always contact a high voltage technician or a high voltage expert specializing in electrical systems if something is not understood or if there are questions.
- ◆ All the work described below is referencing removing, installing and replacing the individual components.

Working on the High Voltage System

During the Following Work	Minimum Qualifications, refer to ⇒ page 9
De-energizing the high voltage system	High voltage technician
Re-energizing the high voltage system	High voltage technician

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Electro-Drive Drive Motor - V141-	X		Technician trained in electrical systems
Electric Drive Power and Control Electronics - JX1-	X		Technician trained in electrical systems
High Voltage System Maintenance Connector - TW-		X	Technician trained in electrical systems
Electric A/C Compressor High Voltage Cable - P3-	X		Technician trained in electrical systems
Drive Motor High Voltage Wiring Harness - PX2-	X		Technician trained in electrical systems
High Voltage Wiring Harness For High Voltage Battery - PX1-	X		Technician trained in electrical systems
Hybrid Battery Unit - AX1- , Removing and Installing	X		Technician trained in electrical systems
Charging the Hybrid-Battery - A38- with High Voltage Battery Charger - VAS6565-	X		High voltage technician
Battery Regulation Control Module - J840-	X		High voltage technician
Battery Fan 1 - V457-		X	Technician trained in electrical systems
Air guides next to the Hybrid Battery Unit - AX1-		X	Technician trained in electrical systems
Air guides under the Hybrid Battery Unit - AX1-	X		Technician trained in electrical systems
Electrical A/C Compressor - V470-	X		Technician trained in electrical systems
Drive Motor Temperature Sensor - G712-	X		Technician trained in electrical systems
Drive Motor Rotor Position Sensor 1 - G713-	X		Technician trained in electrical systems



When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Three-Phrase Current Drive - VX54-	X		Technician trained in electrical systems
Electrical Drive Button - E656-		X	Technician trained in electrical systems
Fuse Electrical A/C Compressor - V470- in Electric Drive Power and Control Electronics - JX1-	X		Technician trained in electrical systems
Potential equalization cable (Ground [GND] wires)	X		Technician trained in electrical systems
Working on the coolant circuit for the high voltage components	X		Technician trained in electrical systems
Measuring insulation resistance	X		High voltage technician
Working when the system is de-energized and the ignition is on	X		Technician trained in electrical systems

Conventional Work Near High Voltage Components

When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ⇒ page 9
	Yes	No	
Spark plugs		X	Technician trained in electrical systems
Catalytic converter		X	Technician trained in electrical systems
Exhaust System		X	Technician trained in electrical systems
Coolant reservoir		X	Technician trained in electrical systems
Front brakes		X	Technician trained in electrical systems
Decoupler	X		Technician trained in electrical systems
Internal Combustion Engine, Removing and Installing	X		Technician trained in electrical systems
Transmission without Electro-Drive Drive Motor - V141- , Removing and Installing	X		Technician trained in electrical systems
Fuel Tank		X	Technician trained in electrical systems
Front subframe		X	Technician trained in electrical systems
Rear axle		X	Technician trained in electrical systems
Underbody Trim		X	Technician trained in electrical systems
Welding (Cover high voltage components with non-combustible materials and then perform a visual inspection)	X		Technician trained in electrical systems
Vehicle Body Work (Using an Alignment Bench)	X		Technician trained in electrical systems



When Working on the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ➔ page 9
	Yes	No	
When working near high voltage components and high voltage cables, do not use tools that generate heat, that have sharp edges or that are used for cutting or shaping, such as welding, soldering, hot air or thermal adhesive equipment (Cover high voltage components with non-combustible materials and then perform a visual inspection).	X		Technician trained in electrical systems
Left Front Headlamp - MX1- , Removing and Installing		X	Technician trained in electrical systems
Right Front Headlamp - MX2- , Removing and Installing		X	Technician trained in electrical systems
Headlamp Bulbs, Removing and Installing		X	Technician trained in electrical systems

General Work

When Working On the Following Components	The High Voltage System Must Be De-energized By A High Voltage Technician Prior To Beginning the Work?		Minimum Qualifications, refer to ➔ page 9
	Yes	No	
12V Battery, removing and installing		X	Technician trained in electrical systems
General controls modules and electric components, 12V, removing and installing		X	Technician trained in electrical systems
Fluids, coolant and fluids, draining and filling		X	Technician trained in electrical systems
Refrigerant extracting, evacuating, filling		X	Technician trained in electrical systems
Refrigerant pipes directly to the A/C compressor	X		Technician trained in electrical systems
A/C System, flushing		X	Technician trained in electrical systems
Peripheral refrigerant line (work that does not involve the A/C compressor directly without opening the refrigerant circuit, for example, loosening and tightening the refrigerant line)		X	Technician trained in electrical systems
Work with the engine raised, engine mount	X		Technician trained in electrical systems
Emissions test		X	Technician trained in electrical systems
Follow the instructions in the paint handbook when performing any paint/drying work		X	Technician trained in electrical systems



Qualification Explanation

Qualification	Area of Application
Hybrid electrically instructed person	May perform general work and Maintenance services on the vehicle. May be requested by the high voltage technician to perform mechanical work on the tension-free high voltage system.
High voltage technician (HVT)	The high voltage technician has the same authorization as a technician trained in electrical systems due to their qualifications. The high voltage technician can also: <ul style="list-style-type: none"> ◆ 1. De-energize the system. ◆ 2. Secure the system so that it cannot be energized again. ◆ 3. Ascertain that the system is definitely de-energized (certified measurement). ◆ 4. Assign work on the high voltage system to the hybrid electrically instructed person. ◆ 5 Put the vehicle back in operation.
High voltage expert (HVE)	A high voltage expert (HVE) is actually a high voltage technician (HVT) but with an extra qualification that allows them to de-energize the high voltage system in the case that a high voltage technician is not able to perform measurements with the standard tools and equipment. The high voltage expert must continue the work if the high voltage technician does not have the authority to work on the high voltage system. The high voltage expert is responsible exclusively to de-energize the high voltage system if it cannot be de-energized by the high voltage technician using the usual means or methods.



2 Description and Operation

- ◆ ⇒ [“2.1 On Board Diagnostic Systems”, page 10](#)
- ◆ ⇒ [“2.2 Evaporative Emission System”, page 10](#)
- ◆ ⇒ [“2.3 Electronic Throttle Control \(ETC\) System”, page 12](#)
- ◆ ⇒ [“2.4 Electronic Power Control \(EPC\) Warning Lamp”, page 12](#)
- ◆ ⇒ [“2.5 Engine Control Module \(ECM\)”, page 13](#)
- ◆ ⇒ [“2.6 Malfunction Indicator Lamp \(MIL\)”, page 13](#)
- ◆ ⇒ [“2.7 Controller Area Network \(CAN\)”, page 13](#)
- ◆ ⇒ [“2.8 Fuel Supply”, page 14](#)
- ◆ ⇒ [“2.9 Ignition and Timing”, page 15](#)
- ◆ ⇒ [“2.10 Variable Valve Timing”, page 16](#)
- ◆ ⇒ [“2.11 Exhaust-Gas Recirculation \(EGR\) System”, page 16](#)
- ◆ ⇒ [“2.12 Secondary Air Injection”, page 16](#)
- ◆ ⇒ [“2.13 Exhaust Systems”, page 16](#)

2.1 On Board Diagnostic Systems

On Board Diagnostics, or OBD, is an automotive term referring to a vehicle's self-diagnostic and reporting capability. OBD systems give the vehicle owner or repair technician access to the status of the various vehicle sub-systems. Modern OBD implementations use a standardized digital communications port to provide real-time data in addition to a standardized series of Diagnostic Trouble Codes (DTCs) which allow one to rapidly identify and remedy malfunctions within the vehicle. Legislation mandates a vehicle equipped with OBD-II to light up the fault indicator lamp if its emissions exceed the prevailing limit due to system malfunction.

All cars built since January 1st, 1996 (MY 1996) are equipped with OBD-II systems. Manufacturers started incorporating OBD-II in various models as early as 1994; however, some early OBD-II cars (MY 1994 and MY 1995) were not 100% compliant.

2.2 Evaporative Emission System

The evaporative emission system has been designed to minimize the release of hydrocarbons from the fuel system into the atmosphere. The evaporative emission system components all work together with the ECM to prevent fuel vapor from escaping and route it to the intake manifold to be burned during normal combustion.

The leak detection system checks the integrity of the evaporative emission system by pressurizing the system.

- ◆ There are 3 different types of evaporative emission systems used. These systems are explained below.
- ◆ ⇒ [“2.2.1 Leak Detection Pump \(LDP\) Evap System”, page 11](#)
- ◆ ⇒ [“2.2.2 Tank Leak Diagnostic Module \(DM - TL\) Evap System”, page 11](#)
- ◆ ⇒ [“2.2.3 Natural Vacuum Leak Detection \(NVL\) Evap System”, page 11](#)
- ◆ ⇒ [“2.2.4 EVAP System, Checking for Leaks”, page 11](#)



2.2.1 Leak Detection Pump (LDP) Evap System

The leak detection pump (LDP) is integrated into the EVAP system and can have two functions. The LDP can:

- ◆ Pressurize the EVAP system and detect a drop in pressure that would indicate a leak.
- ◆ Function as the EVAP Canister Vent on vehicles that do not have a separate EVAP Canister Vent.

The LDP is a vacuum-driven, ECM controlled, diaphragm pump. In order to operate, the engine must be running and vacuum applied to the Vacuum Switch.

2.2.2 Tank Leak Diagnostic Module (DM - TL) Evap System

The canister purge valve can be actively checked using the Tank Leak Diagnostic Module (DM - TL). For this purpose the electric pump is shortly activated while the combustion engine is running, to build up a minor pressure in the fuel tank and monitor the pressure decay after opening the canister purge valve. Optionally as a quick pass method, the monitoring can be carried out by passively monitoring the fuel mixture deviation when the canister purge valve is opened. If a significant fuel mixture deviation is detected, the purge valve monitor passes. The Tank Leak Diagnostic Module (DM - TL) consists of an electrically operated air pump, an orifice with a defined diameter serving as a reference leak, and a change-over valve switching the air flow between the reference leak and the tank. If neither the pump nor the change-over valve is activated, the tank is ventilated through a bypass in the module.

2.2.3 Natural Vacuum Leak Detection (NVLD) Evap System

The system utilizes an engine-off natural vacuum evaporative system integrity check that tests for leaks with a diameter of 0.020 inch while the engine is off and the ignition is off. The natural vacuum leak detection (NVLD) evaporative system integrity check uses a pressure switch to detect evaporative system leaks. The correlation between the pressure and the temperature in a sealed system is used to generate a vacuum in the tank when the temperature drops. If a sufficient temperature drop is detected for a minimum time period, the vacuum level in a sealed system will exceed the threshold to close the NVLD pressure switch. Therefore, if the switch does not close under these conditions, a leak is detected. If the switch closes, the system is considered to be leak-free.

2.2.4 EVAP System, Checking for Leaks

The following procedure is used to diagnose EVAP System leaks.

Special tools and workshop equipment required

- ◆ Smoke tester.
- ◆ EVAP and Fuel Supply System Vacuum hose and line routing diagram.

Leak checking

- Using a Smoke tester, check the Evaporative Emission (EVAP) canister system for leaks.
- Always follow the manufacturers directions for the proper installation and operation of the smoke tester being used.



If a leak is detected:

- Check the fuel filler cap seal for damage and for proper installation. Replace if necessary.
- Check all hose connections of the fuel supply system and replace or repair any leaking lines.
- Check all hose connections of the EVAP system and replace or repair any leaking lines.
- Check that the seal under the locking flange is properly tightened on the fuel tank.
- Secure all hose connections using appropriate fittings for the model type.
- Replace seals and gaskets when performing repair work.
- Repair or replace any damaged component.

If no leaks are found in the EVAP system:

- Erase the DTC memory if a DTC was set. Refer to [⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 26](#).
- Perform a road test to verify repair.

If a DTC was set and does not return:

Diagnosis complete. Generate readiness code. Refer to [⇒ “3.2 Readiness Code”, page 19](#).

If the same DTC does return and no leaks are found in the EVAP system:

- Check for any related TSB's.
- Perform the diagnostic test procedure for the suspected component.

2.3 Electronic Throttle Control (ETC) System

The electronic throttle control (ETC) system consists of the accelerator-pedal module, the engine control module (ECM), and the electronic throttle body. The electronic throttle body mainly consists of the throttle valve, the electric throttle-valve drive element, and the throttle-valve position sensor (TPS). The drive element is a DC servomotor, which acts on the throttle-valve shaft via a gear unit. The throttle-valve position sensor is a redundant sensor system that detects the position of the throttle valve. The sensors have opposite resistance curves so that the ECM can always cross check the signals to ensure the correct position of the throttle valve is always known.

The driver command is detected by a redundant sensor system in the accelerator-pedal module, and the signal is sent to the engine control module. The engine control module then determines the required throttle-valve position by performing calculations from data measured by sensors such as accelerator pedal position sensor, engine speed sensor and vehicle speed sensor. The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.

2.4 Electronic Power Control (EPC) Warning Lamp

When the ignition is switched on, the engine control module (ECM) checks the electronic throttle control system for static system integrity (e.g. circuit integrity, communications, etc); the electronic power control (EPC) warning light is turned on via the Instrument Cluster during this process. Shortly after engine start,



the EPC warning light is turned off if no malfunction in the electronic throttle control system is detected. In the event of a malfunction while the engine is running, the ECM will activate the EPC warning light via the Instrument Cluster and at the same time, a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

2.5 Engine Control Module (ECM)

The Engine Control Module (ECM) is a generic term for any embedded system that controls one or more of the electrical systems or subsystems in a vehicle. It controls a series of actuators on an internal combustion engine to ensure that driver commands (e.g. to accelerate) are translated into appropriate engine performance. It reads values from a multitude of sensors, interprets the data, and adjusts the engine actuators accordingly. The ECM also interacts with the transmission control module (TCM), ABS/traction/stability control module and other vehicle function related control systems.

ECM controlled systems and functions (performance and emission related) will be introduced in the following chapters. These include the OBD system, controller area network (CAN), throttle control module, fuel supply, ignition, variable valve timing, exhaust-gas recirculation, secondary air injection, exhaust system, and EVAP system.

2.6 Malfunction Indicator Lamp (MIL)

When the ignition is switched on, the Engine Control Module (ECM) performs checks on static system integrity (e.g. circuit integrity, communications, etc). The Malfunction Indicator Lamp (MIL) is switched on during this process via the Instrument Cluster. After engine starts, the ECM examines engine operation for potential malfunction(s) or failure(s) that can lead to increased emission values. If no malfunction is detected, the ECM switches off the MIL via the Instrument Cluster.

In the event of a malfunction during the operation of the engine, the ECM will activate the MIL via the instrument cluster and at the same time, a Diagnostic Trouble Code (DTC) is stored in the ECM memory. In OBD systems, the MIL can have up to three stages: steady, flashing and Stop Vehicle. A steady MIL indicates a minor fault (e.g. a failing oxygen sensor) whereas a flashing MIL indicates a more severe malfunction that could result in damage of engine or exhaust system components (e.g. the catalytic converter) if left uncorrected for an extended period. This would also indicate a severe fault. The three stages are 1. ON, then OFF; 2. ON steady; 3. flashing constantly. The 3rd stage indicates damage may occur and driver must stop.

2.7 Controller Area Network (CAN)

Overview

The Controller Area Network (CAN) bus is a message-based protocol that allows control units and devices to communicate with each other using a shared network. With this system, control units of the various electronic systems are no longer interconnected by multiple separate cables. This does away with a large number of electrical connections and results in a reduced likelihood of failure of the device network.

Broadcast Communication

Each of the devices on the network has a CAN circuit and is therefore is considered "intelligent". All devices on the network see all transmitted messages. Each device can determine if a message is relevant or if it should be filtered out. This structure allows modifications to CAN networks with minimal impact. Addi-



tional non-transmitting nodes can be added without modification to the network.

Priority

Every message has an assigned priority. If two nodes try to send messages simultaneously, the one with the higher priority gets transmitted and the one with the lower priority gets postponed. This arbitration does not affect other messages and results in non-interrupted transmission of the highest priority message

2.8 Fuel Supply

Overview

The fuel supply system delivers fuel to an internal combustion engine. With carburetors being replaced by fuel injections systems in the late 1980s and 1990s, the most common types of fuel supply system currently in use are throttle body injection (single-point injection), multiport injection (MPI) and direct injection (DI).

Fuel injectors atomize fuel because high pressure is forcing the fuel through a small nozzle in the injector into the intake air stream or the combustion chamber. This process is often controlled by the ECM and is dependent on data received from other sources (e.g. mass air flow sensor, throttle position sensor, etc.) to determine the precise amount of fuel needed for any given operating condition. The primary advantages of fuel injection over carburetor are improved fuel economy, increased power output and reduced emissions. The following sections will discuss each fuel injection concept in detail.

Throttle Body Injection

Throttle body injection uses a single electrically controlled injector at the throttle body. The fuel is drawn by an electric fuel pump out of the fuel tank and flows through a paper filter into the fuel injector. Since injection happens at the same location as the carburetor, very little engine redesign (intake manifold, fuel line routing, etc.) is necessary. The cost saving of throttle body injection compared to other fuel injection methods encouraged vast adoption in the late 1980s and early 1990s.

Throttle body injection system also inherits many disadvantages of the carburetor. One of them being the inability to precisely control the amount of fuel supplied into each cylinder, and is unable to precisely control combustion and emissions. It also restricts the design of intake manifold as any sharp bends in the intake path will cause atomized fuel to accumulate on the outer wall of the intake path. Supplying moderate engine heat to the intake manifold is also necessary to ensure that the fuel stay vaporized. This results in a relatively high intake air temperature and compromises performance.

Multiport Injection (MPI)

Multiport injection (MPI) consists of an injector for each cylinder just upstream of the intake valve. The fuel pump delivers the fuel into a high-pressure line where it flows to the fuel rail and injectors. When activated by the ECM, each injector sprays fuel at the intake port of its corresponding cylinder – this allows individual cylinders to receive the right amount of fuel in a more precisely timed manner. Sequential fuel injection mode can be applied to activate each injector individually to improve engine response. Lowered fuel consumption and emissions are also achieved.

Sequential multiport injection is still the most common fuel injection system found on most economy cars thanks to its high efficiency, control simplicity and low manufacturing cost (compared to direct injection). However, to further improve drivability (performance) while reducing emissions and fuel consumption, direct injection becomes a superior alternative.



Direct Injection

Injectors in directly injected (DI) engines are mounted on the cylinder head and fuel is injected directly into the engine's combustion chamber. In order to overcome the pressure in the combustion chamber during compression and power stroke, injectors often operate at a primary pressure as high as 3000 psi. At such extreme pressure level, no single fuel pump can supply the required pressure directly from the fuel tank to the injectors. Instead, a low-pressure and a high-pressure system are employed. The low-pressure system principally utilizes the same fuel systems and components for multiport injected engines. The high-pressure system consists of a high-pressure fuel pump driven directly by the camshaft, a fuel rail (high-pressure accumulator), a high-pressure sensor and, depending on the system, a pressure-control valve or a pressure limiter. The injectors are operated by the ECM to send a precise amount of fuel from the high-pressure rail directly into the combustion chamber.

The distinctive difference between direct injection and other injection methods is that direct injection offers the flexibility regarding when in the combustion cycle the fuel is added and how. MPI systems can only add fuel during induction; A DI system can add fuel whenever it needs to. For example, fuel can be added during induction to create a homogeneous charge then added again after ignition to enhance power delivery under full load conditions.

VW/Audi Fuel Stratified Injection (FSI)

The goal of a stratified-charge operation is to form an ignitable mixture near the spark plug at the instant of ignition. This means that, instead of supplying the corresponding stoichiometric fuel quantity to the amount of air in the combustion chamber, the fuel interacts only with a portion of the air before it is conveyed to the spark plug. The rest of the fresh air surrounds the stratified charge allowing an ultra-lean condition with air-fuel ratio exceeding 50:1 in some instances. As less fuel is used to "burn" more air, stratified injection helps to further reduce fuel consumption when the engine is operating in low-load conditions (e.g. highway cruising). This is created by designing the combustion chamber so that a "swirling" effect of the air-fuel charge is caused.

2.9 Ignition and Timing

Ignition

A spark ignition (SI) engine requires a spark to initiate combustion in the combustion chamber. Voltage is supplied to the spark plug where the electricity will arc across a gap at a voltage as high as 100 kilovolts. The ECM determines the precise moment to fire each spark plug using ignition logic which is pre-programmed into the ECM as a function of engine speed and load. An optimally calibrated ignition system ensures consistent and reliable ignition under all conditions. Knock or misfire as a result of incorrect ignition can lead to destruction of engine components or damage of the catalytic converter.

Timing

Shifts in the moment of ignition (ignition timing) can result in increased emissions, decreased performance and fuel economy. Whereas more spark advance improves power and fuel economy, it also raises HC and NOx emissions. Excessive spark advance can cause engine knock which is potentially destructive to engines. If the ECM detects knock from a signal sent by a knock sensor, it will delay (retard) the timing of the spark. Excessive spark retard lowers power output and produces high exhaust temperatures, which can also harm the engine. Carefully designed ignition logic provides optimum timing that best balances performance, fuel economy and emissions.



2.10 Variable Valve Timing

Engines equipped with variable valve timing provide the option of adjusting the phase of the camshaft with respect to the crankshaft. This allows the ECM to control the time at which the valves open or close, and therefore better assists engine "breathing" at various engine speeds. When engine speed increases, the duration of intake and exhaust stroke shortens so that less fresh air can be drawn into the combustion chamber and less exhaust gas can escape. In such a scenario, the ECM opens the intake valve before the exhaust gas has completely left the combustion chamber, and their considerable velocity assists in drawing in the fresh charge – this is referred to as "valve overlap".

In addition to valve timing, some engines also employ variable valve lift that switches to a more aggressive camshaft-lobe profile as engine speed increases. A more aggressive camshaft-lobe profile actuates valves more rapidly and lifts valves to a greater magnitude in comparison to a normal camshaft-lobe profile. This improves intake and exhaust flow rate, allowing engines to raise maximum operating speed and power output.

2.11 Exhaust-Gas Recirculation (EGR) System

Exhaust-Gas Recirculation (EGR) can be utilized to control the cylinder charge and therefore the combustion process. The exhaust gas that is recirculated to the intake manifold increases the proportion of inert gas in the fresh gas filling; this results in a reduction in the peak combustion temperature and, in turn, a drop in temperature-dependent NO_x emission.

Exhaust-gas recirculation is made possible by a connection between the exhaust pipe and the intake manifold. Due to the pressure differential, the intake manifold can draw in exhaust gas via this connection. Together with the exhaust-gas recirculation valve, the ECM adjusts the opening cross-section and therefore controls the partial flow tapped from the main exhaust flow. A malfunction in exhaust-gas recirculation system can result in performance loss and increased emissions. In such a scenario, the Malfunction Indicator Lamp (MIL) lights up and a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

2.12 Secondary Air Injection

Additionally injecting air into the exhaust pipe triggers an exothermic (release of heat) reaction. This leads to the combustion of HC and CO components that prevail mainly during the warm up phase. This oxidation process releases additional heat. Consequently, the exhaust gas becomes hotter, causing the catalytic converter to heat up at a faster rate. For spark-ignition engines, secondary-air injection is an effective means of reducing HC and CO emissions after starting the engine and to rapidly heat up the catalytic converter. This ensures that the conversion of NO_x emissions commences earlier.

An electronically controlled valve operates the secondary-air valve (a one-way check valve). The ECM actuates the pump and the control valve, ensuring that secondary air can be injected at a defined point in time. The secondary air must also be injected as close to the outlet valve as possible in order to exploit the high temperatures to utilize the exothermic (release of heat) reaction effectively.

2.13 Exhaust Systems

Overview

There are three important functions of the exhaust system: to reduce the pollutants in exhaust gas, muffle engine combustion noise and to discharge exhaust gas at a convenient location on



the vehicle (often underneath the rear bumper). A passenger-car exhaust system consists of the following; exhaust manifold, exhaust treatment components, sound absorption components and the system of pipes connecting these components.

Exhaust Manifold

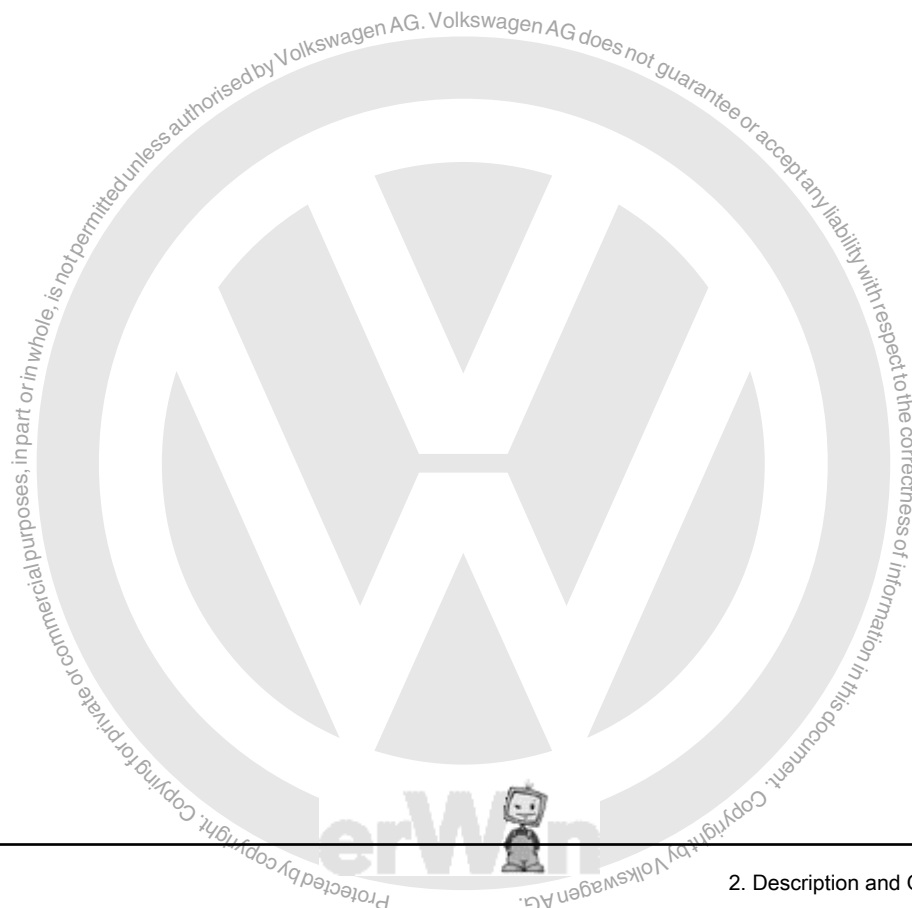
The manifold is an important component in the exhaust system. It routes the exhaust gas out of the cylinder outlet ports into the subsequent exhaust system. The geometry of the manifold (i.e. length and cross-section of the individual pipes) has an impact on the performance characteristics, the acoustic behavior of the exhaust system, and the exhaust temperature. In some cases, the manifold is insulated with an air gap to quickly reach high exhaust temperature and to shorten the time taken by the catalytic converter to reach its operating temperature.

Emission Control

The primary emission control component is the catalytic converter, which breaks down the gaseous pollutants in the exhaust gas (CO, HC and NOx). Catalytic converters are installed as close as possible to the engine so that they can quickly reach their operating temperature and therefore be effective in urban driving. It also bears a sound-absorbing function, especially to the higher frequency portion of the engine combustion noise.

Sound Absorption

Mufflers dampen or absorb the noise produced by engine combustion. In principle, they can be installed at any position in the exhaust system. However, they are mostly located in the middle and rear sections of the exhaust system. Depending on the number of cylinders and engine output, generally 1 to 3 mufflers are used in an exhaust system. In V-engines, the left and right cylinder banks are often run separately, each being fitted with its own catalytic converters and mufflers. Although the aim of mufflers is to reduce noise in compliance with legislations, they can also help to create the sound specific to the type of vehicle.





3 Diagnosis and Testing

- ◆ ⇒ ["3.1 Preliminary Check", page 18](#)
- ◆ ⇒ ["3.2 Readiness Code", page 19](#)
- ◆ ⇒ ["3.3 Diagnostic Modes 01 - 09", page 21](#)
- ◆ ⇒ ["3.4 Engine DTC Tables", page 45](#)
- ◆ ⇒ ["3.5 Transmission DTC Tables", page 296](#)
- ◆ ⇒ ["3.6 Diagnostic Procedures", page 356](#)

3.1 Preliminary Check



Note

- ◆ *Before performing any pin point test or component diagnosis, a Preliminary Check must be performed.*
- ◆ *Check for Technical Bulletins that may supersede any information included in the repair manual or GST Manual.*
- ◆ For Electrical Testing: Refer to ⇒ [page 18](#).
- ◆ For Fuel System Mechanical Testing: Refer to ⇒ [page 19](#).

Electrical Testing

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • CONNECT: Scan Tool. • IGNITION: ON. • CHECK: For stored or related DTCs. – Were any other DTCs stored? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 18. – NO: ◆ GO TO: Step 3 ⇒ page 18.
2	<ul style="list-style-type: none"> • Repair these DTCs first before performing any of the following steps. 	<ul style="list-style-type: none"> ◆ GO TO: Proper Diagnostic procedure per the stored DTC. Refer to ⇒ "3.4 Engine DTC Tables", page 45.
3	<ul style="list-style-type: none"> • Using the Scan Tool, erase the DTC memory. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. • Perform a road test to attempt to duplicate the customers complaint. – Does DTC return? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 18. – NO: ◆ GO TO: Step 5 ⇒ page 18.
4	<ul style="list-style-type: none"> • Perform the diagnostic procedure for that DTC. 	<ul style="list-style-type: none"> ◆ GO TO: Proper Diagnostic procedure per the stored DTC. Refer to ⇒ "3.4 Engine DTC Tables", page 45.
5	<ul style="list-style-type: none"> • FAULT: Intermittent or a sporadic condition. • CHECK: Suspected components. • PERFORM: Visual Inspection of wiring and components. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector. 	<ul style="list-style-type: none"> ◆ Perform a road test to verify the repair. ◆ Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 19.



Fuel System Mechanical Testing

Check the following items for possible mechanical delivery deficiency:

- Fuel level in tank is too low.
- Fuel lines pinched.
- Fuel filter plugged.
- Fuel pump delivery unit internal leak.
- Clogged injectors.
- Poor fuel quantity delivery. Refer to appropriate repair manual.

3.2 Readiness Code



Caution

When performing the Readiness drive cycle operation, pay strict attention to driving conditions and observe and obey all posted speed limits.

Readiness code description

Diagnostics are performed at regular intervals during normal vehicle operation. After repairing an emissions related system, a readiness code is generated by road testing the vehicle.

If a malfunction is recognized during the drive cycle, it will be stored in the DTC memory.

The OBD drive cycle operation will be monitored with a hand held diagnostic tool. Consult the manufacturer's instruction manual for correct tool operation.

The readiness code is erased every time the DTC memory is erased or any time the battery is disconnected. If the DTC memory has been erased or the battery is disconnected, a new readiness code must be generated.

Only erase the DTC memory if a DTC has been stored.

General recommendations

Most monitors will complete easier and quicker using a "steady-foot" and "smooth" acceleration during the drive cycle operation.

Operating conditions

For the EVAP monitor test, the coolant temperature and the ambient air temperature must be between 10° C and 35° C with a difference between them no greater than 4° C. The ambient air temperature must not change more than 4° C during the drive cycle procedure (e.g. when driving out of a heated workshop in the winter).



Note

Do not assume that the scan tool ID and engine code are correct if the scan tool communicates. The scan tool does not use the ID to establish communication—the units are automatically identified.

Test requirements

- NO DTC in memory.
- Switch OFF all electrical and electronic accessories.



- Necessary driving speed: 50 – 70 mph.
- Drive profile takes approximately 60 – 90 min.

Readiness Drive Cycle Procedure

- CONNECT: Scan Tool.

Step	Procedure	Result / Action to Take
1	Activate Monitors: • START: Engine and idle for 2 – 3 min.	<ul style="list-style-type: none"> ◆ Monitoring Active. ◆ Executes Misfire Monitoring.
2	O2 Sensor Monitoring: • DRIVE: Vehicle at 45 – 55 mph for a continuous 7 minute period. Avoid stopping.	<ul style="list-style-type: none"> ◆ Executes O2 Sensor Monitoring. ◆ Executes Fuel Trim Monitoring. ◆ Executes EVAP Monitoring.
3	Fuel Cut-Off Monitoring: • ACCELERATE: Vehicle to an engine speed of 5,000 RPM; lift off the throttle until the engine speed is around 1,200 RPM.	<ul style="list-style-type: none"> ◆ Fuel Cut-Off Monitoring Ready.
4	Catalyst Monitoring: • ACCELERATE: Vehicle smoothly to 60 – 65 mph, cruise at a constant speed for 5 min.	<ul style="list-style-type: none"> ◆ Executes Catalyst Monitoring. ◆ Executes O2 Sensor Monitoring. ◆ Executes Fuel Trim Monitoring. ◆ Executes Misfire Monitoring. ◆ Executes EVAP Monitoring.
5	Secondary Air Injection, EVAP Monitoring: • DRIVE: Vehicle for 30 – 40 min. at a constant speed of 50 – 70 mph in high gear for 2 min with no coasting.	<ul style="list-style-type: none"> ◆ Executes Secondary Air Injection Monitoring. ◆ Executes EVAP Monitoring. • Check the status of the readiness code.

- If any engine monitor fails the drive cycle test. Repeat the drive cycle test until all engine monitors have successfully run through and passed.



Note

- ◆ When repeating the drive cycle operation for a failed evaporative or thermostat monitor, allow the engine to cool until the coolant temperature and the ambient air temperature are between 10° C and 35° C with a difference between them no greater than 4° C and then repeat the drive cycle operation.
- ◆ Depending on the scan tool used, the readiness code status may be displayed as complete, passed or OK. At an ambient air temperature < 7° C, the setting of the readiness for the NOx catalytic converter test is delayed. Here the vehicle must be driven considerably longer.

Readiness Codes and Monitoring Completed

- 1 - If any engine monitor fails the drive cycle test, repeat the drive cycle test until all engine monitors have successfully run through and passed.
- 2 - If the drive cycle operation fails again:
- 3 - Check the DTC memory for stored DTCs.
- 4 - Repair the vehicle if necessary.



- 5 - Repeat the drive cycle operation until all engine monitors have successfully run through and passed.
- 6 - Remove the scan tool and switch the ignition off.

3.3 Diagnostic Modes 01 - 09

The information provided in Modes 01 through 09 displays the various levels of emission related data that may be monitored, as well as the ability to retrieve and read stored DTC trouble codes, erase stored DTC trouble codes, generate readiness codes, and select the various PIDs and Test-IDs used within the modes to monitor the engine, and emission related component parameters.



Note

Depending on scan tool and protocol used, the information in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

- ◆ ⇒ [“3.3.1 Diagnostic Mode 01 - Read Current System Data”, page 21](#)
- ◆ ⇒ [“3.3.2 Diagnostic Mode 02 - Read Operating Conditions”, page 23](#)
- ◆ ⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 24](#)
- ◆ ⇒ [“3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 26](#)
- ◆ ⇒ [“3.3.5 Diagnostic Mode 05 - Read Oxygen Sensor Monitoring Test Results”, page 26](#)
- ◆ ⇒ [“3.3.6 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, 2015 MY”, page 27](#)
- ◆ ⇒ [“3.3.7 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, 2016 MY”, page 34](#)
- ◆ ⇒ [“3.3.8 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle”, page 41](#)
- ◆ ⇒ [“3.3.9 Diagnostic Mode 08 - Request Control of On-Board System, Test or Component”, page 42](#)
- ◆ ⇒ [“3.3.10 Diagnostic Mode 09 - Request Vehicle Information”, page 42](#)
- ◆ ⇒ [“3.3.11 Diagnostic Mode 0A - Check Permanent DTC Memory”, page 43](#)

3.3.1 Diagnostic Mode 01 - Read Current System Data

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Test requirement

- Coolant temperature at least 80° C.

Procedure

- Connect the scan tool.
- Start the engine and run at idle.





- Select “Diagnostic Mode 1: Obtain data.”.
- From the following table, select the desired the “PID” that is to be monitored, e.g. “PID \$05 Coolant temperature”.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
\$00:	Supported Definition PIDs \$01 – \$20
\$01:	Number Of Errors In Mode 3 / Mil Status / Readiness Status
\$03:	Fuel System Status
\$04:	Calculated Load Value
\$05:	Coolant Temperature
\$06:	O2 Sensor Bank 1
\$07:	O2 Sensor Adaptation Value Bank 1
\$0B:	Manifold Absolute Pressure
\$0C:	Engine Speed
\$0D:	Vehicle Speed
\$0E:	Ignition Angle Cylinder 1
\$0F:	Intake Air Temperature
\$10:	Air Mass
\$11:	Absolute Throttle Position
\$13:	Location Of Oxygen Sensors (Max. 2 Exhaust Banks)
\$15:	O2 Sensor Voltage (Jump Probes)
\$1C:	OBD Requirements
\$1F:	Time Since Engine Start
\$20:	Supported Definition PIDs \$21 – \$40
\$21:	Distance Driven With Mil On
\$23:	Fuel (Rail) Pressure
\$2E:	Fuel Tank Vent Valve Control
\$2F:	Fuel Level (if used for diagnostics)
\$30:	Number Of Warm Up Cycles Since Erasing Fault Memory
\$31:	Distance Driven After Erasing Fault Memory
\$33:	Atmospheric Pressure
\$34:	O2 Sensor Voltage (Linear Probes)
\$3C:	Catalyst Temperature
\$40:	Supported Definition PIDs \$41 – \$60
\$41:	Diagnostic Status In This Cycle
\$42:	ECU System Voltage
\$43:	Absolute Load Value
\$44:	Lambda Value
\$45:	Relative Throttle Position
\$46:	Ambient Air Temperature
\$47:	Absolute Throttle Position (Redundant)
\$49:	Accelerator Pedal Position 1 Absolute
\$4A:	Accelerator Pedal Position 2 Absolute (Redundant)
\$4C:	Throttle Position Set Point
\$51:	Fuel Type
\$56:	Offset Lambda Control Behind Catalyst, Bank 1



PID	Component or System
\$60:	Supported PIDs \$61-\$80
\$70:	Boost Pressure Control

- Switch the ignition off.

3.3.2 Diagnostic Mode 02 - Read Operating Conditions

When an emissions-related fault (pending DTC, visible in mode 07) is first detected, operating conditions are stored. Mode 02 makes it possible to access this freeze frame data as soon as this fault is shown in mode 03. Each control module only shows freeze frame data for one fault via mode 02. Therefore, there are two priority levels. If there is a malfunction with higher priority, the freeze frame data is overwritten.

- Fault with higher priority: Misfire malfunction or fuel trim malfunction.
- Fault with normal priority: All other emissions-related faults.



Note

Depending on scan tool and protocol used, the information in diagnostic mode 02 may be referred to by different names such as Test-ID, Hex-ID, Component-ID, or On-Board Diagnostic Monitor Identifier (OBDMID).

Procedure

- Connect the scan tool.
- Start the engine and run at idle.



Note

If the engine does not start, crank the engine using starter for at least 5 seconds, do not switch the ignition off afterward.

- Select “Diagnostic Mode 2: Obtain operating conditions.”.
- From the following table, select the desired the “PID”, e.g. “PID \$05 Coolant temperature” that is to be monitored.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
\$00:	Supported Definition PIDs \$01 – \$20
\$02:	DTC Which Triggered Freeze Frame Data
\$03:	Fuel System Status
\$04:	Calculated Load Value
\$05:	Coolant Temperature
\$06:	O2 Sensor Bank 1
\$07:	O2 Sensor Adaptation Value Bank 1
\$0B:	Manifold Absolute Pressure
\$0C:	Engine Speed
\$0D:	Vehicle Speed



PID	Component or System
\$0E:	Ignition Angle
\$0F:	Intake Air Temperature
\$10:	Air Mass
\$11:	Absolute Throttle Position 1
\$1F:	Time Since Engine Start
\$20:	Supported Definition PIDs \$21 – \$40
\$23:	Fuel Pressure (Rail Pressure)
\$2E:	Fuel Tank Vent Valve Control
\$2F:	Fuel Level (if used for diagnostics)
\$33:	Atmospheric Pressure
\$40:	Supported Definition PIDs \$41 – \$60
\$42:	ECU System Voltage
\$43:	Absolute Load Value
\$44:	Lambda Value
\$45:	Relative Throttle Position
\$46:	Ambient Air Temperature
\$47:	Absolute Throttle Position 2
\$49:	Accelerator Pedal Position 1 Absolute
\$4A:	Accelerator Pedal Position 2 Absolute
\$4C:	Throttle Position Set Point
\$51:	Fuel Type
\$56:	Offset Lambda Control Behind Catalyst, Bank 1
\$60:	Supported PIDs \$61-\$80
\$70:	Boost Pressure Control

- Switch the ignition off.

3.3.3 Diagnostic Mode 03 - Read DTC Memory

Diagnostic Mode 03 makes it possible to read emissions-related faults (confirmed DTCs; faults which have activated the MIL) in the ECM and in the TCM.

When the ECM recognizes an emissions-related fault in two consecutive drive cycles, it sends a request to the instrument cluster over the CAN to turn on the malfunction indicator lamp. If an electronic throttle malfunction is recognized, the ECM will send a request to the instrument cluster over the CAN to turn on the electronic power control warning lamp.

The DTCs are sorted by SAE code with the DTC tables consisting of a 5-digit alphanumeric value.



Note

Depending on scan tool and protocol used, diagnostic mode 03 and the information provided may be referred to by a different name.

The following tables provide a breakdown and explanation of the DTC code.



P-Codes

Component group					
P	x	x	x	x	DTC for the drivetrain
Norm-Code					
P	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts
P	1	x	x	x	Additional emission relevant DTCs provided by the manufacturer
P	2	x	x	x	DTCs defined by SAE with specified texts, from MY 2000
P	3	x	x	x	Additional emission relevant DTCs provided by the manufacturer from MY 2000

Component group					
Repair group					
P	x	0	x	x	Fuel and air mixture and additional emission regulations
P	x	1	x	x	Fuel and air ratios
P	x	2	x	x	Fuel and air ratios
P	x	3	x	x	Ignition system
P	x	4	x	x	Additional exhaust system
P	x	5	x	x	Speed and idle control
P	x	6	x	x	Control module and output signals
P	x	7	x	x	Transmission
P	x	8	x	x	Transmission
P	x	9	x	x	Control modules, input and output signals

U-Codes

Component group					
U	x	x	x	x	DTC for network (CAN bus)
Norm-Code					
U	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts

Procedure

- Connect the scan tool.
- Switch the ignition to the ON position.
- Select Diagnostic Mode 03: Interrogating fault memory.
- The stored DTC or DTCs will be displayed on the scan tool screen.

The following table is an example of the DTC information that may be displayed on the scan tool screen:

Indication example	Explanation
P0444	SAE Diagnostic Trouble Code
EVAP System Purge Control Valve "A" Circuit Open	Malfunctioning wiring path or malfunctioning component
Circuit open	Malfunction type as next



- Refer to the DTC tables for the diagnostic repair procedures.
- Switch the ignition off.

3.3.4 Diagnostic Mode 04 - Erase DTC Memory

Diagnostic Mode 04 makes it possible to erase the DTC memory and to reset all emissions-related diagnostic data. In that way, all faults in the DTC memory in the ECM and TCM are erased. The adaptation values may also be reset.

Emissions-related diagnostic data includes (as applicable):

- ◆ - MIL status
- ◆ - Number of DTCs
- ◆ - Readiness bits
- ◆ - Confirmed DTCs
- ◆ - Pending DTCs
- ◆ - DTC that belongs to freeze frame
- ◆ - Freeze frame data
- ◆ - Test results of specific diagnostic functions
- ◆ - Distance driven with MIL on
- ◆ - Number of warm-up cycles after erasing the DTC memory
- ◆ - Distance driven after erasing the DTC memory
- ◆ - Misfire counter



Note

Depending on the scan tool and protocol used, diagnostic mode 04 and the information provided may be referred to by a different name.

Procedure

- Connect the scan tool.
- Switch the ignition on.
- Select Diagnostic Mode 03: Interrogating fault memory.
- Then select Mode 4: Reset/delete diagnostic data.

The scan tool will display "Diagnostic data being erased".

- Switch the ignition off.

3.3.5 Diagnostic Mode 05 - Read Oxygen Sensor Monitoring Test Results



Note

Mode 05 may not be supported on all systems. On systems where Diagnostic Mode 05 is not supported, refer to Diagnostic Mode 6 for oxygen sensor monitoring test results.

Test Requirements

- No Test requirements are available for this powertrain.



Function Test

- No Function Tests are available for this powertrain.

3.3.6 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, 2015 MY

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.

The min & max values for each individual test in Mode 06 represent the min & max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process. e.g.:

	Minimum Value
GST manual documentation	0.3499
Aftermarket scan tool display	0.35

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.
- Coolant temperature at least 80° C.

Work procedure

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select Mode 6: Check test the results of components that are not continuously monitored.

Select the desired Test-ID.

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all "Test-IDs" that may be selected.

Monitor-ID (Hex-ID)	Component or System
\$01: ⇒ page 28	O2 Sensor Monitor Bank 1 – Sensor 1
\$02: ⇒ page 28	O2 Sensor Monitor Bank 1 – Sensor 2
\$21: ⇒ page 29	Catalytic Converter Monitoring
\$35: ⇒ page 29	Camshaft Adjustment Bank 1
\$3A: ⇒ page 30	Tank Venting System Leak Test (0.090")



Monitor-ID (Hex-ID)	Component or System
\$3B: ➔ page 30	Tank Venting System Leak Test (0.040" / 1.0 mm)
\$3C: ➔ page 31	Tank Venting System Leak Test (0.020" / 0.5 mm)
\$3D: ➔ page 31	Tank Vent Valve Function Check
\$41: ➔ page 32	O2 Sensor Heater Bank 1 – Sensor 1
\$42: ➔ page 32	O2 Sensor Heater Bank 1 – Sensor 2
\$A2: ➔ page 33	Mis-Fire Cylinder 1 Data
\$A3: ➔ page 33	Mis-Fire Cylinder 2 Data
\$A4: ➔ page 33	Mis-Fire Cylinder 3 Data
\$A5: ➔ page 34	Mis-Fire Cylinder 4 Data

Monitor-ID \$01: O2 Sensor Monitor Bank 1 – Sensor 1

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$01”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$83	P0133	Oxygen Sensor Dynamic Test Bank 1, Sensor 1.	0.350 – 0.399	1.999	Refer to DTC P0133 in the DTC summary table. ➔ page 52

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
➔ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#), [page 24](#).
- Switch the ignition off.

Monitor-ID \$02: O2 Sensor Monitor Bank 1 – Sensor 2

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$02”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$01	—	Voltage Threshold Of Fat To Lean (Fixed Value).	0.624 V	0.624 V	—
\$02	—	Voltage Threshold Of Lean To Fat (Fixed Value).	0.624 V	0.624 V	—
\$05	P0139	Oxygen Sensor Dynamic Testing Delay Rich to Lean Bank 1, Sensor 2.	0.0 s	1.0 s	Refer to DTC P0139 in the DTC summary table. ➔ page 53



Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$07	—	Minimum Oxygen Sensor Voltage In This Cycle Bank 1, Sensor 2.	0.0 V	0.450 V	—
\$08	—	Maximum Oxygen Sensor Voltage In This Cycle Bank 1, Sensor 2.	0.450 V	1.2607 V	—
\$81	P2271	Oxygen Sensor Oscillation Testing Rich Bank 1, Sensor 2.	0.0 V	0.624 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 89
\$82	P2270	Oxygen Sensor Oscillation Testing Lean Bank 1, Sensor 2.	0.624 V	1.2607 V	Refer to DTC P2270 in the DTC summary table. ⇒ page 89
\$86	P2271	Oxygen Sensor Dynamic Testing Bank 1, Sensor 2.	0.0 s	12.0 s	Refer to DTC P2271 in the DTC summary table. ⇒ page 89

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure
[⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory ”, page 24](#).

- Switch the ignition off.

Monitor-ID \$21: Catalytic Converter Monitoring

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$21”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$84	P0420	Catalytic Converter Monitoring, Bank 1.	1.0	65,535	Refer to DTC P0420 in the DTC summary table. ⇒ page 69
\$84	P3298	Catalytic Converter Monitoring, Bank 3.	1.0	65,535	Refer to DTC P3298 in the DTC summary table. ⇒ page 96

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure
[⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory ”, page 24](#).

- Switch the ignition off.

Monitor-ID \$35: Camshaft Adjustment Bank 1

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$35”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.



Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$80	P0011	Intake Camshaft Diagnosis Target Position Is Not Reached.	2.5° kW	28° kW	Refer to DTC P0011 in the DTC summary table. ➔ page 45
		Alternative Testing With Set Point Change Limitation.	-14° kW	2.5° kW	
\$81	P000A	Intake Camshaft Diagnosis Target Slow Response.	6.8° kW	28° kW	Refer to DTC P000A in the DTC summary table. ➔ page 45
		Alternative Testing With Set Point Change Limitation.	-14° kW	6.8° kW	
			6.8° kW	6.8° kW	

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
➔ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#), [page 24](#) .

- Switch the ignition off.

Monitor-ID \$3A: Tank Venting System Leak Test (0.090")

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$3A”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$81	P0455	Tank Tightness Testing.	0.95 s	65,535 s	Refer to DTC P0455 in the DTC summary table. ➔ page 71

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
➔ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#), [page 24](#) .

- Switch the ignition off.

Monitor-ID \$3B: Tank Venting System Leak Test (0.040" / 1.0 mm)

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$3B”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.



Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$81	P0442	Tank Tightness Testing.	2.0 – 2.15 s	65,535 s	Refer to DTC P0442 in the DTC summary table. ➔ page 70

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure

➔ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 24](#).

- Switch the ignition off.

Monitor-ID \$3C: Tank Venting System Leak Test (0.020" / 0.5 mm)

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$3C”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$81	P0456	Tank Tightness Testing.	4.5 – 6.5 s	65,535 s	Refer to DTC P0456 in the DTC summary table. ➔ page 72
\$82	—	Tank Tightness Testing After Initial Rinsing.	6.4 g	65,535 g	—

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure

➔ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 24](#).

- Switch the ignition off.

Monitor-ID \$3D: Tank Vent Valve Function Check

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$3D”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$80	P0441	Active Testing Of The Air Balance In Idle.	0.01 – 0.299	0.01	Refer to DTC P0441 in the DTC summary table. ➔ page 69
\$82	—	Active Testing Oxygen Sensor Control Deviation Lean Direction.	0.0952 1	10	—
\$82	—	Active Testing Oxygen Sensor Control Deviation Rich Direction.	-10	-0.060	—



- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure

⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#),
[page 24](#) .

- Switch the ignition off.

Monitor-ID \$41: O2 Sensor Heater Bank 1 – Sensor 1

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$41”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$85	P0135	Oxygen Sensor Heater Test Internal Resistance Bank 1, Sensor 1.	715.0° C	1,200.0 ° C	Refer to DTC P0135 in the DTC summary table. ⇒ page 52

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure

⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#),
[page 24](#) .

- Switch the ignition off.

Monitor-ID \$42: O2 Sensor Heater Bank 1 – Sensor 2

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$42”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$81	P0141	Oxygen Sensor Heater Test Internal Resistance Bank 1, Sensor 2.	0.0 Ω	1,024.0 – 25,920. 0 Ω	Refer to DTC P0141 in the DTC summary table. ⇒ page 54

- Switch the ignition off.
- If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTCs or the corresponding diagnostic repair procedure

⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#),
[page 24](#) .

- Switch the ignition off.



Monitor-ID \$A2: Mis-Fire Cylinder 1 Data

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$A2”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$0B	P0301	Misfire Cylinder 1, Average Value Over 10 Driving Cycles.	0.0 counts	65,535 counts	Refer to DTC P0301 in the DTC summary table. ⇒ page 64
\$0C	P0301	Misfire Cylinder 1, In This Driving Cycle.	0.0 counts	65,535 counts	Refer to DTC P0301 in the DTC summary table. ⇒ page 64

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure
[⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 24](#).

- Switch the ignition off.

Monitor-ID \$A3: Mis-Fire Cylinder 2 Data

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$A3”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$0B	P0302	Misfire Cylinder 2, Average Value Over 10 Driving Cycles.	0.0 counts	65,535 counts	Refer to DTC P0302 in the DTC summary table. ⇒ page 64
\$0C	P0302	Misfire Cylinder 2, In This Driving Cycle.	0.0 counts	65,535 counts	Refer to DTC P0302 in the DTC summary table. ⇒ page 64

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure
[⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 24](#).

- Switch the ignition off.

Monitor-ID \$A4: Mis-Fire Cylinder 3 Data

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.



Select "Monitor-ID \$A4".

- Select the desired "Test-ID" or "Hex-ID".
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$0B	P0303	Misfire Cylinder 3, Average Value Over 10 Driving Cycles.	0.0 counts	65,535 counts	Refer to DTC P0303 in the DTC summary table. ⇒ page 65
\$0C	P0303	Misfire Cylinder 3, In This Driving Cycle.	0.0 counts	65,535 counts	Refer to DTC P0303 in the DTC summary table. ⇒ page 65

- If any of components or systems fail to meet the specified values. Refer to Diagnostic "Mode 03: Interrogating Fault Memory" to check for stored DTC's or the corresponding diagnostic repair procedure

⇒ ["3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 24](#).

- Switch the ignition off.

Monitor-ID \$A5: Mis-Fire Cylinder 4 Data

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Diagnostic Mode 6: Check test the results of components that are not continuously monitored".

Select "Monitor-ID \$A5".

- Select the desired "Test-ID" or "Hex-ID".
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$0B	P0304	Misfire Cylinder 4, Average Value Over 10 Driving Cycles.	0.0 counts	65,535 counts	Refer to DTC P0304 in the DTC summary table. ⇒ page 65
\$0C	P0304	Misfire Cylinder 4, In This Driving Cycle.	0.0 counts	65,535 counts	Refer to DTC P0304 in the DTC summary table. ⇒ page 65

- Switch the ignition off.
- If any of the components or systems fail to meet the specified values, refer to Diagnostic "Mode 03: Interrogating Fault Memory" to check for stored DTCs or the corresponding diagnostic repair procedure

⇒ ["3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 24](#).

- Switch the ignition off.

3.3.7 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, 2016 MY

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.



The min & max values for each individual test in Mode 06 represent the min & max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process.

For example; GST manual documentation will show the value as 0.3499 (units) while the scan tool will display the same value as 0.35 (units).

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.
- Coolant temperature at least 80 °C.

Work procedure

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select Mode 6: Check test the results of components that are not continuously monitored.

Select the desired Test-ID.

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all "Test-IDs" that may be selected.

Monitor-ID	Component or System
\$01: ⇒ page 35	Oxygen Sensor Monitor Bank 1 – Sensor 1
\$02: ⇒ page 36	Oxygen Sensor Monitor Bank 1 – Sensor 2
\$21: ⇒ page 37	Catalytic Converter Monitoring
\$35: ⇒ page 37	Camshaft Adjustment Bank 1
\$3C: ⇒ page 38	Tank Venting System Leak Test (0.020" / 0.5 mm)
\$3D: ⇒ page 38	Tank Vent Valve Function Check
\$41: ⇒ page 39	O2 Sensor Heater Bank 1 – Sensor 1
\$42: ⇒ page 39	O2 Sensor Heater Bank 1 – Sensor 2
\$A2: ⇒ page 39	Misfire Cylinder 1 Data
\$A3: ⇒ page 40	Misfire Cylinder 2 Data
\$A4: ⇒ page 40	Misfire Cylinder 3 Data
\$A5: ⇒ page 41	Misfire Cylinder 4 Data

Monitor-ID \$01: Oxygen Sensor Monitor Bank 1 – Sensor 1

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Diagnostic Mode 6: Check test the results of components that are not continuously monitored".



Select "Monitor-ID \$01".

- Select the desired "Test-ID" or "Hex-ID".
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$83	P0133	Oxygen Sensor Dynamic Test Bank 1, Sensor 1.	0.0 V	1.0 V	Refer to DTC P0133 in the DTC summary table. ⇒ page 124
\$86	P0133	Oxygen Sensor Dynamic Test Bank 1, Sensor 1.	0.0 V	1.0 V	Refer to DTC P0133 in the DTC summary table. ⇒ page 124
\$8A	P2195	Oxygen Sensor Intrusive Check	1.45	32.767	Refer to DTC P2195 in DTC summary table. ⇒ page 245
\$8B	P2196	Oxygen Sensor Intrusive Check	0.55	32.767	Refer to DTC P2196 in the DTC summary table. ⇒ page 246

- If any of components or systems fail to meet the specified values. Refer to Diagnostic "Mode 03: Interrogating Fault Memory" to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ ["3.3.3 Diagnostic Mode 03 - Read DTC Memory"](#), [page 24](#).

- Switch the ignition OFF.

Monitor-ID \$02: Oxygen Sensor Monitor Bank 1 – Sensor 2

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Diagnostic Mode 6: Check test the results of components that are not continuously monitored".

Select "Monitor-ID \$02".

- Select the desired "Test-ID" or "Hex-ID".
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$05	P013A	Oxygen Sensor Transition Time.	760.0 mV/s	65,534.0 mV/s	Refer to DTC P013A in the DTC summary table. ⇒ page 128
\$92	P013B	Oxygen Sensor Maximum Gradient Of Sensor Signal During Lean – Rich – Transition.	760.0 mV/s	65,534.0 mV/s	Refer to DTC P013B in the DTC summary table. ⇒ page 132
\$93	P013E	Oxygen Sensor Dynamic Test, Delay Rich To Lean.	0.0 s	0.9 s	Refer to DTC P013E in the DTC summary table. ⇒ page 136
\$94	P013F	Oxygen Sensor Dynamic Test, Delay Lean To Rich.	0.0 s	NaN	Refer to DTC P013F in the DTC summary table. ⇒ page 140
\$95	P2270	Oxygen Sensor Target Voltage In Fat Mode Not Reached.	0.95 V	7.999 V	Refer to DTC P2270 in the DTC summary table. ⇒ page 261
\$96	P2271	Oxygen Sensor Target Voltage In Lean-Burn Mode Not Reached.	0.0 V	0.2251 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 265



- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 24](#).

- Switch the ignition OFF.

Monitor-ID \$21: Catalytic Converter Monitoring

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$21”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$84	P0420	Catalytic Converter Assessment Of Oxygen Storage Capacity (OSC) Compared To Catalytic Converter Map.	0.0 OSC	1.0 OSC	Refer to DTC P0420 in the DTC summary table. ⇒ page 188

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 24](#).

- Switch the ignition OFF.

Monitor-ID \$35: Camshaft Adjustment Bank 1

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$35”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$80	P0011	VVT Intake Camshaft Diagnosis, Target Position Not Reached, Target Error.	0.0° CRK	10.0° CRK	Refer to DTC P0011 in the DTC summary table. ⇒ page 99
\$81	P000A	VVT Intake Camshaft Diagnosis, Specified Position Reached Too Slowly, Slow Response.	15.0° CRK	655.35° CRK	Refer to DTC P000A in the DTC summary table. ⇒ page 98
\$82	P0014	VVT Exhaust Camshaft Diagnosis, Target Position Not Reached, Target Error.	0.0° CRK	10.0° CRK	Refer to DTC P0014 in the DTC summary table. ⇒ page 100
\$83	P000B	VVT Exhaust Camshaft Diagnosis, Specified Position Reached Too Slowly, Slow Response.	3.5° CRK	655.35° CRK	Refer to DTC P000B in the DTC summary table. ⇒ page 98



- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure

⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#),
[page 24](#) .

- Switch the ignition OFF.

Monitor-ID \$3C: Tank Venting System Leak Test (0.020" / 0.5 mm)

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$3C”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$83	P0456	NVLD Fine Leak Detection.	10.0	65,535.0	Refer to DTC P0456 in the DTC summary table. ⇒ page 195

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure

⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#),
[page 24](#) .

- Switch the ignition OFF.

Monitor-ID \$3D: Tank Vent Valve Function Check

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$3D”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$8B	P0441	Tank Vent Valve – Function Check, Test Using Cross-Correlation.	0.1	655.35	Refer to DTC P0441 in the DTC summary table. ⇒ page 192

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure

⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#),
[page 24](#) .

- Switch the ignition OFF.



Monitor-ID \$41: O2 Sensor Heater Bank 1 – Sensor 1

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$41”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$85	P0135	Oxygen Sensor Ceramic Temperature Monitoring.	630.0° C	6,513.5° C	Refer to DTC P0135 in the DTC summary table. ⇒ page 127

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory ”, page 24](#).

- Switch the ignition OFF.

Monitor-ID \$42: O2 Sensor Heater Bank 1 – Sensor 2

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$42”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$90	P0141	Oxygen Sensor Nernst Cell Resistance Test.	0.0 Ω	700.0 Ω	Refer to DTC P0141 in the DTC summary table. ⇒ page 143

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory ”, page 24](#).

- Switch the ignition OFF.

Monitor-ID \$A2: Misfire Cylinder 1 Data

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$A2”.

- Select the desired “Test-ID” or “Hex-ID”.



- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$0B	P0301	Misfire Cylinder 1, Average Value Over 10 Driving Cycles.	0.0 counts	65,535.0 counts	Refer to DTC P0301 in the DTC summary table. ⇒ page 163
\$0C	P0301	Misfire Cylinder 1, In This Driving Cycle.	0.0 counts	65,535.0 counts	Refer to DTC P0301 in the DTC summary table. ⇒ page 163

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure
⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#), [page 24](#).

- Switch the ignition OFF.

Monitor-ID \$A3: Misfire Cylinder 2 Data

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$A3”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$0B	P0302	Misfire Cylinder 2, Average Value Over 10 Driving Cycles.	0.0 counts	65,535.0 counts	Refer to DTC P0302 in the DTC summary table. ⇒ page 165
\$0C	P0302	Misfire Cylinder 2, In This Driving Cycle.	0.0 counts	65,535.0 counts	Refer to DTC P0302 in the DTC summary table. ⇒ page 165

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure
⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#), [page 24](#).

- Switch the ignition OFF.

Monitor-ID \$A4: Misfire Cylinder 3 Data

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$A4”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.



Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$0B	P0303	Misfire Cylinder 3, Average Value Over 10 Driving Cycles.	0.0 counts	65,535.0 counts	Refer to DTC P0303 in the DTC summary table. ⇒ page 167
\$0C	P0303	Misfire Cylinder 3, In This Driving Cycle.	0.0 counts	65,535.0 counts	Refer to DTC P0303 in the DTC summary table. ⇒ page 167

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure
⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#), [page 24](#).
- Switch the ignition OFF.

Monitor-ID \$A5: Misfire Cylinder 4 Data

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID \$A5”.

- Select the desired “Test-ID” or “Hex-ID”.
- Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
\$0B	P0304	Misfire Cylinder 4, Average Value Over 10 Driving Cycles.	0.0 counts	65,535.0 counts	Refer to DTC P0304 in the DTC summary table. ⇒ page 169
\$0C	P0304	Misfire Cylinder 4, In This Driving Cycle.	0.0 counts	65,535.0 counts	Refer to DTC P0304 in the DTC summary table. ⇒ page 169

- Switch the ignition OFF.
- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure
⇒ [“3.3.3 Diagnostic Mode 03 - Read DTC Memory”](#), [page 24](#).

3.3.8 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle

Mode 07 makes it possible to check emissions-related faults which appeared during the current or last driving cycle (pending DTCs).

A pending DTC is saved the first time a fault is detected (output via Mode 07).

- If the fault is detected again by the end of the following driving cycle, a confirmed DTC is entered (output via Mode 03) and the MIL is activated.



- If this malfunction is not detected again by the end of the following driving cycle, the corresponding pending code will be deleted at the end of the driving cycle.



Note

Depending on the scan tool and protocol used, some of the information provided may be referred to by a different name.

Procedure

- Connect the scan tool.
- Start the engine and run at idle.



Note

If the engine does not start, crank the engine using starter for at least 5 seconds. Do not switch the ignition off afterward.

- Select Mode 7: Check test results of components that are continuously monitored.

The number of pending DTCs or 0 malfunctions detected will be displayed on the scan tool screen.

- Refer to the DTC tables for the diagnostic repair procedures.
- Switch the ignition off.

3.3.9 Diagnostic Mode 08 - Request Control of On-Board System, Test or Component

Diagnostic Mode 08 is used to control the operation of an on-board system, test or component. A Mode 8 service can be used to turn on-board system ON or OFF, or to cycle an on-board system, test, or component on or off for a specific period of time. The service can also be used to request system status or to report test results.

Test Requirements

- No Test requirements are available for this powertrain.

Function Test

- No Function Tests are available for this powertrain.

3.3.10 Diagnostic Mode 09 - Request Vehicle Information

Diagnostic Mode 09 makes it possible to access vehicle-specific information from the ECM and the TCM (where applicable).



Note

Depending on scan tool and protocol used, Diagnostic Mode 09 and the information provided may be referred to by a different name.

Test requirement

- No DTCs stored in the DTC memory.



Procedure

- Connect the scan tool.
- Switch the ignition on.
- Select Mode 09: Vehicle information.
- Select the desired Test ID.
- The information requested will be displayed on the scan tool screen.

The following table is a numerical list of all Test IDs that may be selected.

Test-ID	Diagnostic text
\$02:	Vehicle identification number (VIN) e.g.
	◆ A different 17 digit number will be displayed for each vehicle
\$04:	Calibration identification (CALID) e.g.
	◆ Engine Control Module
	◆ Transmission Control Module
\$06:	Calibration Verification Number (CVN) (check sum) e.g.
	◆ EC5AE460 the check sum is different for every control module version
	◆ 000D105
\$08:	In-Use Performance Tracking Information (CAN)
\$0A:	ECU Name
	◆ Engine Control Module

- Switch the ignition off.

3.3.11 Diagnostic Mode 0A - Check Permanent DTC Memory



Note

- ◆ The following is a generic explanation of the requirements, coverage, and operation of Mode 0A.
- ◆ Mode 0A may only be supported exclusively by OBD control modules in US vehicles. Mode 0A may not be supported in EOBD vehicles, meaning the control module may not send a response here.

Mode 0A - Check Permanent DTC Memory (Request emissions-related diagnostic trouble codes with permanent status after code clear)

Permanent Fault Codes From MY 2010 with Phase-In conforming to CCR 1968.2 (d)(2.2.5): 50% from MY 2010 / 75% from MY 2011 / 100% from MY 2012 The vehicle only participates in Phase-In if all of the OBD-relevant control modules in the vehicle meet these requirements.

Mode 0A enables the request of all OBD-relevant faults with the status "Permanent Fault Code"

- Permanent Fault Codes are Confirmed Fault Codes that are currently activating the MIL. That means faults that are still dis-



played in Mode 03 but no longer activate the MIL (History Fault Codes) are not Permanent Fault Codes.

- Permanent Fault Codes are updated in Mode 0A at the same time as NVRAM storage immediately after switching the ignition off. A newly detected Permanent Fault Code is only visible after switching the ignition off/on in Mode 0A.

- Permanent Fault Codes may only be erased in the control module after they are corrected as long as the last diagnostic result was a PASS and the MIL is no longer activated by this fault. The Permanent Fault Codes should be erased from Mode 0A at the same time the MIL switches off when the ignition is switched off/on.

- Permanent Fault Codes may not be erased by clearing the DTC memory or disconnecting the power supply. Storage in NVRAM is required.

- Permanent Fault Codes may only be erased after clearing the DTC memory under the following conditions: - As long as no FAIL diagnostic result was detected for a Permanent Fault Code - and at least one PASS diagnostic result was detected - and the Minimum Trip Conditions for a General Denominator (without considering high/ambient temperature) were met in this phase in any DCY after erasing the DTC memory.

- The engine control module relays the message "Minimum Trip conditions met" to all other OBD control modules via CAN: CAN message OBD_01, Byte 8, Bit 4: OBD_Minimum_Trip

- Permanent Fault Codes may NOT be erased if the diagnostic result is FAIL after clearing the DTC memory. A Pending Fault Code should be stored and the DTC memory line should be overwritten with new Freeze Frame data. (Exception: If the Pending Fault Code is corrected without a Confirmed Fault Code being detected, the Permanent Fault Code may also be erased under the conditions described below.)

- Permanent Fault Codes should be erased in engine control modules after Update Programming. At this time, all readiness bits (Mode 01 PID \$01) must be reset to "not complete" [(g)(4.4.6) (D)]. Permanent Fault Codes should not be erased in OBD control modules with Comprehensive Components (CCM) as a single readiness bit if the identical program/data status is being programmed. If a different program/data status is being programmed, Permanent Fault Codes should be erased after Update Programming.

- The procedure in Mode 01 through Mode 09 and in the service tester is NOT affected by implementation of the Permanent Fault Codes.



Note

After MIL off during the 40 warm-up cycle self-healing process, the fault may not be reported as Permanent Fault Code anymore

Procedure

- ◆ Erasing Permanent Fault Codes after code clear Service \$0A
 - Permanent Fault Codes: can only be erased at the end of a driving cycle (during ECM keep alive time) if all the following conditions are fulfilled:
- ◆ ERASE: Permanent Fault Codes after code clear, the vehicle needs to be driven !
- ◆ NO FAIL: DTC cleared
- ◆ MONITORS: PASS



- ◆ MINIMUM: Conditions fulfilled 600 s. (cumulative) Engine running
- ◆ DRIVE: 300 s (cumulative) vehicle speed > 25 mph (40 km/h)

3.4 Engine DTC Tables

- ◆ ⇒ ["3.4.1 Engine Control Module , 2015 MY", page 45](#)
- ◆ ⇒ ["3.4.2 Engine Control Module , 2016 MY", page 98](#)

3.4.1 Engine Control Module , 2015 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P000A "A" Camshaft Position Slow Response Bank 1	VVT Intake Response Check	<ul style="list-style-type: none"> Signal change < 3 – 4° CAVs 	<ul style="list-style-type: none"> Engine speed > 1,000 rpm ECT > -10.5° C Time after engine start 0.7 s Number of checks 3 Number of checks during cold start 2 Time length 3.5 s 	<ul style="list-style-type: none"> 30.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ "3.6.3 Camshaft Adjustment Valve 1 N205 , Checking", page 362 .
P0010 "A" Camshaft Position Actuator Control Circuit/ Open Bank 1	VVT Intake Open Circuit	<ul style="list-style-type: none"> Signal voltage > 4.4 – 5.6 V 	<ul style="list-style-type: none"> Camshaft valve commanded off Engine speed > 80 rpm 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ "3.6.3 Camshaft Adjustment Valve 1 N205 , Checking", page 362 .
P0011 "A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	VVT Intake Stuck Check	<ul style="list-style-type: none"> Adjustment angle > 7° CA 	<ul style="list-style-type: none"> Engine speed > 1,000 rpm ECT > -10.5° C Time after engine start 0.7 s Number of checks 3 [-] Number of checks during cold start 2 [-] Time length 3.5 s 	<ul style="list-style-type: none"> 30.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ "3.6.3 Camshaft Adjustment Valve 1 N205 , Checking", page 362 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0016 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Phase Sensor Rationality Check	<ul style="list-style-type: none"> Adaptive vs. target values > 20° CA 	<ul style="list-style-type: none"> Engine speed 600 – 1,600 rpm ECT > 50.25 °C 	<ul style="list-style-type: none"> 2.0 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Speed Sensor - G28- . Refer to "3.6.11 Engine Speed Sensor G28, Checking", page 384 . Check the Camshaft Position Sensor - G40- . Refer to "3.6.5 Camshaft Position Sensor G40, Checking", page 368 .
P0030 HO2S Heater Control Circuit Bank 1 Sensor 1	Oxygen Sensor Heater Front Circuit Continuity	<ul style="list-style-type: none"> Open circuit Heater voltage 4.4 – 5.6 V 	<ul style="list-style-type: none"> Vehicle system voltage 9.0 – 16.0 V Engine speed > 80 rpm Dew point exceeded for > 10 s 	<ul style="list-style-type: none"> 10.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
P0031 HO2S Heater Control Circuit Low Bank 1 Sensor 1	Oxygen Sensor Heater Front Circuit Continuity	<ul style="list-style-type: none"> Short to ground Heater voltage 2.15 – 3.25 V 	<ul style="list-style-type: none"> Vehicle system voltage 9.0 – 16.0 V Engine speed > 80 rpm Dew point exceeded for > 10 s 	<ul style="list-style-type: none"> 10.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
P0032 HO2S Heater Control Circuit High Bank 1 Sensor 1	Oxygen Sensor Heater Front Circuit Continuity	<ul style="list-style-type: none"> Short to battery plus Heater current > 3 A 	<ul style="list-style-type: none"> Vehicle system voltage 9.0 – 16.0 V Engine speed > 80 rpm Dew point exceeded for > 10 s 	<ul style="list-style-type: none"> 10.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
P0036 HO2S Heater Control Circuit Bank 1 Sensor 2	Oxygen Sensor Heater Circuit Continuity	<ul style="list-style-type: none"> Open circuit Heater voltage 4.4 – 5.6 V 	<ul style="list-style-type: none"> Dew point exceeded for > 10 s Engine speed > 80 rpm 	<ul style="list-style-type: none"> 10.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0037 HO2S Heater Control Circuit Low Bank 1 Sensor 2	Oxygen Sensor Heater Circuit Continuity	<ul style="list-style-type: none"> Short to ground Heater voltage 2.15 – 3.25 V 	<ul style="list-style-type: none"> Dew point exceeded for > 10 s Engine speed > 80 rpm 	<ul style="list-style-type: none"> 10.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0038 HO2S Heater Control Circuit High Bank 1 Sensor 2	Oxygen Sensor Heater Circuit Continuity	<ul style="list-style-type: none"> Short to battery plus Heater current > 3 A 	<ul style="list-style-type: none"> Dew point exceeded for > 10 s Engine speed > 80 rpm 	<ul style="list-style-type: none"> 10.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel Rail Pressure Control Valve Functional Check Stuck Open	<ul style="list-style-type: none"> Pressure control activity > 4.0 MPa Fuel trim activity > 1.3 [-] 	<ul style="list-style-type: none"> Fuel cut off not active Evap purge flow > 0.25 kg/h Engine speed 2,000 – 4,000 RPM Engine load > 40% Fuel cut off not active RPM 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual for proper procedures. Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 . Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276, Checking", page 398 . Check the Fuel Pump Control Module - J538- / Fuel Delivery Unit - GX1- . Refer to ⇒ "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 .
P0089 Fuel Pressure Regulator 1 Performance	Fuel System Low Pressure System Functional Check	<ul style="list-style-type: none"> Difference between actual pressure – target pressure > 15 MPa 	<ul style="list-style-type: none"> Time after engine start 5 s 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual for test procedure.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Difference between actual pressure – target pressure < -0.2 MPa Total pressure controller response < -0.25 MPa – > 0.35 MPa 	<ul style="list-style-type: none"> Time after engine start 5 s Fuel cut off not active Time after fuel cut off 20 s 	<ul style="list-style-type: none"> 2.0 s 180.0 s 		<p>If the fuel pressure is out of range:</p> <ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276- . Checking", page 398 . <p>If the fuel pressure is not out of range:</p> <ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247- . Checking", page 400 .
P008A Low Pressure Sensor Low Pressure System Pressure - Too Low	Fuel System Pressure Sensor Low Pressure System Out Of Range	<ul style="list-style-type: none"> Actual pressure > 0.8 – < 0.08 MPa 		<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual for test procedure. <p>If the fuel pressure is out of range:</p> <ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276- . Checking", page 398 .
P008B Low Pressure Sensor Low Pressure System Pressure - Too High	Fuel System Pressure Sensor Low Pressure System Out Of Range	<ul style="list-style-type: none"> Actual pressure > 0.8 – < 0.08 MPa 		<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual for test procedure. <p>If the fuel pressure is out of range:</p> <ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276- . Checking", page 398 .
P0100 Mass or Volume Air Flow Sensor "A" Circuit	MAF Sensor Signal Check	<ul style="list-style-type: none"> Signal duty cycle 0 		<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9- . Checking", page 417 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0101 Mass or Volume Air Flow Sensor "A" Circuit Range/Performance	MAF Sensor Rationality Check	<ul style="list-style-type: none"> Mass air flow vs lower threshold map < 3 – 197 kg/h Mass air flow vs upper threshold map > 70 – 1,157 kg/h 	<ul style="list-style-type: none"> Time after engine start > 150 revolutions 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9 , Checking", page 417 .
P0102 Mass or Volume Air Flow Sensor "A" Circuit Low	MAF Sensor Signal Range Check	<ul style="list-style-type: none"> Signal duty cycle < 0.066 ms 		<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9 , Checking", page 417 .
P0103 Mass or Volume Air Flow Sensor "A" Circuit High	MAF Sensor Signal Range Check	<ul style="list-style-type: none"> MAF signal duty cycle > 4.5 ms 		<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9 , Checking", page 417 .
P0106 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Range/Performance	Boost Pressure Sensor Rationality Check	<ul style="list-style-type: none"> Boost pressure sensor signal vs. altitude sensor signal < -13 kPa Boost pressure sensor signal vs. altitude sensor signal < > 23 kPa 	<ul style="list-style-type: none"> Throttle position < 7% Engine speed < 1,000 RPM 	<ul style="list-style-type: none"> 3.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31 , Checking", page 372 .
P0112 Intake Air Temperature Sensor 1 Circuit Low Bank 1	IAT Sensor Short To Ground	<ul style="list-style-type: none"> IAT > 141.0° C 		<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9 , Checking", page 417 .
P0113 Intake Air Temperature Sensor 1 Circuit High Bank 1	IAT Sensor Short To Battery Plus/Open Circuit	<ul style="list-style-type: none"> IAT < -45.75° C 		<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9 , Checking", page 417 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0116 Engine Coolant Temperature Sensor 1 Circuit Range/Performance	ECT Sensor Stuck Check	<ul style="list-style-type: none"> Delta ECT < 2.25 – 3.75 K ECT @ engine start > 50° C 	<ul style="list-style-type: none"> ECT @ start 50 – 140° C Driving condition 1, 5 x > 10 s Vehicle speed 0 mph Mass air flow > 4 – 28 kg/h And Driving condition 2, 1 x > 40 s Vehicle speed 37 – 75 mph Mass air flow < 28 – 200 kg/h 	<ul style="list-style-type: none"> > 110.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor - G62- . Refer to ➤ "3.6.9 Engine Coolant Temperature Sensor G62 , Checking", page 380 .
P0117 Engine Coolant Temperature Sensor 1 Circuit Low	ECT Sensor Short To Ground	<ul style="list-style-type: none"> ECT > 141° C 		<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor - G62- . Refer to ➤ "3.6.9 Engine Coolant Temperature Sensor G62 , Checking", page 380 .
P0118 Engine Coolant Temperature Sensor 1 Circuit High	ECT Sensor Open Circuit/ Short To Battery Plus	<ul style="list-style-type: none"> ECT < -43.5° C 		<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor - G62- . Refer to ➤ "3.6.9 Engine Coolant Temperature Sensor G62 , Checking", page 380 .
P0121 Throttle/Pedal Position Sensor 1 Rationality Check	Throttle Position Sensor 1 Rationality Check	<ul style="list-style-type: none"> TPS 1 – TPS 2 > 6.3 % And Actual TPS 1 calc value > actual TPS 2 calc value Or TPS 1 calc value > 9% 	<ul style="list-style-type: none"> Engine speed > 1,200 RPM 	<ul style="list-style-type: none"> 0.14 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ➤ "3.6.31 Throttle Valve Control Module GX3 , Checking", page 439 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0122 Throttle/Pedal Position Sensor/Switch "A" Circuit Low	Throttle Position Sensor 1 Out Of Range Low	<ul style="list-style-type: none"> Signal voltage < 0.25 V 		<ul style="list-style-type: none"> 0.14 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .
P0123 Throttle/Pedal Position Sensor/Switch "A" Circuit High	Throttle Position Sensor 1 Out Of Range High	<ul style="list-style-type: none"> Signal voltage > 4.75 V 		<ul style="list-style-type: none"> 0.14 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .
P0130 O2 Sensor Circuit Bank 1 Sensor 1	Oxygen Sensor Heater Front Out Of Range	<ul style="list-style-type: none"> O2S ceramic temp. < 640° C Or Internal resistance > 1,000 Ohm (threshold and trigger time for fault code & open loop) 	<ul style="list-style-type: none"> Battery voltage 11 – 16 V Heater control active Fuel cut off not active Modeled exhaust gas temp > 330° C 	<ul style="list-style-type: none"> 20.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
P0131 O2 Sensor Circuit Low Voltage Bank 1 Sensor 1	Oxygen Sensor Front Short To Ground	<ul style="list-style-type: none"> Virtual mass (VM) 1.66 – 2.36 V Or Nernst voltage (UN) < 1.42 – 2.1 V Or Adjustment voltage (AI) 0.3 – 1.5 V Or Adjustment voltage IP 0.3 – 1.5 V 	<ul style="list-style-type: none"> Engine speed > 25 rpm 	<ul style="list-style-type: none"> 4.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .




DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0132 O2 Sensor Circuit High Voltage Bank 1 Sensor 1	Oxygen Sensor Front Short To Battery Plus	<ul style="list-style-type: none"> Virtual mass (VM) 2.61 – 3.41 V Or Nernst voltage (UN) < 3.42 – 4.62 V Or Adjustment voltage (AI) 4.75 – 7.25 V Or Adjustment voltage IP 4.75 – 7.25 V 	<ul style="list-style-type: none"> Engine speed > 25 rpm 	<ul style="list-style-type: none"> 4.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10- Checking", page 430.
P0133 O2 Sensor Circuit Slow Response Bank 1 Sensor 1	Oxygen Sensor Front Signal Dynamic Check	<ul style="list-style-type: none"> O2S signal front signal ratio ≤ 0.35 [-] vs. modeled O2S signal And Cycles completed ≥ 40 [-] 	<ul style="list-style-type: none"> Lambda control closed loop Engine load 23 – 90% Engine speed 1,400 – 4,000 RPM Delta engine load > 6 %/seg. Purge fuel rate vs. injection rate < 0.18 [-] Actual Lambda 0.85 – 1.15 [-] 	<ul style="list-style-type: none"> 40.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10- Checking", page 430.
P0135 O2 Sensor Heater Circuit Bank 1 Sensor 1	Oxygen Sensor Heater Front Out Of Range High	<ul style="list-style-type: none"> O2S ceramic temperature < 715° C 	<ul style="list-style-type: none"> Heater control active Fuel cut off not active Modeled exhaust gas temp. > 300° C 	<ul style="list-style-type: none"> 55.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10- Checking", page 430.
			<ul style="list-style-type: none"> Heater control active Fuel cut off not active Engine shut off time > 300 s ECT @ start > -10.5° C Modeled exhaust gas temp. > 300° C 	<ul style="list-style-type: none"> 12.0 s Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0136 O2 Sensor Circuit Bank 1 Sensor 2	Oxygen Sensor Rear Heater Coupling Check	<ul style="list-style-type: none"> Delta of signal voltage > 2 V And Cycles completed >= 6 [-] 	<ul style="list-style-type: none"> O2S rear dew point exceeded for 60 s O2S rear fully heated up 	<ul style="list-style-type: none"> 10.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0137 O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	Oxygen Sensor Rear Signal Check	<ul style="list-style-type: none"> Signal voltage < 0.06 V For > 3 s And Difference of sensor voltage with load pulse and voltage pulse and voltage without load pulse (mean value of 3 measurements) < 0.015 V 	<ul style="list-style-type: none"> Fuel cut off not active Engine speed > 25 rpm O2S rear fully heated up 	<ul style="list-style-type: none"> 10.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
		<ul style="list-style-type: none"> Signal voltage < 30 mV 	<ul style="list-style-type: none"> ECT @ start < 39.8° C ECT @ engine off > 60° C 	<ul style="list-style-type: none"> 60.0 s Once / DCY 		
P0138 O2 Sensor Circuit High Voltage Bank 1 Sensor 2	Oxygen Sensor Rear Short To Battery Plus	<ul style="list-style-type: none"> Signal voltage > 1.26 V 	<ul style="list-style-type: none"> O2S rear fully heated up 	<ul style="list-style-type: none"> 5.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0139 O2 Sensor Circuit Slow Response Bank 1 Sensor 2	Oxygen Sensor Rear Oscillation Check	<ul style="list-style-type: none"> O2S signal rear during fuel cut off > 160 mV 	<ul style="list-style-type: none"> Fuel cut off > 4 s O2S rear readiness > 60 s Modeled exhaust gas temp. > 350° C O2S signal rear > 588 mV 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		<ul style="list-style-type: none"> O2S signal rear > 624 mV And O2S signal rear < 624 mV 	<ul style="list-style-type: none"> O2S rear, ready > 4 s O2S rear readiness > 60 s Modeled exhaust gas temp. > 350° C 	<ul style="list-style-type: none"> 15.0 s Continuous 		
		<ul style="list-style-type: none"> O2S signal rear < 624 mV 	<ul style="list-style-type: none"> Mass air flow 25 – 150 kg/h O2S rear readiness > 10 s Modeled exhaust gas temp. > 350° C 	<ul style="list-style-type: none"> 100.0 s Continuous 		
		<ul style="list-style-type: none"> O2S signal rear > 624 mV 	<ul style="list-style-type: none"> Mass air flow 25 – 150 kg/h O2S rear readiness > 10 s Modeled exhaust gas temp. > 350° C Fuel cut off > 4 s O2S signal rear > 588 mV 			
P0140 O2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	Oxygen Sensor Rear Signal Activity Check	<ul style="list-style-type: none"> mV 	<ul style="list-style-type: none"> O2S rear ready 	<ul style="list-style-type: none"> 400.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0141 O2 Sensor Heater Circuit Bank 1 Sensor 2	Oxygen Sensor Heater Out Of Range	<ul style="list-style-type: none"> Heater resistance 1,920 – 25,920 Ω 	<ul style="list-style-type: none"> Modeled exhaust gas temp 300 – 650° C Heater commanded on  Fuel cut off not active IAT > -10.5° C 	<ul style="list-style-type: none"> 15.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0171 System Too Lean Bank 1	Fuel System Additive System Too Lean	<ul style="list-style-type: none"> Adaptive value > 6 % 	<ul style="list-style-type: none"> Lambda control closed loop Evap purge valve closed ECT > 60° C Engine speed < 1,200 RPM Mass air flow < 26 kg/h Engine load 9 – 45% 	<ul style="list-style-type: none"> 60.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual for test procedure. Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.6.17 Fuel Pressure Sensor G247, Checking”, page 400 . Check the Fuel Injectors . Refer to ⇒ “3.6.15 Fuel Injectors, Checking”, page 396 . Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking”, page 430 . Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking”, page 427 . Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to ⇒ “3.6.13 EVAP Canister Purge Regulator Valve N80, Checking”, page 392 . Check the intake system for leaks (false air). Check the vacuum lines for leaks.
	Fuel System Multiplicative System Too Lean	<ul style="list-style-type: none"> Adaptive value > 26 % 	<ul style="list-style-type: none"> Lambda control closed loop Evap purge valve closed ECT > 60° C Mass air flow 30 – 450 kg/h Engine speed 1,320 – 6,000 RPM Engine load 20 – 100% 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0172 System Too Rich Bank 1	Fuel System Additive System Too Rich	<ul style="list-style-type: none"> Adaptive value < -6 % 	<ul style="list-style-type: none"> Lambda control closed loop Evap purge valve closed ECT > 60° C Engine speed < 1,200 RPM Mass air flow < 26 kg/h Engine load 9 – 45% 	<ul style="list-style-type: none"> 50.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual for test procedure. Check the Fuel Pressure Sensor - G247- . Refer to "3.6.17 Fuel Pressure Sensor G247 , Checking", page 400 . Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors , Checking", page 396 . Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 . Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking", page 427 . Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to "3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392 . Check the evaporative emission system for contamination. Refer to appropriate repair manual for component location.
	Fuel System Multiplicative System Too Rich	<ul style="list-style-type: none"> Adaptive value < -26 % 	<ul style="list-style-type: none"> Lambda control closed loop Evap purge valve closed ECT > 60° C Mass air flow 30 – 450 kg/h Engine speed 1,320 – 6,000 RPM Engine load 20 – 100% 			




DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0190 Fuel Pressure Regulator 1 Control Circuit/ Open	Fuel Rail Pressure Sensor High Pressure System Signal Range Check	<ul style="list-style-type: none"> Signal voltage > 4.8 V 		<ul style="list-style-type: none"> 3.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .
P0191 Fuel Rail Pressure Sensor Circuit Range/ Performance Bank 1	Fuel Rail Pressure Sensor High Pressure System Out Of Range	<ul style="list-style-type: none"> Actual pressure > 18 MPa 		<ul style="list-style-type: none"> Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure, refer to appropriate repair manual for proper procedures. If the fuel pressure is out of range: <ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276, Checking", page 398 . If the fuel pressure is not out of range: <ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .
P0192 Fuel Rail Pressure Sensor Circuit Low Bank 1	Fuel Rail Pressure Sensor High Pressure System Signal Range Check	<ul style="list-style-type: none"> Signal voltage < 0.2 V 		<ul style="list-style-type: none"> 3.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 . Check the fuel pressure, refer to appropriate repair manual for proper procedures.
P0201 Cylinder 1 Injector "A" Circuit	Injection Valves Open Circuit	<ul style="list-style-type: none"> Signal current < 2.1 A 	<ul style="list-style-type: none"> Engine speed > 80 RPM High side signal current > 2.6 A 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396 .
P0202 Cylinder 2 Injector "A" Circuit	Injection Valves Open Circuit	<ul style="list-style-type: none"> Signal current < 2.1 A 	<ul style="list-style-type: none"> Engine speed > 80 RPM High side signal current > 2.6 A 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0203 Cylinder 3 Injector "A" Circuit	Injection Valves Open Circuit	<ul style="list-style-type: none"> Signal current < 2.1 A 	<ul style="list-style-type: none"> Engine speed > 80 RPM High side signal current > 2.6 A 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors , Checking", page 396 .
P0204 Cylinder 4 Injector "A" Circuit	Injection Valves Open Circuit	<ul style="list-style-type: none"> Signal current < 2.1 A 	<ul style="list-style-type: none"> Engine speed > 80 RPM High side signal current > 2.6 A 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors , Checking", page 396 .
P0221 Throttle/Pedal Position Sensor 2 Rationality Check	Throttle Position Sensor 2 Rationality Check	<ul style="list-style-type: none"> TPS 1 – TPS 2 > 6.3% And Actual TPS 2 calc value > actual TPS 1 calc. value Or TPS 2 calc. value > 9% 	<ul style="list-style-type: none"> Engine speed > 1,200 RPM 	<ul style="list-style-type: none"> 0.14 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3 , Checking", page 439 .
P0222 Throttle/Pedal Position Sensor 2 Out Of Range Low	Throttle Position Sensor 2 Out Of Range Low	<ul style="list-style-type: none"> Signal voltage < 0.2 V 		<ul style="list-style-type: none"> 0.14 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3 , Checking", page 439 .
P0223 Throttle/Pedal Position Sensor 2 Out Of Range High	Throttle Position Sensor 2 Out Of Range High	<ul style="list-style-type: none"> Signal voltage > 4.75 V 		<ul style="list-style-type: none"> 0.14 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3 , Checking", page 439 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0234 Turbocharger/ Supercharger "A" Overboost Condition	Boost Pressure Control Valve Boost Pressure Check	<ul style="list-style-type: none"> Actual pressure – modeled pressure 30 – 127.5 kPa 	<ul style="list-style-type: none"> Engine speed > 2,680 – 3,520 RPM 	<ul style="list-style-type: none"> 1.5 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31 , Checking", page 372 . Check the Turbocharger Recirculation Valve - N249- . Refer to ⇒ "3.6.32 Turbocharger Recirculation Valve N249 , Checking", page 442 . Check the charge air system for proper seal.
P0237 Turbocharger/ Supercharger Boost Sensor "A" Circuit Low	Boost Pressure Sensor Short To Ground	<ul style="list-style-type: none"> Signal voltage < 0.2 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31 , Checking", page 372 . Check the Turbocharger Recirculation Valve - N249- . Refer to ⇒ "3.6.32 Turbocharger Recirculation Valve N249 , Checking", page 442 . Check the intake and charge air system for proper seal.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0238 Turbocharger/ Supercharger Boost Sensor "A" Circuit High	Boost Pressure Sensor Short To Battery Plus/Open Circuit	<ul style="list-style-type: none"> Signal voltage > 4.88 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31, Checking", page 372 . Check the Turbocharger Recirculation Valve - N249- . Refer to ⇒ "3.6.32 Turbocharger Recirculation Valve N249, Checking", page 442 . Check the intake and charge air system for proper seal.
P0243 Turbocharger/ Supercharger Wastegate Actuator "A"	Boost Pressure Control Valve Open Circuit	<ul style="list-style-type: none"> Signal voltage > 4.4 – 5.6 V 	<ul style="list-style-type: none"> Charge pressure control valve commanded off Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31, Checking", page 372 . Check the Turbocharger Recirculation Valve - N249- . Refer to ⇒ "3.6.32 Turbocharger Recirculation Valve N249, Checking", page 442 . Check the charge air system for proper seal.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0245 Turbo-charger/ Super-charger Waste-gate Actuator "A" Low	Boost Pressure Control Valve Short To Ground	<ul style="list-style-type: none"> Signal voltage < 2.15 – 3.25 V 	<ul style="list-style-type: none"> Charge pressure control valve commanded off Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31 , Checking", page 372 . Check the Turbo-charger Recirculation Valve - N249- . Refer to ⇒ "3.6.32 Turbo-charger Recirculation Valve N249 , Checking", page 442 . Check the charge air system for proper seal.
P0246 Turbo-charger/ Super-charger Waste-gate Actuator "A" High	Boost Pressure Control Valve Short To Battery Plus	<ul style="list-style-type: none"> Signal current > 2.2 A 	<ul style="list-style-type: none"> Charge pressure control valve commanded on Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31 , Checking", page 372 . Check the Turbo-charger Recirculation Valve - N249- . Refer to ⇒ "3.6.32 Turbo-charger Recirculation Valve N249 , Checking", page 442 . Check the charge air system for proper seal.
P025A Fuel Pump Module "A" Control Circuit/Open	Fuel Pump Open Circuit	<ul style="list-style-type: none"> Signal voltage > 4.4 – 5.6 V 	<ul style="list-style-type: none"> Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.7 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pump Control Module - J538- / Fuel Delivery Unit - GX1- . Refer to ⇒ "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1 , Checking", page 404 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P025C Fuel Pump Module "A" Control Circuit Low	Fuel Pump Short To Ground	• Signal voltage < 2.15 – 3.25 V	• Engine speed > 80 RPM	• 0.7 s • Continuous	• 2 DCY	– Check the Fuel Pump Control Module - J538- / Fuel Delivery Unit - GX1- . Refer to ⇒ "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1 , Checking", page 404 .
P025D Fuel Pump Module "A" Control Circuit High	Fuel Pump Short To Battery Plus	• Signal current > 1.1 A	• Engine speed > 80 RPM	• 0.7 s • Continuous	• 2 DCY	– Check the Fuel Pump Control Module - J538- / Fuel Delivery Unit - GX1- . Refer to ⇒ "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1 , Checking", page 404 .
P0261 Cylinder 1 Injector "A" Circuit Low	Injection Valves Short To Ground	• Signal current < 2.1 A	• Engine speed > 80 RPM • High side signal current > 4.2 A	• 0.5 s • Continuous	• 2 DCY	– Check the Cylinder 1 Fuel Injector - N30- . Refer to ⇒ "3.6.15 Fuel In- jectors , Check- ing", page 396 .
P0262 Cylinder 1 Injector "A" Circuit High	Injection Valves Short To Battery Plus	• Signal current > 14.7 A	• Engine speed > 80 RPM	• 0.5 s • Continuous	• 2 DCY	– Check the Cylinder 1 Fuel Injector - N30- . Refer to ⇒ "3.6.15 Fuel In- jectors , Check- ing", page 396 .
P0264 Cylinder 2 Injector "A" Circuit Low	Injection Valves Short To Ground	• Signal current < 2.1 A	• Engine speed > 80 RPM • High side signal current > 4.2 A	• 0.5 s • Continuous	• 2 DCY	– Check the Cylinder 2 Fuel Injector - N31- . Refer to ⇒ "3.6.15 Fuel In- jectors , Check- ing", page 396 .
P0265 Cylinder 2 Injector "A" Circuit High	Injection Valves Short To Battery Plus	• Signal current > 14.7 A	• Engine speed > 80 RPM	• 0.5 s • Continuous	• 2 DCY	– Check the Cylinder 2 Fuel Injector - N31- . Refer to ⇒ "3.6.15 Fuel In- jectors , Check- ing", page 396 .
P0267 Cylinder 3 Injector "A" Circuit Low	Injection Valves Short To Ground	• Signal current < 2.1 A	• Engine speed > 80 RPM • High side signal current > 4.2 A	• 0.5 s • Continuous	• 2 DCY	– Check the Cylinder 3 Fuel Injector - N32- . Refer to ⇒ "3.6.15 Fuel In- jectors , Check- ing", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0268 Cylinder 3 Injector "A" Circuit High	Injection Valves Short To Battery Plus	<ul style="list-style-type: none"> Signal current > 14.7 A 	<ul style="list-style-type: none"> Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 3 Fuel Injector - N32- . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .
P0270 Cylinder 4 Injector "A" Circuit Low	Injection Valves Short To Ground	<ul style="list-style-type: none"> Signal current < 2.1 A 	<ul style="list-style-type: none"> Engine speed > 80 RPM High side signal current > 4.2 A 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 4 Fuel Injector - N33- . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .
P0271 Cylinder 4 Injector "A" Circuit High	Injection Valves Short To Battery Plus	<ul style="list-style-type: none"> Signal current > 14.7 A 	<ul style="list-style-type: none"> Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 4 Fuel Injector - N33- . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .
P0299 Turbocharger/ Supercharger "A" Underboost Condition	Boost Pressure Control Valve Boost Pressure Check	<ul style="list-style-type: none"> Modeled pressure - actual pressure > 15 kPa 	<ul style="list-style-type: none"> Engine speed > 2,680 – 3,520 RPM Target charge > P amb + 45 kPa 	<ul style="list-style-type: none"> 10.0 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to "3.6.6 Charge Air Pressure Sensor G31, Checking", page 372 . Check the Turbocharger Recirculation Valve - N249- . Refer to "3.6.32 Turbocharger Recirculation Valve N249, Checking", page 442 . Check the charge air system for proper seal.
P0300 Random/ Multiple Cylinder Misfire Detected	Misfire Crankshaft Speed Fluctuation Single or Multiple Misfire	<ul style="list-style-type: none"> Emission threshold 1st interval % MR > 1.7 % Emission threshold misfire rate (MR) > 1.7% 	<ul style="list-style-type: none"> Time after engine start idle – 150 RPM Camshaft revolution 1 Engine speed range idle – 6,760 RPM Engine torque > zero torque Nm Fuel cut off not active ECT @ start > -10.5° C 	<ul style="list-style-type: none"> 1,000 revolutions Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Catalyst damage Misfire rate (MR) > 2.5 – 20% 	<ul style="list-style-type: none"> If ECT @ start < -10.5° C Then wait until actual ECT > 18° C 	<ul style="list-style-type: none"> 200 revolutions Continuous 	<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage - N70, N127, N291, N292- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P0301 Cylinder 1 Misfire Detected	Misfire Crankshaft Speed Fluctuation Single or Multiple Misfire	<ul style="list-style-type: none"> Emission threshold 1st interval % MR > 1.7 % Emission threshold misfire rate (MR) > 1.7% Catalyst damage Misfire rate (MR) > 2.5 – 20% 	<ul style="list-style-type: none"> Time after engine start idle – 150 RPM Camshaft revolution 1 Engine speed range idle – 6,760 RPM Engine torque > zero torque Nm Fuel cut off not active ECT @ start > -10.5° C If ECT @ start < -10.5° C Then wait until actual ECT > 18° C 	<ul style="list-style-type: none"> 1,000 revolutions Continuous 200 revolutions Continuous 	<ul style="list-style-type: none"> 2 DCY Immediately 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396 . Check the Ignition Coils with Power Output Stage - N70, N127, N291, N292- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P0302 Cylinder 2 Misfire Detected	Misfire Crankshaft Speed Fluctuation Single or Multiple Misfire	<ul style="list-style-type: none"> Emission threshold 1st interval % MR > 1.7 % Emission threshold misfire rate (MR) > 1.7% 	<ul style="list-style-type: none"> Time after engine start idle – 150 RPM Camshaft revolution 1 Engine speed range idle – 6,760 RPM Engine torque > zero torque Nm 	<ul style="list-style-type: none"> 1,000 revolutions Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Catalyst damage Misfire rate (MR) > 2.5 – 20% 	<ul style="list-style-type: none"> Fuel cut off not active ECT @ start > -10.5° C If ECT @ start < -10.5° C Then wait until actual ECT > 18° C 	<ul style="list-style-type: none"> 200 revolutions Continuous 	<ul style="list-style-type: none"> Immediately 	<p>⇒ “3.6.15 Fuel Injectors , Checking”, page 396 .</p> <ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage - N70, N127, N291, N292- . Refer to ⇒ “3.6.20 Ignition Coils with Power Output Stage , Checking”, page 409 .
P0303 Cylinder 3 Misfire Detected	Misfire Crankshaft Speed Fluctuation Single or Multiple Misfire	<ul style="list-style-type: none"> Emission threshold 1st interval % MR > 1.7 % Emission threshold misfire rate (MR) > 1.7% Catalyst damage Misfire rate (MR) > 2.5 – 20% 	<ul style="list-style-type: none"> Time after engine start idle – 150 RPM Camshaft revolution 1 Engine speed range idle – 6,760 RPM Engine torque > zero torque Nm Fuel cut off not active ECT @ start > -10.5° C If ECT @ start < -10.5° C Then wait until actual ECT > 18° C 	<ul style="list-style-type: none"> 1,000 revolutions Continuous 200 revolutions Continuous 	<ul style="list-style-type: none"> 2 DCY Immediately 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to ⇒ “3.6.15 Fuel Injectors , Checking”, page 396 . Check the Ignition Coils with Power Output Stage - N70, N127, N291, N292- . Refer to ⇒ “3.6.20 Ignition Coils with Power Output Stage , Checking”, page 409 .
P0304 Cylinder 4 Misfire Detected	Misfire Crankshaft Speed Fluctuation Single or Multiple Misfire	<ul style="list-style-type: none"> Emission threshold 1st interval % MR > 1.7 % Emission threshold misfire rate (MR) > 1.7% 	<ul style="list-style-type: none"> Time after engine start idle – 150 RPM Camshaft revolution 1 Engine speed range idle – 6,760 RPM Engine torque > zero torque Nm Fuel cut off not active ECT @ start > -10.5° C 	<ul style="list-style-type: none"> 1,000 revolutions Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to ⇒ “3.6.15 Fuel Injectors , Checking”, page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Catalyst damage Misfire rate (MR) > 2.5 – 20% 	<ul style="list-style-type: none"> If ECT @ start < -10.5° C Then wait until actual ECT > 18° C 	<ul style="list-style-type: none"> 200 revolutions Continuous 	<ul style="list-style-type: none"> Immediately 	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage - N70, N127, N291, N292- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P0321 Ignition/Distributor Engine Speed Input Circuit Range/Performance	RPM Sensor Rationality Check	<ul style="list-style-type: none"> Counted versus reference teeth > 1 	<ul style="list-style-type: none"> Engine speed > idle speed Vehicle speed < 1 or > 15 mph 	<ul style="list-style-type: none"> 1.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Speed Sensor - G28- . Refer to ⇒ "3.6.11 Engine Speed Sensor G28, Checking", page 384 .
P0322 Ignition/Distributor Engine Speed Input Circuit No Signal	RPM Sensor Signal Activity Check	<ul style="list-style-type: none"> Comparison with phase sensor no signal 		<ul style="list-style-type: none"> Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Speed Sensor - G28- . Refer to ⇒ "3.6.11 Engine Speed Sensor G28, Checking", page 384 .
P0324 Knock Control System Error	Knock Control Internal Hardware Check	<ul style="list-style-type: none"> Zero test procedure failed 	<ul style="list-style-type: none"> ECT > 40.5° C 	<ul style="list-style-type: none"> 150.0 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Knock Sensor 1 - G61- . Refer to ⇒ "3.6.24 Knock Sensor 1 G61, Checking", page 421 .
P0327 Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor	Knock Sensor Rationality Check Low	<ul style="list-style-type: none"> Sensor signal < 0.12 – 0.31 V 	<ul style="list-style-type: none"> ECT @ cylinder head > 60° C MAF ≤ 229.0 mg/rev Engine speed > 2,016 RPM 	<ul style="list-style-type: none"> 4.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Knock Sensor 1 - G61- . Refer to ⇒ "3.6.24 Knock Sensor 1 G61, Checking", page 421 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0328 Knock/Combustion Vibration Sensor 1 Circuit High Bank 1 or Single Sensor	Knock Sensor 1 Signal Range Check	<ul style="list-style-type: none"> Upper threshold 4.5 – 30.0 V 	<ul style="list-style-type: none"> Engine speed > 2,400 RPM ECT > 40.5° C Engine load > 30% 	<ul style="list-style-type: none"> 2.5 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Knock Sensor 1 - G61- . Refer to ⇒ "3.6.24 Knock Sensor 1 G61, Checking", page 421 .
P0332 Knock/Combustion Vibration Sensor 2 Circuit Low Bank 2	Knock Sensor 2 Signal Range Check	<ul style="list-style-type: none"> Lower threshold 0.05 – 0.38 V 	<ul style="list-style-type: none"> Engine speed > 2,400 RPM ECT > 40.5° C Engine load > 30% 	<ul style="list-style-type: none"> 2.5 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Knock Sensor 1 - G61- . Refer to ⇒ "3.6.24 Knock Sensor 1 G61, Checking", page 421 .
P0333 Knock/Combustion Vibration Sensor 2 Circuit High Bank 2	Knock Sensor 2 Signal Range Check	<ul style="list-style-type: none"> Upper threshold 4.5 – 30.0 V 	<ul style="list-style-type: none"> Engine speed > 2,400 RPM ECT > 40.5° C Engine load > 30% 	<ul style="list-style-type: none"> 2.5 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Knock Sensor 1 - G61- . Refer to ⇒ "3.6.24 Knock Sensor 1 G61, Checking", page 421 .
P0341 Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor	Phase Sensor Rationality Check	<ul style="list-style-type: none"> Signal voltage no altering @ reference gap 		<ul style="list-style-type: none"> 3.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Position Sensor - G40- . Refer to ⇒ "3.6.5 Camshaft Position Sensor G40, Checking", page 368 .
P0342 Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor	Phase Sensor Rationality Check	<ul style="list-style-type: none"> Signal voltage low 12 revolutions 		<ul style="list-style-type: none"> 3.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Position Sensor - G40- . Refer to ⇒ "3.6.5 Camshaft Position Sensor G40, Checking", page 368 .
P0343 Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor	Phase Sensor Rationality Check	<ul style="list-style-type: none"> Signal voltage high 12 revolutions 		<ul style="list-style-type: none"> 3.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Position Sensor - G40- . Refer to ⇒ "3.6.5 Camshaft Position Sensor G40, Checking", page 368 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0351 Ignition Coil "A" Primary Control Circuit/ Open	Ignition Coils Open Circuit	<ul style="list-style-type: none"> Signal current < 4.95 – 8.82 mA 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil 1 With Power Output Stage - N70- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P0352 Ignition Coil "B" Primary Control Circuit/ Open	Ignition Coils Open Circuit	<ul style="list-style-type: none"> Signal current < 4.95 – 8.82 mA 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil 2 With Power Output Stage - N127- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P0353 Ignition Coil "C" Primary Control Circuit/ Open	Ignition Coils Internal Hardware Check	<ul style="list-style-type: none"> Internal fault changing error 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil 3 With Power Output Stage - N291- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P0354 Ignition Coil "D" Primary Control Circuit/ Open	Ignition Coils Internal Hardware Check	<ul style="list-style-type: none"> Internal fault changing error 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil 4 With Power Output Stage - N292- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .



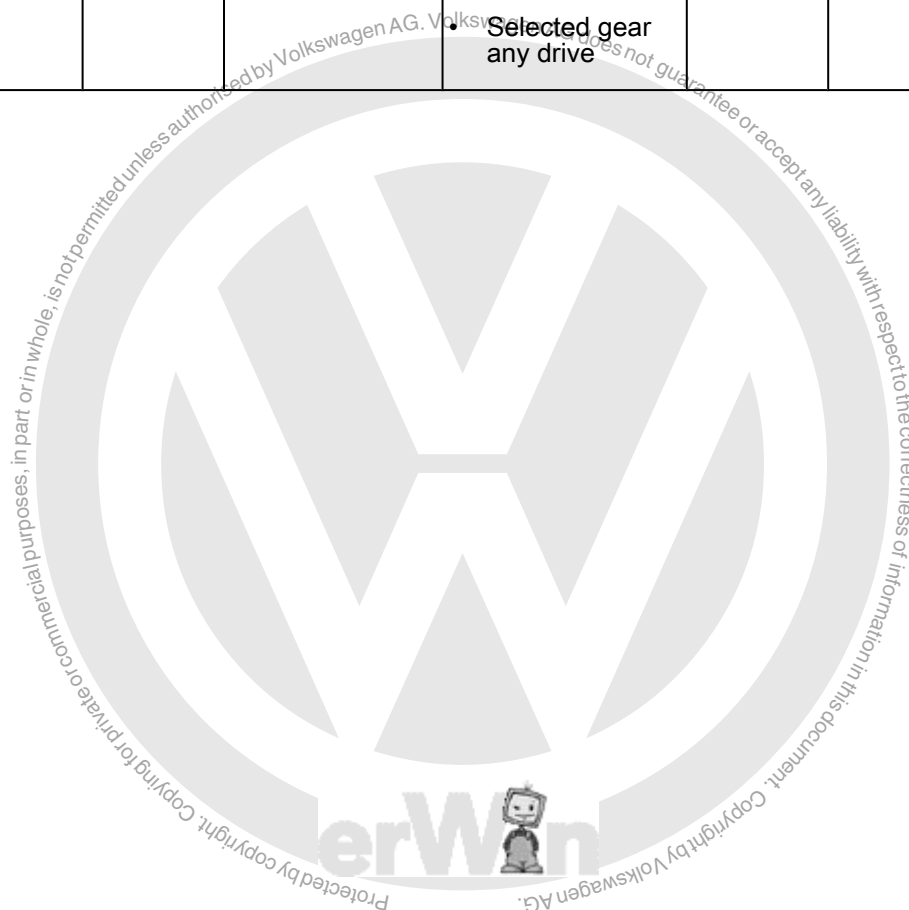
DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0420 Catalyst System Efficiency Below Threshold Bank 1	Catalyst NOx, NMOG / NMHC Conversion Capability	<ul style="list-style-type: none"> Amplitude ratio O2S < 1 [-] 	<ul style="list-style-type: none"> Engine start temperature > -10° C Delta mass air flow < 20 kg/h/s Evap purge flow < 25 % Engine load 18 – 75 % Lower range Mass air flow @23 – 85 kg/h Catalyst temperature 440 – 620° C Upper range Mass air flow @70 – 130 kg/h Catalyst temperature 550 – 750° C Engine speed 1,200 – 4,000 RPM 	<ul style="list-style-type: none"> 70.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7 Checking”, page 427 .
P0441 EVAP System Incorrect Purge Flow	Evap Purge System Functional Check	<ul style="list-style-type: none"> Deviation lambda control -6 – 9.5% And Deviation idle control < 30% 	<ul style="list-style-type: none"> Engine speed idle RPM Engine speed deviation < 80 RPM Integrated air mass > 4.90 – 6.50 kg Or Evap purge flow integral > 75 – 145 g ECT > 65° C Or substitute ECT > 80° C IAT > 3.8° C IAT @ engine start > 3.8° C Altitude < 2,500 m 	<ul style="list-style-type: none"> 25.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to ⇒ “3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 392 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0442 EVAP System Leak Detected (Small Leak)	Evap System Small Leak Pressure Check	<ul style="list-style-type: none"> Time for pressure drop < 1.95 – 2.15 s (depending on altitude and IAT) 	<ul style="list-style-type: none"> Evap purge valve closed LDP activated Ambient pressure > 743.5 hPa Number of diagnosis at temps <= 5 IAT > 4° C Delta ambient pressure < 300 Pa IAT drop after engine start < 7 K Time after engine start > 175 s ECT 4 – 115° C ECT @ start 4 – 35° C Vehicle speed > 19 mph Selected gear any drive 	<ul style="list-style-type: none"> 150.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to ⇒ “3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 392 .
P0444 EVAP System Purge Control Valve "A" Circuit Open	Evap Purge Valve Open Circuit	<ul style="list-style-type: none"> Signal voltage > 4.4 – 5.6 V 	<ul style="list-style-type: none"> Evap purge valve commanded off Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to ⇒ “3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 392 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0455 EVAP System Leak Detected (Large Leak)	Evap System Large Leak Pressure Check	<ul style="list-style-type: none"> Time for pressure drop < 0.95 s (depending on altitude and IAT) 	<ul style="list-style-type: none"> Evap purge valve closed LDP activated Ambient pressure > 743.5 hPa Number of diagnosis at temps <= 5 IAT > 4° C Delta ambient pressure < 300 Pa IAT drop after engine start < 7 K Time after engine start > 175 s ECT 4 – 115° C ECT @ start 4 – 35° C Vehicle speed > 19 mph Selected gear any drive 	<ul style="list-style-type: none"> 150.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to "3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392 .





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0456 EVAP System Leak Detected (Very Small Leak)	EVAP System Very Small Leak Pressure Check	<ul style="list-style-type: none"> Time for pressure drop 1.95 – 2.15 < x < 4.5 – 6.5 s (depending on altitude and IAT) 	<ul style="list-style-type: none"> Evap purge valve closed LDP activated Ambient pressure > 743.5 hPa Number of diagnosis at temps ≤ 5 IAT > 4° C Delta ambient pressure < 300 Pa IAT drop after engine start < 7 K Time after engine start > 175 s ECT 4 – 115° C ECT @ start 4 – 35° C Vehicle speed > 19 mph Selected gear any drive Time after engine start < 1,500 s IAT drop after engine start < 4 K Vehicle speed < 93.2 mph Delta ambient pressure < 150 Pa 	<ul style="list-style-type: none"> 200.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP System visually for any leaking hoses or damage to components. Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to ⇒ "3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392 . Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400- . Refer to ⇒ "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406 .
P0458 EVAP System Purge Control Valve "A" Circuit Low	Evap Purge Valve Short To Ground	<ul style="list-style-type: none"> Signal voltage 2.15 – 3.25 V 	<ul style="list-style-type: none"> Evap purge valve commanded off Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to ⇒ "3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0459 EVAP System Purge Control Valve "A" Circuit High	Evap Purge Valve Short To Battery Plus	<ul style="list-style-type: none"> Signal current > 2,2 A 	<ul style="list-style-type: none"> Evap purge valve commanded on Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to ⇒ "3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392 .
P0501 Vehicle Speed Sensor "A" Circuit Range/Performance	Vehicle Speed Sensor Rationality Check	<ul style="list-style-type: none"> VSS signal < 2 mph 	<ul style="list-style-type: none"> Fuel cut-off active Engine speed 1,520 – 4,520 RPM 	<ul style="list-style-type: none"> 4.0 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the vehicle speed signal. Refer to ⇒ "3.6.33 Vehicle Speed Signal, Checking", page 444 .
P0506 Idle Control System RPM - Lower Than Expected	Idle Controller Out Of Range Low	<ul style="list-style-type: none"> Engine speed deviation < -80 RPM And RPM controller torque value = maximum controller limit 	<ul style="list-style-type: none"> Engine load 24 – 43.5% Engine speed idle Accelerator PP 0% Fuel cut off not active Vehicle speed 0 mph Purge fuel rate vs. injection rate < 0.18 Altitude < 3,125 m IAT > -10° C ECT > -10° C 	<ul style="list-style-type: none"> 4.0 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3 , Checking", page 439 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0507 Idle Control System RPM - Higher Than Expected	Idle Controller Out Of Range High	<ul style="list-style-type: none"> Engine speed deviation < -80 RPM And RPM controller torque value = minimum controller limit 	<ul style="list-style-type: none"> Engine load 24 - 43.5% Engine speed idle Accelerator PP 0% Fuel cut off not active Vehicle speed 0 mph Purge fuel rate vs. injection rate < 0.18 Altitude < 3,125 m IAT > -10° C ECT > -10° C 	<ul style="list-style-type: none"> 8.0 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .
P050A Cold Start Idle Control System Performance	Idle Controller Out Of Range Low	<ul style="list-style-type: none"> Engine speed deviation < -80 RPM And RPM controller torque value = maximum controller limit 	<ul style="list-style-type: none"> Engine load 24 - 43.5% Engine speed idle Accelerator PP 0% Fuel cut off not active Vehicle speed 0 mph Purge fuel rate vs. injection rate < 0.18 Altitude < 3,125 m IAT > -10° C ECT > -10° C 	<ul style="list-style-type: none"> 4.0 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Idle Controller Out Of Range High	<ul style="list-style-type: none"> Engine speed deviation < -80 RPM And RPM controller torque value = minimum controller limit 	<ul style="list-style-type: none"> Engine load 24 – 43.5% Engine speed idle Accelerator PP 0% Fuel cut off not active Vehicle speed 0 mph Purge fuel rate vs. injection rate < 0.18 Altitude < 3,125 m IAT > -10° C ECT > -10° C 	<ul style="list-style-type: none"> 8.0 s Multiple 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P050B Cold Start Ignition Timing Performance	Cold Start Monitoring Ignition Control Ignition Timing Monitor At Idle	<ul style="list-style-type: none"> Difference between actual and commanded ignition angle > 34% 	<ul style="list-style-type: none"> Catalyst heating active Idle speed active Vehicle speed 0 mph 	<ul style="list-style-type: none"> 0.5 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Inspect the air cleaner element and the air intake system for leaks, also check throttle drive for carbon buildup and clean as necessary. Inspect the PCV system for leaks. Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9 , Checking", page 417 . Check the Ignition Coils with Power Output Stage . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 . Check the Engine Coolant Temperature Sensor - G62- . Refer to ⇒ "3.6.9 Engine Coolant Temperature Sensor G62 , Checking", page 380 . If NO other codes are set, check the Engine Control Module - J623- . Refer to appropriate repair manual.
P052A Cold Start "A" Camshaft Position Timing Over-Advanced Bank 1	Cold Start Monitoring VVT Actuator Intake Response Check	<ul style="list-style-type: none"> Adjustment angle > 3.5° CA 	<ul style="list-style-type: none"> Catalyst heating active 	<ul style="list-style-type: none"> 3.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ "3.6.3 Camshaft Adjustment Valve 1 N205 , Checking", page 362 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P053F Cold Start Fuel Pressure Performance Bank 2	Fuel Rail High Pressure System For Cold Start Monitoring Functional Check	<ul style="list-style-type: none"> Difference between actual pressure – target pressure > 1.5 MPa 	<ul style="list-style-type: none"> Time after engine start and fuel cut off 10 s Fuel cut off not active 	<ul style="list-style-type: none"> 3.5 s 		<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual for proper procedure. Check the Fuel Pump Control Module - J538- / Fuel Delivery Unit - GX1- . Refer to ⇒ “3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1 , Checking”, page 404 . Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ “3.6.16 Fuel Pressure Regulator Valve N276 , Checking”, page 398 .
P0601 Internal Control Module Memory Check-sum Error	ECM Internal Checksum Verification	<ul style="list-style-type: none"> Internal check sum incorrect 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Control Module - J623- . Refer to appropriate repair manual.
P0604 Internal Control Module Random Access Memory (RAM) Error	ECM RAM Check	<ul style="list-style-type: none"> Write ability check failed 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0605 Internal Control Module Read Only Memory (ROM) Error	ECM ROM Check	<ul style="list-style-type: none"> Check failed 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0606 Control Module Processor	ECM EE-PROM-Check	<ul style="list-style-type: none"> Check failed 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
	ECM Drive By Wire Module Check					
	Fuel Supply Shut Off Drive	<ul style="list-style-type: none"> Engine torque out of range 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	By Wire Module Check	<ul style="list-style-type: none">• Engine operating condition out of range		<ul style="list-style-type: none">• Immediately• Once / DCY		
	CAN Bus CAN Controller RAM Check	<ul style="list-style-type: none">• RAM error memory checksum error				
	Self Check For Sensor IC		<ul style="list-style-type: none">• Engine speed idle	<ul style="list-style-type: none">• 10.0 s• Continuous		
	Altitude Sensor Open Circuit	<ul style="list-style-type: none">• Signal voltage < 1.0 V		<ul style="list-style-type: none">• 0.2 s• Continuous		
	Altitude Sensor Short To Ground					
P062B Internal Control Module Fuel Injector Control Performance	Injection Valves Communication Functional Monitoring	<ul style="list-style-type: none">• Internal logic failure	<ul style="list-style-type: none">• Engine speed > 80 RPM	<ul style="list-style-type: none">• 1.1 s• Continuous	<ul style="list-style-type: none">• 2 DCY	<ul style="list-style-type: none">– Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors , Checking", page 396 .
P0638 Throttle Actuator Control Range/ Performance Bank 1	Throttle Actuator Rationality Check Close Movement	<ul style="list-style-type: none">• Time to open over reference point + 12% > 0.14 s• Or• Time to close below reference point + 3% > 0.56 s	<ul style="list-style-type: none">• Ignition on• Engine speed < 300 RPM• IAT > 5° C• Vehicle speed 0 mph• ECT > 5° C	<ul style="list-style-type: none">• 5.0 s• Continuous	<ul style="list-style-type: none">• 2 DCY	<ul style="list-style-type: none">– Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3 , Checking", page 439 .
	Throttle Actuator Basic Setting Rationality Check Close Movement					
	Throttle Actuator Basic Setting Signal Range Check @ Mechanical Stop Low	<ul style="list-style-type: none">• TPS 1 signal voltage not 0.42 – 0.77 V• Or• TPS 2 signal voltage not 4.26 – 4.58 V				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0641 Sensor Reference Voltage "A" Circuit/Open	5V Sensor Reference Internal Hardware Check	<ul style="list-style-type: none"> Internal communication failure A 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0642 Sensor Reference Voltage "A" Circuit Low	5V Sensor Reference Out Of Range Low	<ul style="list-style-type: none"> Signal voltage < 4.6 – 5.0 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0643 Sensor Reference Voltage "A" Circuit High	5V Sensor Reference Out Of Range High	<ul style="list-style-type: none"> Signal voltage > 5.0 – 5.4 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0651 Sensor Reference Voltage "B" Circuit/Open	5V Sensor Reference Internal Hardware Check	<ul style="list-style-type: none"> Internal communication failure A 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0652 Sensor Reference Voltage "B" Circuit Low	5V Sensor Reference Out Of Range Low	<ul style="list-style-type: none"> Signal voltage < 4.6 – 5.0 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0653 Sensor Reference Voltage "B" Circuit High	5V Sensor Reference Out Of Range High	<ul style="list-style-type: none"> Signal voltage > 5.0 – 5.4 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0657 Actuator Supply Voltage "A" Circuit/Open	Supply Voltage Relay Engine Components Open Circuit	<ul style="list-style-type: none"> Signal voltage > 4.4 – 5.6 V 	<ul style="list-style-type: none"> Relay commanded off Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Component Power Supply Relay - J757- . Refer to ⇒ "3.6.8 Engine Component Power Supply Relay J757 , Checking", page 378 .
P0658 Actuator Supply Voltage "A" Circuit Low	Supply Voltage Relay Engine Components Short To Ground	<ul style="list-style-type: none"> Signal voltage < 2.15 – 3.25 V 	<ul style="list-style-type: none"> Relay commanded off Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Component Power Supply Relay - J757- . Refer to ⇒ "3.6.8 Engine Component Power Supply Relay J757 , Checking", page 378 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0659 Actuator Supply Voltage "A" Circuit High	Supply Voltage Relay Engine Components Short To Battery Plus	<ul style="list-style-type: none"> Signal current > 1.1 A 	<ul style="list-style-type: none"> Relay commanded on Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Component Power Supply Relay - J757- . Refer to ⇒ "3.6.8 Engine Component Power Supply Relay J757 , Checking", page 378 .
P0685 ECM/ PCM Power Relay Control Circuit/ Open	Main Relay Open Circuit	<ul style="list-style-type: none"> Control voltage 2.6 – 3.7 V And Sense circuit voltage < 6.0 V 	<ul style="list-style-type: none"> Ignition off 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Motronic Engine Control Module Power Supply Relay - J271- . Refer to ⇒ "3.6.25 Motronic Engine Control Module Power Supply Relay J271 , Checking", page 423 .
P0686 ECM / PCM Power Relay Control Circuit Low	Main Relay Short To Ground	<ul style="list-style-type: none"> Control voltage 2.6 – 3.7 V And Sense circuit voltage > 6.0 V 	<ul style="list-style-type: none"> Ignition off 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Motronic Engine Control Module Power Supply Relay - J271- . Refer to ⇒ "3.6.25 Motronic Engine Control Module Power Supply Relay J271 , Checking", page 423 .
P0687 ECM / PCM Power Relay Control Circuit High	Main Relay Short To Battery Plus	<ul style="list-style-type: none"> Signal current > 1.4 – 0.7 A And Sense circuit voltage < 6.0 V 		<ul style="list-style-type: none"> 0.5 s 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Motronic Engine Control Module Power Supply Relay - J271- . Refer to ⇒ "3.6.25 Motronic Engine Control Module Power Supply Relay J271 , Checking", page 423 .
P0688 ECM/ PCM Power Relay Sense Circuit/ Open	Main Relay Signal Range Check	<ul style="list-style-type: none"> Sense voltage < 3.0 V Sense voltage > 3.0 V 	<ul style="list-style-type: none"> Main relay commanded on Main relay commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Motronic Engine Control Module Power Supply Relay - J271- . Refer to ⇒ "3.6.25 Motronic Engine Control Module Power Supply Relay J271 , Checking", page 423 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0697 Sensor Reference Voltage "C" Circuit/Open	5V Sensor Reference Internal Hardware Check	<ul style="list-style-type: none"> Internal communication failure A 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0698 Sensor Reference Voltage "C" Circuit Low	5V Sensor Reference Out Of Range Low	<ul style="list-style-type: none"> Signal voltage < 4.6 – 5 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0699 Sensor Reference Voltage "C" Circuit High	5V Sensor Reference Out Of Range High	<ul style="list-style-type: none"> Signal voltage > 5 – 5.4 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P12A1 Fuel Rail Pressure Sensor Inappropriately Low	Fuel Rail Pressure Sensor High Pressure System Rationality Check Inappropriately Low	<ul style="list-style-type: none"> Pressure control activity > 2.5 MPa Fuel trim activity < 0.80 [-] 	<ul style="list-style-type: none"> Lambda control closed loop Evap purge flow > 0.25 kg/h Engine speed 2,000 – 4,000 RPM Fuel cut off not active 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Pressure Sensor - G247- . Refer to "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .
P12A2 Fuel Rail Pressure Sensor Inappropriately High	Fuel Rail Pressure Sensor High Pressure System Rationality Check Inappropriately High	<ul style="list-style-type: none"> Pressure control activity < -0.14 MPa Fuel trim activity > 1.5 [-] 	<ul style="list-style-type: none"> Lambda control closed loop Evap purge flow > 0.25 kg/h Engine speed 600 – 900 RPM Engine load > 10% Fuel cut off not active 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Pressure Sensor - G247- . Refer to "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .
P12A4 Fuel Rail Pump Control Valve Stuck Closed	Fuel Rail Pressure Control Valve Functional Check Stuck Closed	<ul style="list-style-type: none"> Pressure control activity < -6.0 MPa Fuel trim activity 0.9 – 1.15 [-] 	<ul style="list-style-type: none"> Lambda control closed loop Evap purge flow > 0.25 kg/h Engine speed 2,000 – 4,000 RPM Fuel cut off not active 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Pressure Sensor - G247- . Refer to "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P13EA Cold Start Ignition Timing Performance Off Idle	Cold Start Monitoring Ignition Control Ignition Timing Monitor at Part Load	<ul style="list-style-type: none"> Difference between actual and commanded ignition angle > 23% 	<ul style="list-style-type: none"> Catalyst heating active Idle speed not active Vehicle speed >= 3 mph 	<ul style="list-style-type: none"> 0.5 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Inspect the air cleaner element and the air intake system for leaks, also check throttle drive for carbon buildup and clean as necessary. Inspect the PCV system for leaks. Check the Intake Manifold Sensor - GX9- . Refer to "3.6.23 Intake Manifold Sensor GX9 , Checking", page 417 . Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 . Check the Engine Coolant Temperature Sensor - G62- . Refer to "3.6.9 Engine Coolant Temperature Sensor G62 , Checking", page 380 . If NO other codes are set, check the Engine Control Module - J623- . Refer to appropriate repair manual.
P2004 Intake Manifold Runner Control Stuck Open Bank 1	Intake Manifold Runner Flaps Actuator Signal Range Check @ Upper Mechanical Stop	<ul style="list-style-type: none"> Normal closed position unable to reach Signal voltage < 2.62 or > 4.65 V 	<ul style="list-style-type: none"> Ignition off Runner flaps commanded closed Position sensor no DTC Actuator no DTC 	<ul style="list-style-type: none"> 25.0 s 	<ul style="list-style-type: none"> Once DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Control Valve - N316- . Refer to "3.6.21 Intake Manifold Runner Control Valve N316 , Checking", page 411 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Intake Manifold Runner Flaps Actuator Signal Range Check @ Lower Mechanical Stop	<ul style="list-style-type: none"> Normal open position, unable to reach Signal voltage < 0.35 or > 2.38 V 	<ul style="list-style-type: none"> Ignition off Position sensor no DTC Actuator no DTC 			
P2008 Intake Manifold Runner Control Circuit/ Open Bank 1	Intake Manifold Runner Flaps Actuator Signal Range Check	<ul style="list-style-type: none"> Signal duty cycle > 80% And ECM power stage failure 		<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Control Valve - N316- . Refer to ⇒ "3.6.21 Intake Manifold Runner Control Valve N316 , Checking", page 411 .
		<ul style="list-style-type: none"> Deviation vs. calculated value > 5% ECM power stage failure 		<ul style="list-style-type: none"> 1.0 s Continuous 		
P2014 Intake Manifold Runner Position Sensor/ Switch Circuit Bank 1	Intake Manifold Runner Flaps Position Sensor Signal Range Check	<ul style="list-style-type: none"> Signal voltage > 4.82 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Position Sensor - G336- . Refer to ⇒ "3.6.22 Intake Manifold Runner Position Sensor G336 , Checking", page 413 .
P2015 Intake Manifold Runner Position Sensor/ Switch Circuit Range/ Performance Bank 1	Intake Manifold Runner Flaps Actuator Signal Range Check	<ul style="list-style-type: none"> Signal duty cycle > 80% 	<ul style="list-style-type: none"> ECM power stage no failure Position sensor no DTC 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Position Sensor - G336- . Refer to ⇒ "3.6.22 Intake Manifold Runner Position Sensor G336 , Checking", page 413 .
	Intake Manifold Runner Flaps Actuator Rationality Check	<ul style="list-style-type: none"> Deviation vs. calculated value > 5% 		<ul style="list-style-type: none"> 1.0 s Continuous 		
P2016 Intake Manifold Runner Position Sensor/ Switch Circuit Low Bank 1	Intake Manifold Runner Flaps Position Sensor Signal Range Check	<ul style="list-style-type: none"> Signal voltage < 0.18 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Position Sensor - G336- . Refer to ⇒ "3.6.22 Intake Manifold Runner Position Sensor G336 , Checking", page 413 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2088 "A" Camshaft Position Actuator Control Circuit Low Bank 1	VVT In-take Short To Ground	<ul style="list-style-type: none"> Signal voltage < 2.15 – 3.25 V 	<ul style="list-style-type: none"> Camshaft valve commanded off Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ "3.6.3 Camshaft Adjustment Valve 1 N205, Checking", page 362 .
P2089 "A" Camshaft Position Actuator Control Circuit High Bank 1	VVT In-take Short To Battery Plus	<ul style="list-style-type: none"> Signal current > 2.2 A 	<ul style="list-style-type: none"> Camshaft actuator solenoid valve on Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ "3.6.3 Camshaft Adjustment Valve 1 N205, Checking", page 362 .
P2096 Post Catalyst Fuel Trim System Too Lean Bank 1	Fuel System Adaptive Value Limit High	<ul style="list-style-type: none"> Deviation lambda control > 3% 	<ul style="list-style-type: none"> Lambda control closed loop Fuel trim control post cat active Engine speed 1,200 – 4,520 RPM Engine load 18 – 95.3% O2S rear no DTC 	<ul style="list-style-type: none"> 100.0 s 	<ul style="list-style-type: none"> Continuous 2 DCY 	<ul style="list-style-type: none"> Check exhaust system for leaks and correct as necessary. Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 . Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2097 Post Catalyst Fuel Trim System Too Rich Bank 1	Fuel System Adaptive Value Limit High	<ul style="list-style-type: none"> Deviation lambda control > 3% 	<ul style="list-style-type: none"> Lambda control closed loop Fuel trim control post cat active Engine speed 1,200 – 4,520 RPM Engine load 18 – 95.3% O2S rear no DTC 	<ul style="list-style-type: none"> 100.0 s 	<ul style="list-style-type: none"> Continuous 2 DCY 	<ul style="list-style-type: none"> Check exhaust system for leaks and correct as necessary. Check the Oxygen Sensor 1 Before Catalytic Converter - GX10. Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430. Check the Oxygen Sensor 1 After Catalytic Converter - GX7. Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427.
P2101 Throttle Actuator "A" Control Motor Circuit Range/Performance	Throttle Actuator Signal Range Check	<ul style="list-style-type: none"> Duty cycle > 80% And ECM power stage no failure 		<ul style="list-style-type: none"> 0.6 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3. Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3, Checking", page 439.
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator Signal Range Check	<ul style="list-style-type: none"> Duty cycle > 80% And ECM power stage failure 		<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3. Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3, Checking", page 439.
	Fuel Supply Shut Off Drive By Wire Module Check	<ul style="list-style-type: none"> Engine load out of range 		<ul style="list-style-type: none"> 0.5 s Continuous 		
P2122 Throttle/Pedal Position Sensor/Switch "D" Circuit Low	Accelerator PP Sensor 1 Out Of Range Low	<ul style="list-style-type: none"> Signal voltage < 0.63 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Accelerator Pedal Module - GX2. Refer to ⇒ "3.6.1 Accelerator Pedal Module GX2, Checking", page 357.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2123 Throttle/Pedal Position Sensor "D" Circuit High	Accelerator PP Sensor 1 Out Of Range High	• Signal voltage > 4.8 V		• 0.2 s • Continuous	• 2 DCY	– Check the Accelerator Pedal Module - GX2- . Refer to ⇒ "3.6.1 Accelerator Pedal Module GX2 , Checking", page 357 .
P2127 Throttle/Pedal Position Sensor "E" Circuit Low	Accelerator PP Sensor 2 Out Of Range Low	• Signal voltage < 0.29 V		• 0.2 s • Continuous	• 2 DCY	– Check the Accelerator Pedal Module - GX2- . Refer to ⇒ "3.6.1 Accelerator Pedal Module GX2 , Checking", page 357 .
P2128 Throttle/Pedal Position Sensor "E" Circuit High	Accelerator PP Sensor 2 Out Of Range High	• Signal voltage > 2.5 V		• 0.2 s • Continuous	• 2 DCY	– Check the Accelerator Pedal Module - GX2- . Refer to ⇒ "3.6.1 Accelerator Pedal Module GX2 , Checking", page 357 .
P2138 Throttle/Pedal Position Sensor "D"/"E" Voltage Correlation	Accelerator PP Sensor 1 Sensor 2 Rationality Check	• Signal voltage sensor 1 vs sensor 2 > 0.12 – 0.7 V		• 0.24 s • Continuous	• 2 DCY	– Check the Accelerator Pedal Module - GX2- . Refer to ⇒ "3.6.1 Accelerator Pedal Module GX2 , Checking", page 357 .
P2146 Fuel Injector Group "A" Supply Voltage Circuit/ Open	Injection Valves Supply Voltage Short To Battery Plus	• Signal current < 2.6 A	• Engine speed > 80 RPM • Low side signal current > 2.7 A	• 0.5 s • Continuous	• 2 DCY	– Check the Fuel Injectors - N30, N31, N32, N33- . Refer to ⇒ "3.6.15 Fuel Injectors , Checking", page 396 .
P2149 Fuel Injector Group "B" Supply Voltage Circuit/ Open	Injection Valves Supply Voltage Short To Ground	• Signal current > 14.9 A	• Engine speed > 80 RPM	• 0.5 s • Continuous	• 2 DCY	– Check the Fuel Injectors - N30, N31, N32, N33- . Refer to ⇒ "3.6.15 Fuel Injectors , Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2181 Cooling System Performance	Coolant System Rationality Check	<ul style="list-style-type: none"> ECT < 76.5° C And Mass air integral 5.3 – 30.9 kg 	<ul style="list-style-type: none"> ECT at start -7 – 60° C ECT > 40° C IAT > -7° C Accum fuel cut off < 40 – 250 s Delta ambient pressure < 1.2 kPa Average value: Vehicle speed > 21 – 24 mph Vehicle speed < 75 mph Mass air flow > 21 – 96 kg/h Mass air flow < 46 – 164 kg/h 	<ul style="list-style-type: none"> < 1,000.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check cooling system visually for leaks or damaged components. Check the coolant thermostat (visually, if necessary) and Engine Temperature Control Actuator - N493- . Refer to ⇒ "3.6.12 Engine Temperature Control Actuator N493 , Checking, page 388 ." Check the Engine Coolant Temperature Sensor - G62- . Refer to ⇒ "3.6.9 Engine Coolant Temperature Sensor G62 , Checking", page 380 ."
P2195 O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	Oxygen Sensor Front Stuck High Check	<ul style="list-style-type: none"> Lambda value > 108 [-] And O2S rear signal > 0.777 V 	<ul style="list-style-type: none"> Lambda control closed loop O2S rear ready lambda control @ max value Exhaust mass air integral > 0.8 kg 	<ul style="list-style-type: none"> 200.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 ."
P2196 O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	Oxygen Sensor Front Stuck Low Check	<ul style="list-style-type: none"> Lambda value < 0.92 [-] And O2S rear signal < 0.16 V 	<ul style="list-style-type: none"> Lambda control closed loop O2S rear ready Lambda control @ min value Exhaust mass air integral > 0.8 kg 	<ul style="list-style-type: none"> 200.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 ."



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2231 O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1	Oxygen Sensor Heater Coupling Front Coupling With Heater	<ul style="list-style-type: none"> Max. threshold heater coupling > 190 µA 	<ul style="list-style-type: none"> Engine speed < 2,700 RPM Exhaust gas temp < 800° C Lambda control closed loop Lambda value 0.95 – 1.05 Heater control active Duty cycle heater power, 20 – 80% 	<ul style="list-style-type: none"> 20.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
P2237 O2 Sensor Positive Current Control Circuit/Open Bank 1 Sensor 1	Oxygen Sensor Front Open Circuit Pump Current (IP)	<ul style="list-style-type: none"> Lambda value setting < 0.97 [-] Or Lambda value setting > 1.03 [-] And O2S signal front 1.495 – 1.507 V 	<ul style="list-style-type: none"> Lambda control closed loop O2S ceramic temperature 780 +/- 65° C mass air integral > 0.8 kg 	<ul style="list-style-type: none"> 30.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
		<ul style="list-style-type: none"> Fuel cut off > 3 s O2S signal front < 1.7 V 	<ul style="list-style-type: none"> Lambda control closed loop Heater control closed loop O2S ceramic temperature 780 +/- 65° C 	<ul style="list-style-type: none"> 8.0 s Continuous 		
		<ul style="list-style-type: none"> O2S signal front 1.495 – 1.507 V Delta lambda value setting > 0.1 [-] 	<ul style="list-style-type: none"> Lambda control closed loop O2S ceramic temperature 780 +/- 65° C Lambda modulation > 1,8 % 	<ul style="list-style-type: none"> 11.5 s Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2243 O2 Sensor Reference Voltage Circuit/ Open Bank 1 Sensor 1	Oxygen Sensor Front Open Circuit Nernst Voltage (UN)	<ul style="list-style-type: none"> • O2S signal front > 4.7 V • And • Internal resistance > 1,000 Ω • Or • O2S signal front < 0.3 V • And • Internal resistance > 1,000 Ω 	<ul style="list-style-type: none"> • Heater control active 	<ul style="list-style-type: none"> • 18.0 s • Continuous 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking”, page 430 .
P2270 O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 2	Oxygen Sensor Rear Rationality Check	<ul style="list-style-type: none"> • O2S signal rear < 0.62 – 0.654 mV 	<ul style="list-style-type: none"> • Mass air flow > 25 kg/h • O2S rear readiness > 10 s • Modeled exhaust gas temp > 350° C 	<ul style="list-style-type: none"> • 100.0 s • Continuous 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> – Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking”, page 427 .
P2271 O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 2	Oxygen Sensor Rear Rationality Check	<ul style="list-style-type: none"> • O2S signal rear > 0.62 – 0.654 mV 	<ul style="list-style-type: none"> • Mass air flow 25 kg/h • O2S rear readiness > 10 s • Modeled exhaust gas temp. > 350° C • Fuel cut off > 3 s 	<ul style="list-style-type: none"> • 100.0 s • Continuous 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking”, page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2279 Intake Air System Leak	Positive Crankcase Ventilation	<ul style="list-style-type: none"> Threshold to detect a defective system > 1.33 – 1.60 [-] And Ratio of the tie "System defective" during the measurement window to the whole duration of the measurement window > 0.6 [-] 	<ul style="list-style-type: none"> Time after engine start > 60 s Engine load < 50 % ECT > 49.5° C Lambda control value > -5 % Lambda set value 0.86 – 1.05 [-] Vehicle speed < 1 km/h Lambda control active Engine speed idle Altitude < 2,600 m Purge valve closed 	<ul style="list-style-type: none"> 6.0 s 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check for air leaks between intake and throttle body, oil fill cap not tight or oil dipstick not seated in tube. Also, any engine gaskets that can cause additional air to enter the crankcase can set this fault as the PCV system is not metered. If a vacuum leak or crankcase gasket sealing is at cause, the idle may be rough or unstable.
P2293 Fuel Pressure Regulator 2 Performance	Fuel Rail High Pressure System Functional Check	<ul style="list-style-type: none"> Difference between actual pressure – target pressure > 1.5 MPa 	<ul style="list-style-type: none"> Time after engine start and fuel cut off 10 s Fuel cut off not active 	<ul style="list-style-type: none"> 3.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276, Checking", page 398 . Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .
P2294 Fuel Pressure Regulator 1 Control Circuit/ Open	Fuel Rail Pressure Control Valve Open Circuit	<ul style="list-style-type: none"> Signal voltage 2.3 – 2.7 V 	<ul style="list-style-type: none"> Valve commanded off Fuel pump commanded on 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276, Checking", page 398 . Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2295 Fuel Pressure Regulator 2 Control Circuit Low	Fuel Rail Pressure Control Valve Short To Ground	<ul style="list-style-type: none"> Signal voltage 1.8 – 2.2 V 	<ul style="list-style-type: none"> Valve commanded off Fuel pump commanded on 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276, Checking", page 398 . Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .
P2296 Fuel Pressure Regulator 2 Control Circuit High	Fuel Rail Pressure Control Valve Short To Battery Plus	<ul style="list-style-type: none"> Signal voltage > 3.9 V 	<ul style="list-style-type: none"> Valve commanded on Fuel pump commanded on 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276, Checking", page 398 . Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .
P2300 Ignition Coil "A" Primary Control Circuit Low	Ignition Coils Short To Ground	<ul style="list-style-type: none"> Signal voltage < 0.5 – 1.0 V 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil with Power Output Stage - N70- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P2301 Ignition Coil "A" Primary Control Circuit High	Ignition Coils Short To Battery Plus	<ul style="list-style-type: none"> Signal voltage > 5.2 – 6.0 V 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil with Power Output Stage - N70- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2303 Ignition Coil "B" Primary Control Circuit Low	Ignition Coils Short To Ground	<ul style="list-style-type: none"> Signal voltage < 0.5 – 1.0 V 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil with Power Output Stage - N127 - . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P2304 Ignition Coil "B" Primary Control Circuit High	Ignition Coils Short To Battery Plus	<ul style="list-style-type: none"> Signal voltage > 5.2 – 6.0 V 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil with Power Output Stage - N127 - . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P2306 Ignition Coil "C" Primary Control Circuit Low	Ignition Coils Short To Ground	<ul style="list-style-type: none"> Signal voltage < 0.5 – 1.0 V 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil with Power Output Stage - N291- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P2307 Ignition Coil "C" Primary Control Circuit High	Ignition Coils Short To Battery Plus	<ul style="list-style-type: none"> Signal voltage > 5.2 – 6.0 V 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil with Power Output Stage - N291- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P2309 Ignition Coil "D" Primary Control Circuit Low	Ignition Coils Short To Ground	<ul style="list-style-type: none"> Signal voltage < 0.5 – 1.0 V 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil with Power Output Stage - N292- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P2310 Ignition Coil "D" Primary Control Circuit High	Ignition Coils Short To Battery Plus	<ul style="list-style-type: none"> Signal voltage > 5.2 – 6.0 V 	<ul style="list-style-type: none"> Engine speed < 5,000 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coil with Power Output Stage - N292- . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2400 EVAP System Leak Detection Pump Control Circuit/ Open	LDP Open Circuit	<ul style="list-style-type: none"> Signal voltage > 4.4 – 5.6 V 	<ul style="list-style-type: none"> LDP commanded off Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- . Refer to ⇒ “3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking”, page 406 .
P2401 EVAP System Leak Detection Pump Control Circuit Low	LDP Short To Ground	<ul style="list-style-type: none"> Signal voltage < 2.15 – 3.25 V 	<ul style="list-style-type: none"> LDP commanded off Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- . Refer to ⇒ “3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking”, page 406 .
P2402 EVAP System Leak Detection Pump Control Circuit High	LDP Short To Battery Plus	<ul style="list-style-type: none"> Signal current > 1.1 A 	<ul style="list-style-type: none"> LDP commanded on Engine speed > 80 RPM 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- . Refer to ⇒ “3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking”, page 406 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2403 EVAP System Leak Detection Pump Sense Circuit/ Open	Reed Sensor Rationality Check Unable To Close	<ul style="list-style-type: none"> Low signal voltage > 1 s 	<ul style="list-style-type: none"> LDP commanded off Evap purge valve closed LDP activated Ambient pressure > 743.5 hPa Number of diagnosis at temps <= 5 IAT > 4° C Delta ambient pressure < 300 Pa IAT drop after engine start < 7 K Time after engine start > 175 s ECT 4 – 115° C ECT @ start 4 – 35° C Vehicle speed > 19 mph Selected gear any drive 	<ul style="list-style-type: none"> 10.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- . Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2404 EVAP System Leak Detection Pump Sense Circuit Range/Performance	Reed Sensor Rationality Check Unable To Open	<ul style="list-style-type: none"> High signal voltage > 0.36 s 	<ul style="list-style-type: none"> LDP commanded on Evap purge valve closed LDP activated Ambient pressure > 743.5 hPa Number of diagnosis at temps <= 5 IAT > 4° C Delta ambient pressure < 300 Pa IAT drop after engine start < 7 K Time after engine start > 175 s ECT 4 – 115° C ECT @ start 4 – 35° C Vehicle speed > 19 mph Selected gear any drive 	<ul style="list-style-type: none"> 10.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- . Refer to ⇒ "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406 .
P2414 O2 Sensor Exhaust Sample Error Bank 1 Sensor 1	Oxygen Sensor Front Signal Range Check	<ul style="list-style-type: none"> Signal voltage 2.5 – 3.2 V 	<ul style="list-style-type: none"> O2S ceramic temperature 780 +/- 65° C Low fuel signal on Then wait > 600 s 	<ul style="list-style-type: none"> 10.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 .
P2539 Low Pressure Fuel System Sensor Circuit	Fuel System Pressure Sensor Low Pressure System Signal Range Check	<ul style="list-style-type: none"> Signal voltage > 4.9 V 		<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247 , Checking", page 400 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2541 Low Pressure Fuel System Sensor Low Pressure Signal Range Check	Fuel System Pressure Sensor Low Pressure Signal Range Check	<ul style="list-style-type: none"> Signal voltage < 0.2 V 		<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .
P2626 O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	Oxygen Sensor Front Open Circuit Adjustment Voltage (IA)	<ul style="list-style-type: none"> O2S signal front > 3.2 V 	<ul style="list-style-type: none"> O2S ceramic temperature 780 +/- 65° C Modeled exhaust gas temp. < 700° C Fuel cut off active 	<ul style="list-style-type: none"> 1.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
P3081 Engine Temperature Too Low	Coolant System Temperature Too Low	<ul style="list-style-type: none"> Modeled ECT minus ECT > 10 K 	<ul style="list-style-type: none"> ECT < 60° C 	<ul style="list-style-type: none"> 2.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor - G62- . Refer to ⇒ "3.6.9 Engine Coolant Temperature Sensor G62, Checking", page 380 .
P3298 Catalytic Converter System, Exhaust-Bank 3 Efficiency Below Threshold	Catalyst NOx, NMOG / NMHC Conversion Capability	<ul style="list-style-type: none"> Amplitude ratio O2S < 1 [-] 	<ul style="list-style-type: none"> Engine start temperature > -10° C Delta mass air flow < 20 kg/h/s Evap purge flow < 25 % Engine load 18 – 75 % Lower range Mass air flow @23 – 85 kg/h Catalyst temperature 440 – 620° C Upper range Mass air flow @70 – 130 kg/h Catalyst temperature 550 – 750° C Engine speed 1,200 – 4,000 RPM 	<ul style="list-style-type: none"> 70.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 . Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0001 High Speed CAN Communication Bus	CAN Bus Reading Back Send Message	<ul style="list-style-type: none"> CAN message no feedback 		<ul style="list-style-type: none"> 0.25 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U0002 High Speed CAN Communication Bus Performance	CAN Bus CAN Communication Check	<ul style="list-style-type: none"> Global time out receiving no message 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U0101 Lost Communication with TCM	CAN Messages Only AT Communication With TCM	<ul style="list-style-type: none"> CAN message No message Or MT vehicle ECM coded as AT Vehicle 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U0302 Software Incompatibility with Transmission Control Module	CAN Messages Only AT Software Incompatibility With TCM	<ul style="list-style-type: none"> AT vehicle ECM coded as MT vehicle 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check for software updates and TSB's. Re-program ECM as necessary. If none are found, replace the Direct Shift Gearbox (DSG) Mechatronic - J743-. Refer to appropriate repair manual.
U0402 Invalid Data Received From TCM	CAN Messages Only AT Communication With TCM	<ul style="list-style-type: none"> Invalid data received from TCM invalid data 		<ul style="list-style-type: none"> 0.05 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0415 Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	Vehicle Speed Out Of Range	<ul style="list-style-type: none"> Receiving fault value 327.42 km/h 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to appropriate repair manual for the ABS. Refer to the proper wiring schematic for terminal and component location.

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P000A "A" Camshaft Position Slow Response Bank 1	VVT Actuator Intake Rationality Check	<ul style="list-style-type: none"> Adjustment angle difference ≥ 1.00; $\leq 10.0^\circ$ CRK 	<ul style="list-style-type: none"> Modeled oil temperature $-40 - 160^\circ$ C Engine speed 608 – 6,016 RPM Set point change $> 20.0^\circ$ CRK Camshaft position n.a. Dynamic diagnosis timer $\geq 0.95 - 4.0$ s 	<ul style="list-style-type: none"> 0 FTP75; 300 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205-. Refer to ⇒ "3.6.3 Camshaft Adjustment Valve 1 N205, Checking", page 362.
P000B "B" Camshaft Position Slow Response Bank 1	Variable Valve Timing (VVT) Exhaust Actuator rationality check	<ul style="list-style-type: none"> Adjustment angle difference ≥ 1.00; $< 3.50^\circ$ CRK 	<ul style="list-style-type: none"> Modeled oil temperature $-40 - 160^\circ$ C Engine speed 608 – 6,016 RPM Set point change $> 6.0^\circ$ CRK Camshaft position n.a. Dynamic diagnosis timer $\geq 0.95 - 4.0$ s 	<ul style="list-style-type: none"> 0 FTP75; 700 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Exhaust Camshaft Adjustment Valve 1 - N318-. Refer to ⇒ "3.6.14 Exhaust Camshaft Adjustment Valve 1 N318, Checking", page 394



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0010 "A" Camshaft Position Actuator Control Circuit/ Open Bank 1	VVT Actuator Intake Open Circuit	<ul style="list-style-type: none"> Output voltage lower range 1.92 – 2.21 V Output voltage upper range (hardware values) 2.85 – 3.25 V 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ "3.6.3 Camshaft Adjustment Valve 1 N205 , Checking", page 362 .
P0011 "A" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	VVT Actuator Intake Rationality Check	<ul style="list-style-type: none"> Camshaft position deviation > 10.0° CRK 	<ul style="list-style-type: none"> Modeled oil temperature -40 – 160° C Engine speed 608 – 6,016 RPM Camshaft position n.a. Camshaft position adjustment active Catalyst heating not active Camshaft position deviation integrator (actual vs. setpoint position) >= 9.00 – 12.00° CRK 	<ul style="list-style-type: none"> 0 FTP75; 250 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ "3.6.3 Camshaft Adjustment Valve 1 N205 , Checking", page 362 .
P0013 "B" Camshaft Position Actuator Control Circuit/ Open Bank 1	Variable Valve Timing (VVT) Exhaust Actuator open circuit	<ul style="list-style-type: none"> Output voltage, lower range 1.92 – 2.21 V Output voltage, upper range 2.85 – 3.25 V (hardware values) 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to ⇒ "3.6.14 Exhaust Camshaft Adjustment Valve 1 N318 , Checking", page 394



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0014 "B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	Variable Valve Timing (VVT) Exhaust Actuator Rationality Check	<ul style="list-style-type: none"> Difference between target and actual position > 10.00° CRK 	<ul style="list-style-type: none"> Modeled oil temperature -40 – 160° C Engine speed 608 – 6,016 RPM Camshaft position n.a. Camshaft position adaptation active Catalyst heating not active Camshaft position deviation integrator (actual vs. setpoint position) >= 9.00 – 12.00° CRK 	<ul style="list-style-type: none"> 0 FTP75; 450 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to ⇒ "3.6.14 Exhaust Camshaft Adjustment Valve 1 N318 , Checking", page 394



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0016 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Camshaft Position/ Crankshaft Position Intake - Correlation Adaptation Value Monitoring	<ul style="list-style-type: none"> Adapted value for each edge of the target wheel < -14.0° CRK Or Adapted value for each edge of the target wheel > 14.0° CRK 	<ul style="list-style-type: none"> Camshaft position adaptation active (Exhaust side) Engine speed 288 – 4,000 rpm Modeled oil temperature >= -15° C Modeled oil temperature <= 160° C Diff. actual exhaust camshaft position vs. previous camshaft position @ reference signal edge < 2.00° CRK And Case 1: Ignition off Engine speed > 380 rpm Engine stalling >= 1.0 s Or Case 2: Engine speed >= 380 rpm Or Engine running Engine stalling >= 5.0 s Or Case 3: Backwards rotation not detected Or Case 4: Engine speed >= 400 rpm Engine stopped 	<ul style="list-style-type: none"> 720° CRK Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to "3.6.3 Camshaft Adjustment Valve 1 N205 , Checking", page 362 . Check the Engine Speed Sensor - G28- . Refer to "3.6.11 Engine Speed Sensor G28 , Checking", page 384 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Diff. actual camshaft adaptation per cylinder vs. previous reference camshaft adaptation $\geq 12.00^\circ$ CRK 	<p>General:</p> <ul style="list-style-type: none"> Camshaft phasing commanded Engine speed $< 8,160$ rpm Diff. actual intake camshaft position vs. previous camshaft position @ reference signal edge $< 2.00^\circ$ CRK Case 1: Ignition off Engine speed > 380 RPM Engine stalling ≥ 1.0 s Case 2: synchronization test incorrect Or Engine running And Engine stalling ≥ 5.0 s Case 3: Backwards rotation not detected Or Case 4: Engine speed ≥ 400 RPM Engine stopped 	<ul style="list-style-type: none"> 0.1 s Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0017 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor B	Camshaft Position/ Crankshaft Position Exhaust - Correlation Adaptation Value Monitoring	<ul style="list-style-type: none"> Adapted value for each edge of the target wheel < -14.0° CRK Or Adapted value for each edge of the target wheel > 14.0° CRK 	<ul style="list-style-type: none"> Camshaft position adaptation active (Exhaust side) Modeled oil temperature >= -15° C Modeled oil temperature <= 160° C Engine speed 288 – 4,000 RPM Diff. actual exhaust camshaft position vs. previous camshaft position @ reference signal edge < 2.0° CRK And Case 1: <ul style="list-style-type: none"> Ignition off Engine speed > 380 RPM Engine stalling >= 1.0 s Or Case 2: <ul style="list-style-type: none"> Engine speed >= 380 RPM Or Engine running And Engine stalling >= 5.0 s Or Case 3: <ul style="list-style-type: none"> Backwards rotation not detected Or Case 4: <ul style="list-style-type: none"> Engine speed >= 400 RPM Engine stopped 	<ul style="list-style-type: none"> 720° CRK Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to "3.6.14 Exhaust Camshaft Adjustment Valve 1 N318 Checking", page 394 Check the Engine Speed Sensor - G28- . Refer to "3.6.11 Engine Speed Sensor G28, Checking", page 384



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0030 HO2S Heater Control Circuit Bank 1 Sensor 1	Oxygen Sensors Heater Front Open Circuit	<ul style="list-style-type: none"> O2S upstream heater voltage lower range 1.92 – 2.21 V O2S downstream heater voltage upper range 2.85 – 3.25 V 		<ul style="list-style-type: none"> 2.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 .
P0031 HO2S Heater Control Circuit Low Bank 1 Sensor 1	Oxygen Sensors Heater Front Short To Ground	<ul style="list-style-type: none"> O2S upstream heater voltage lower range < 1.92 – 2.21 V 		<ul style="list-style-type: none"> 2.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 .
P0032 HO2S Heater Control Circuit High Bank 1 Sensor 1	Oxygen Sensors Heater Front Short To Battery Voltage	<ul style="list-style-type: none"> O2S upstream heater driver temperature > 160.0 – 200.0° C Or O2S upstream heater driver output current driver stage internal value 	<ul style="list-style-type: none"> EGT @ O2S front >= -273° C Actuator commanded on 	<ul style="list-style-type: none"> 2.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 .
P0033 Turbocharger/ Supercharger Bypass Valve "A" Control Circuit	Turbocharger Bypass (TCBY) open circuit Turbocharger Bypass (TCBY) short to battery plus	<ul style="list-style-type: none"> Voltage, lower range 1.92 – 2.21 V voltage, upper range 2.85 – 3.25 V (hardware values) Current driver stage internal value Or Temperature > 160 – 200° C (hardware values) 	<ul style="list-style-type: none"> Actuator commanded off Actuator commanded on 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Turbocharger Recirculation Valve - N249- . Refer to ⇒ "3.6.32 Turbocharger Recirculation Valve N249 , Checking", page 442



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0034 Turbo-charger/ Super-charger Bypass Valve "A" Control Circuit Low	Turbo-charger Bypass (TCBY) short to ground	<ul style="list-style-type: none"> Voltage < 1.92 – 2.21 V (hardware values) 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Turbocharger Recirculation Valve - N249- . Refer to ⇒ "3.6.32 Turbocharger Recirculation Valve N249, Checking", page 442
P0036 HO2S Heater Control Circuit Bank 1 Sensor 2	Oxygen Sensors Heater Rear Open Circuit	<ul style="list-style-type: none"> O2S downstream heater voltage lower range 1.92 – 2.21 V O2S downstream heater voltage upper range 2.85 – 3.25 V 	<ul style="list-style-type: none"> Engine not in start process 	<ul style="list-style-type: none"> 2.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0037 HO2S Heater Control Circuit Low Bank 1 Sensor 2	Oxygen Sensors Heater Rear Short To Ground	<ul style="list-style-type: none"> O2S downstream heater voltage < 1.92 – 2.21 V 	<ul style="list-style-type: none"> Engine not in start process 	<ul style="list-style-type: none"> 2.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0038 HO2S Heater Control Circuit High Bank 1 Sensor 2	Oxygen Sensors Heater Rear Short To Battery Voltage	<ul style="list-style-type: none"> O2S downstream heater driver temperature > 160.0 – 200.0° C Or O2S downstream heater driver output current driver stage internal value 	<ul style="list-style-type: none"> EGT @ O2S rear (binary) >= -273 O2S heater commanded on Engine not in start process 	<ul style="list-style-type: none"> 2.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0045 Turbo-charger/ Super-charger Boost Control "A" Circuit/ Open	Turbo-charger Boost Pressure Control Open Circuit	<ul style="list-style-type: none"> Bypass valve driver load resistance > 200 kOhm 	<ul style="list-style-type: none"> Deviation between actual and filtered boost pressure actuator position <= 5.0 % Boost pressure actuator controller not active Time delay > 1.0 s 	<ul style="list-style-type: none"> 0.4 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- . Refer to ⇒ "3.6.7 Charge Pressure Actuator V465 / Charge Pressure Actuator Position Sensor G581, Checking", page 374 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0068 MAP/MAF - Throttle Position Correlation	Intake Manifold Rationality Check	<ul style="list-style-type: none"> Difference between target intake manifold pressure and actual intake manifold pressure < -15.0 – -10.0 kPa 	<ul style="list-style-type: none"> Time after engine start > 5.0 s Barometric pressure > 73.0 – 105.0 kPa Engine speed > 576 – 512 RPM Engine speed < 3,000 RPM IAT @ intake manifold > -48° C ECT @ cylinder head > -48° C Difference between engine speed and filtered engine speed < 8,160 RPM Diff. air mass setpoint vs. filtered air mass setpoint for load dynamic detection < 25.01 mg/rev Throttle actuator commanded on Modeled pressure quotient 0.10 – 0.60 [-] Gradient of intake manifold pressure >= -199.90; <= 199.90 kPa/s Vehicle speed <= 1 mph 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake system for vacuum leaks, make sure oil dipstick is pushed properly into place. Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9, Checking", page 417 . Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Intake Air System Rationality Check	<ul style="list-style-type: none"> Filtered lambda controller included correction and adaptation -30.00 – 30.00 % Lambda control active And Deviation throttle area controller < -60.00 % 	<p>General conditions:</p> <ul style="list-style-type: none"> Throttle position > 0.0° TPS Throttle position < 100.003° TPS Engine speed > 576; < 3,008 rpm Modeled pressure quotient > 0.27; < 0.57 [-] Engine running Throttle actuator commanded on Time after engine start > 5.0 s Throttle position sensor failure not detected Fuel cut off not active Fast throttle adaptation finished MAP gradient -199.90 – 199.90 kPa/s BARO plausibility diagnosis finished Intake manifold modeled adaptation active And Choice of: MAF sensor active Or MAP sensor active And Choice of: Pressure upstream throttle < 135.00 kPa Or Pressure upstream throttle not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">• And• Choice of:• BARO > 73.00; < 107.50 kPa• Or• Barometric pressure sensor not active			
P0070 Ambient Air Temperature Sensor Circuit "A"	CAN: Ambient Air Temperature Sensor Short To Battery Voltage Or Open Circuit	<ul style="list-style-type: none">• AAT sensor voltage (hardware values) > 4.50 V		<ul style="list-style-type: none">• 2.0 s• Continuous	<ul style="list-style-type: none">• 2 DCY	<ul style="list-style-type: none">– Check the Outside Air Temperature Sensor - G17- . Refer to ⇒ "3.6.26 Outside Air Temperature Sensor G17 , Checking", page 425 .





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0071 Ambient Air Temperature Sensor Circuit "A" Range/Performance	Ambient Air Temperature Sensor Cross Check	<ul style="list-style-type: none"> High side: Diff. AAT @ cold start vs. IAT @ manifold @ cold start > 25 K Diff. AAT @ cold start vs. ECT @ cylinder head @ cold start n.a. [K] Diff. AAT @ cold start vs. ECT @ radiator outlet @ cold start > 25 K Min. amount of faulty reference measurements to detect defective sensor 2.00 [-] Or Low side: Diff. IAT @ manifold @ cold start vs. AAT @ cold start > 25.0 K Diff. ECT @ cylinder head @ cold start vs. AAT @ cold start n.a. [K] Diff. ECT @ radiator outlet @ cold start vs. AAT @ cold start > 25.0 K min. amount of faulty reference measurements to detect defective sensor 2.00 [-] 	<ul style="list-style-type: none"> Engine off time >= 360.0 min Engine off time plausible Time after engine start < 1,400.0 s Depending on temperature slope: Diff. actual vs previous IAT < 256.0 K Diff. actual vs previous ECT @ cylinder head n.a. K Diff.. actual vs previous ECT @ radiator outlet < 256.0 K Diff. actual vs previous AAT < 256.0 K For time >= 1.0 s Depending on meanvalue condition Mean value of all temperature sensors @ cold start >= -256 ° C Number of valid sensors >= 2.00 [-] Depending on block heater / solar radiation detection Time after engine start >= 0.5 s Vehicle speed >= 22 mph For time >= 20.0 s Diff. actual IAT @ manifold vs. min. IAT @ manifold < 5.0 K Diff. actual ECT @ cylinder head vs. min. ECT @ cylinder head n.a. K 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Outside Air Temperature Sensor - G17- . Refer to "3.6.26 Outside Air Temperature Sensor G17, Checking", page 425 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Diff. actual AAT vs. min. AAT < 4.0 K Diff. actual ECT @ radiator outlet vs. min. ECT @ radiator outlet < 1.1 K 			
P0072 Ambient Air Temperature Sensor Circuit "A" Low	CAN: Ambient Air Temperature Sensor Short To Ground	<ul style="list-style-type: none"> AAT sensor voltage < 0.10 V 		<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Outside Air Temperature Sensor - G17- . Refer to ⇒ "3.6.26 Outside Air Temperature Sensor G17 , Checking", page 425 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0087 Fuel Rail/ System Pressure - Too Low Bank 1	Fuel System Pressure Sensor, High Pressure Side Out Of Range Low	<ul style="list-style-type: none"> Deviation between reference fuel pressure setpoint and current fuel pressure > 2,999.80 kPa Case: 1 Deviation lambda of controller included adaptation -50.00 – 50.00 % High pressure controller output > 45 mg Fuel pressure < 3,500.31 kPa Case 2: Fuel pump at max limit Mass fuel flow setpoint < 1,389.00 mg/rev Fuel pressure < 34,777.60 kPa 	<p>General:</p> <ul style="list-style-type: none"> Engine speed 608 – 6,816 rpm Fuel mass setpoint 5.00 – 1,389.00 mg/rev Time after engine start > 10.0 s Engine warm-up not calibrated Catalyst heating not calibrated Full load not calibrated Catalyst purge not calibrated Lambda control not calibrated Evap purge functionality diagnosis not calibrated Fuel pressure setpoint <= 34,777.60 kPa And Depending on low dynamic conditions: Fuel mass setpoint lower range > 5.00 mg/rev For time >= 10.0 s Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev Fuel mass setpoint gradient - mg/rev For time >= 5.0 s And Depending on canister purge: Canister load not calibrated [-] Or Evap purge valve not calibrated 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure, refer to the repair manual for proper procedures. Check the Fuel Pressure Sensor - G247- . Refer to "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 . Check the Fuel Pressure Regulator Valve - N276- . Refer to "3.6.16 Fuel Pressure Regulator Valve N276, Checking", page 398 . Check the Fuel Pump Control Module - J538- / Fuel Delivery Unit - GX1- . Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Fuel Rail Pressure (FRP) rationality check low	<ul style="list-style-type: none"> • Deviation lambda of controller included adaption -50.00 – 50.00% • And • High pressure controller output > 45 mg • And • Deviation between fuel pressure setpoint and current fuel pressure > 2999.80 kPa • And • Fuel pressure >= 3500.31 kPa 	<ul style="list-style-type: none"> • General: • Engine speed 608 – 6816 rpm • Fuel mass setpoint 5.00 – 1389.00 g/rev • Time after engine start > 10.0 s • Engine warm-up not calibrated • Catalyst heating not calibrated • Full load not calibrated • Catalyst purge not calibrated • Lambda control not calibrated • Evap purge functionality diagnosis not calibrated • Fuel pressure setpoint gradient <= 34777.60 kPa • And • Depending on low dynamic conditions: • Fuel mass setpoint lower range > 5.00 mg/rev • For time >= 10.0 s • Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev • Fuel mass setpoint gradient -1389.00 – 1389.00 mg/rev • For time >= 5.0 s • And • Depending on canister purge: • Canister load not calibrated [-] • Or • Evap purge valve not calibrated 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0090 Fuel Pressure Regulator 1 Control Circuit/ Open	Fuel Volume Regulator Control open circuit	<ul style="list-style-type: none"> Voltage high side < 1.87 – 2.26 V Voltage low side > 2.78 – 3.33 V 	<ul style="list-style-type: none"> Engine speed 0 rpm Or Fuel cut off active Actuator commanded off 	<ul style="list-style-type: none"> 0.8 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276 , Checking", page 398 .
P0091 Fuel Pressure Regulator 1 Control Circuit Low	Fuel Volume Regulator Control short to ground (high side)	<ul style="list-style-type: none"> Low and high side Off: Voltage low side > 2.78 – 3.33 V Voltage high side < 1.87 – 2.26 V Low and high side On: Current low side driver stage internal value Current high side driver stage internal value 	<ul style="list-style-type: none"> Engine speed > 600 rpm And Fuel cut off not active Actuator commanded on 	<ul style="list-style-type: none"> 0.8 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276 , Checking", page 398 .
	Fuel Volume Regulator Control short to ground (low side)	<ul style="list-style-type: none"> Voltage low side < 1.87 – 2.26 V (hardware values) 	<ul style="list-style-type: none"> Ignition on Or Ignition off (during ECM keep alive-time) And Actuator commanded off 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0092 Fuel Pressure Regulator 1 Control Circuit High	Fuel Control Valve Short To Battery Plus (Low Side)	<ul style="list-style-type: none"> Current low side (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Ignition on Or Ignition off (during ECM keep alive-time) And Actuator commanded on 	<ul style="list-style-type: none"> 0.8 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276 , Checking", page 398 .
	Fuel Control Valve Short To Battery Plus (High Side)	<ul style="list-style-type: none"> Voltage high side (hardware values) < 2.78 – 3.33 V 	<ul style="list-style-type: none"> Ignition on Or Ignition off (during ECM keep alive-time) And Actuator commanded off 			
P00B7 Engine Coolant Flow Low/ Performance	Engine Cooling System: Bypass Valve Functional Check	<ul style="list-style-type: none"> Diff. previous and actual position of RVC < 4.0° 	<ul style="list-style-type: none"> ECT @ cylinder head > 11° C RCV position 0.00 – 270.0° Diff. previous actual and target position of RCV > 5.0° And RCV adaptation finished Or RCV adaptation not active 	<ul style="list-style-type: none"> 3.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check coolant system for leaks or damage. Check the Engine Temperature Control Actuator - N493- . Refer to ⇒ "3.6.12 Engine Temperature Control Actuator N493 , Checking", page 388 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0106 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Range/Performance	Manifold Pressure Sensor By Engine Standing: Rationality Check During ECM Keep Alive-Time:	<ul style="list-style-type: none"> Case 1: Diff. barometric pressure vs. intake manifold pressure ≥ 8.50 kPa Diff. upstream throttle pressure vs. intake manifold pressure > 8.50 kPa Diff. barometric pressure vs. upstream throttle pressure < 8.50 kPa Case 2: Intake manifold pressure (raw value) < 25.00; > 125.00 kPa Case 3; Diff. barometric pressure vs. intake manifold pressure n.a. kPa Diff. upstream throttle pressure vs. intake manifold pressure n.a. kPa Diff. barometric pressure vs. upstream throttle pressure n.a. kPa Diff. intake manifold pressure vs. intake manifold pressure @ idle or low part load n.a. kPa Case 4: Diff. barometric pressure vs. intake manifold pressure n.a. kPa Diff. upstream throttle pressure vs. intake manifold pressure n.a. kPa 	<ul style="list-style-type: none"> Engine stopped Ignition off Vehicle speed < 1 mph ECM keep alive time > 10.0 s Delay time after engine stop ≥ 5.0 s Barometric pressure sensor voltage $0.20 - 4.80$ V MAP sensor voltage $0.20 - 4.80$ V Turbocharger boost pressure sensor voltage $0.20 - 4.80$ V 	<ul style="list-style-type: none"> 3.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Sensor - GX9. Refer to "3.6.23 Intake Manifold Sensor GX9, Checking", page 417.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Diff. barometric pressure vs. upstream throttle pressure n.a. kPa Diff. intake manifold pressure vs. intake manifold pressure @ idle or low part load n.a. kPa 				
	Intake Air System Rationality Check	<ul style="list-style-type: none"> General conditions: Filtered lambda controller included correction and adaptation < -30.0 % And Deviation throttle area controller > 45.0 % 	<ul style="list-style-type: none"> Throttle position > 0.0° TPS Throttle position < 100.003° TPS Engine speed > 576; < 3,008 RPM Modeled pressure quotient > 0.27; < 0.57 [-] Engine running Throttle actuator commanded on Time after engine start > 5.0 s Throttle position sensor failure not detected Fuel cut off not active Fast throttle adaptation finished Gradient intake manifold pressure -199.90 – 199.90 kPa/s Barometric pressure plausibility diagnosis finished Intake manifold modeled adaptation active And Choice of: MAF sensor active Or 	<ul style="list-style-type: none"> 5.0 s Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> General conditions: Filtered lambda controller included correction and adaptation > 30.0 % And Deviation throttle area controller < -45.0 % 	<ul style="list-style-type: none"> Manifold pressure sensor active And Choice of: pressure upstream throttle < 135.00 kPa Or Pressure upstream throttle not active And Choice of: BARO > 73.00; < 107.50 [kPa] Or Barometric pressure sensor not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0107 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Low	Manifold Pressure Sensor Short To Ground	<ul style="list-style-type: none">Intake manifold pressure sensor voltage < 0.20 V		<ul style="list-style-type: none">0.5 sContinuous	<ul style="list-style-type: none">2 DCY	<ul style="list-style-type: none">Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9, Checking", page 417 .
P0108 Manifold Absolute Pressure/Barometric Pressure Sensor Circuit High	Manifold Pressure Sensor Short To Battery Voltage	<ul style="list-style-type: none">Intake manifold pressure sensor voltage > 4.80 V		<ul style="list-style-type: none">0.5 sContinuous	<ul style="list-style-type: none">2 DCY	<ul style="list-style-type: none">Check the Intake Manifold Sensor - GX9- . Refer to ⇒ "3.6.23 Intake Manifold Sensor GX9, Checking", page 417 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0111 Intake Air Temperature Sensor @ Manifold Cross Check 1 Circuit Range/ Performance Bank 1	Intake Air Temperature Sensor @ Manifold Cross Check	<ul style="list-style-type: none"> High side: reference measuring Diff. IAT @ manifold @ cold start vs. AAT @ cold start > 25.0 K Diff. IAT @ manifold @ cold start vs. ECT @ cylinder head @ cold start n.a. K Diff. IAT @ manifold @ cold start vs. ECT @ radiator outlet @ cold start > 25.0 K Min. amount of faulty reference measurements to detect defective sensor 2.00 [-] Or Low side: reference measuring Diff. AAT @ cold start vs. IAT @ manifold @ cold start > 25.0 K Diff. ECT @ cylinder head @ cold start vs. IAT @ manifold @ cold start > 25.0 K Diff. ECT @ radiator outlet @ cold start vs. IAT @ manifold @ cold start > 25.0 K Min. amount of faulty reference measurements to detect defective sensor 2.00 [-] 	<ul style="list-style-type: none"> Engine off time >= 360.00 min Engine off time plausible Time after engine start <= 1,400.0 s Depending on temperature slope Diff. actual vs previous IAT < 256.0 K Diff. actual vs previous ECT @ cylinder head n.a. K Diff. actual vs previous ECT @ radiator outlet < 256.0 K Diff. actual vs previous AAT < 256.0 K For time >= 1.0 s Depending on mean value condition Mean value of all temperature sensors @ cold start >= -256° C Number of valid sensors >= 2.00 [-] Depending on block heater / solar radiation detection Time after engine start >= 0.5 s Vehicle speed >= 22 mph For time >= 20.0 s Diff. actual IAT @ manifold vs. min. IAT @ manifold < 5.0 K Diff. actual ECT @ cylinder head vs. min. ECT @ cylinder head n.a. K 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Sensor - GX9. Refer to "3.6.23 Intake Manifold Sensor GX9, Checking", page 417.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Diff. actual AAT vs. min. AAT < 4.0 K Diff. actual ECT @ radiator outlet vs. min. ECT @ radiator outlet < 1.1 K 			
P0112 Intake Air Temperature Sensor 1 Circuit Low Bank 1	Intake Air Temperature Sensor Short To Ground	<ul style="list-style-type: none"> IAT sensor voltage < 0.10 V 		<ul style="list-style-type: none"> 0.5 s Continuous 		
P0113 Intake Air Temperature Sensor 1 Circuit High Bank 1	Intake Air Temperature Sensor open circuit	<ul style="list-style-type: none"> IAT sensor voltage > 4.50 V 				
P0116 Engine Coolant Temperature Sensor 1 Circuit Range/Performance	Engine Coolant Temperature Sensor @ Cylinder Head Rationality Check Inappropriately Low	<ul style="list-style-type: none"> Diff. min temperature of cross check sensors vs. ECT @ cylinder head @ engine start $\geq 25^{\circ}\text{C}$ 	<ul style="list-style-type: none"> Cross checks finished 	<ul style="list-style-type: none"> 1.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor - G62 - . Refer to 3.6.9 Engine Coolant Temperature Sensor G62, Checking, page 380 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Engine Coolant Temperature Sensor @ Cylinder Head Rationality Check High	<ul style="list-style-type: none"> Difference between maximum and minimum temperature of ECT @ cylinder head < 1° C ECT @ cylinder head @ engine start > 40 – 80° C 	<ul style="list-style-type: none"> ECT @ cylinder head > -256° C IAT @ throttle -48 – 143° C Depending on thermostat control: ECT @ cylinder head n.a.° C or ECT @ cylinder head n.a.° C Engine n.a. And Engine part load Or Engine full load Engine speed > 1,300 rpm Vehicle speed >= 12 mph Engine load > 2.00 % For time >= 20.0 – 43.0 s Engine idle Vehicle speed < 3 mph Or Fuel cut off active Or Engine stop for time >= 20.0 – 43.0 s Time after engine start > 100 s Cross checks finished Engine running Engine off time >= 360.00 min Valid AAT signal for time >= 2.0 s Valid engine stop signal for time >= 2.0 s 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Engine Coolant Temperature Sensor @ Cylinder Head Rationality Check Low	<ul style="list-style-type: none"> Difference between modeled and measured cylinder head temperature > 5° C 	<ul style="list-style-type: none"> ECT @ cylinder head -128 – 127° C Time after engine start > 60.0 s 	<ul style="list-style-type: none"> 30 s Once / DCY 		
P0117 Engine Coolant Temperature Sensor 1 Circuit Low	Engine Coolant Temperature Sensor @ Cylinder Head Short To Ground	<ul style="list-style-type: none"> ECT sensor voltage @ cylinder head < 0.30 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor - G62- . Refer to ⇒ "3.6.9 Engine Coolant Temperature Sensor G62 , Checking", page 380
P0118 Engine Coolant Temperature Sensor 1 Circuit High	Engine Coolant Temperature Sensor @ Cylinder Head Short To Battery / Open Circuit	<ul style="list-style-type: none"> ECT sensor voltage @ cylinder head > 4.90 V 	<ul style="list-style-type: none"> Modeled IAT @ throttle >= -33° C Time after engine start > 60 s 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor - G62- . Refer to ⇒ "3.6.9 Engine Coolant Temperature Sensor G62 , Checking", page 380
P0121 Throttle/ Pedal Position Sensor/ Switch "A" Circuit Range/ Performance	Throttle Position Sensor 1 Rationality Check	<ul style="list-style-type: none"> Normalized difference between measured and modeled value of mass air flow from TPS 1 >= 1.00 [-] Or Relative mass air flow integral from TPS 1 > 60.0 [-] 	<ul style="list-style-type: none"> throttle adaptation (@ initial start or after detection of throttle exchange or checksum error) not active 	<ul style="list-style-type: none"> 0.01 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3 , Checking", page 439
		<ul style="list-style-type: none"> Difference between TPS 1 and TPS 2 > 6.499° TPS 		<ul style="list-style-type: none"> 0.3 s Continuous 		
P0122 Throttle/ Pedal Position Sensor/ Switch "A" Circuit Low	Throttle Position Sensor 1 Short To Ground / open circuit	<ul style="list-style-type: none"> Throttle position sensor 1 voltage < 0.15 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3 , Checking", page 439



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0123 Throttle/Pedal Position Sensor/Switch "A" Circuit High	Throttle Position Sensor 1 Short To Battery Voltage	<ul style="list-style-type: none"> Throttle position sensor 1 voltage > 4.85 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .
P0131 O2 Sensor Circuit Low Voltage Bank 1 Sensor 1	Oxygen Sensors Front Short To Ground	<ul style="list-style-type: none"> O2S sensor voltage < 0.15 V 	<ul style="list-style-type: none"> Engine running 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
P0132 O2 Sensor Circuit High Voltage Bank 1 Sensor 1	Oxygen Sensors Front Short To Battery Voltage	<ul style="list-style-type: none"> O2S sensor voltage > 5.20 – 5.35 V 	<ul style="list-style-type: none"> Engine running 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0133 O2 Sensor Circuit Slow Response Bank 1 Sensor 1	Oxygen Sensors Front Response Check	<ul style="list-style-type: none"> Dynamic Path: Lambda value vs. modeled lambda value ≥ 1.10 [-] Or Ratio of failed diagnostic cycle n.a. [-] 	<ul style="list-style-type: none"> General conditions: Injection mode change (DFI/MFI) not active ECT @ cylinder head $\geq -48^{\circ}\text{C}$ Vehicle speed > 0 mph Integrated air mass after gear change > 0.0 g Air mass , lower range ≥ 0.00 mg/rev Air mass , upper range ≤ 1389.00 mg/rev Counter of integrated mass for fuel in oil < 255.00 [-] And Time after engine start ≥ 0.0 s Or Integrated air mass per cylinder ≥ 0.00 kg Depending on canister and catalyst purge: Evap purge n.a. Or Evap purge n.a. Or Evap purge n.a. Canister load calculation n.a. Or Evap purge n.a. Canister load n.a. [-] And Case 1: O2S front n.a. 	<ul style="list-style-type: none"> 2.4 s Once / DCY 	<ul style="list-style-type: none"> 1 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10- , Checking", page 430 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • Lambda stimulation n.a. • Upper limit of lambda controller output n.a. • Lower limit of lambda controller output n.a. • Engine speed n.a. rpm • Air mass n.a. mg/rev • MAF n.a. kg/h • Catalyst purge n.a. • And • Depending on limited dynamic conditions: • Integrated air mass n.a. g • Dynamic engine speed n.a. g • Dynamic air mass n.a. mg/rev • Dynamic lambda n.a. % • Or • Dynamic engine speed n.a. rpm • Diff. actual engine load vs. filtered engine load in limited dynamic conditions, lower range n.a. kg/h • Diff. actual engine load vs. filtered engine load in limited dynamic conditions, upper range n.a. kg/h • Dynamic torque n.a. [-] • Case 2: • Lambda set value adjustment for conditioning and measuring active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Delay path: Lambda delay value vs. modeled lambda value > 1.10 [-] 	<ul style="list-style-type: none"> General conditions: Air mass , lower range >= 0.0 mg/rev Air mass , upper range <= 1,389.0 mg/rev Vehicle speed >= 0 mph Time after engine start >= 0.0 s Injection mode change (DFI/MFI) not active Counter integrated mass for fuel in oil < 255.0 [-] Engine speed 1,216 – 3,008 RPM MAF (intake air rate) 20.0 – 150.0 kg/h Vehicle speed >= 3 mph Integrated MAF per cylinder >= 0.30 – 2.0 kg Depending on dynamic conditions: Dynamic engine speed < 288 RPM Dynamic torque < 80.0 Nm Dynamic MAF < 70.0 kg/h For time >= 0.6 s And depending on canister and catalyst purge: Evap purge n.a. Or Evap purge n.a. Or Evap purge n.a. Or Evap purge n.a. 	<ul style="list-style-type: none"> 13.2 s Once / DCY 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Canister load calculation n.a. Or Evap purge n.a. Canister load n.a. 			
P0135 O2 Sensor Heater Circuit Bank 1 Sensor 1	Oxygen Sensors Heater Front Functional Check	<ul style="list-style-type: none"> O2S ceramic temperature, < 630° C 	<ul style="list-style-type: none"> O2S heater commanded on For time >= 10.0 s 	<ul style="list-style-type: none"> 20 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
P0137 O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	Oxygen Sensors Rear Short To Ground	<ul style="list-style-type: none"> O2S sensor voltage < 0.45 V 	<ul style="list-style-type: none"> O2S heater active 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0138 O2 Sensor Circuit High Voltage Bank 1 Sensor 2	Oxygen Sensors Rear Short To Battery	<ul style="list-style-type: none"> O2S sensor voltage > 5.2 – 5.35 V 	<ul style="list-style-type: none"> O2S heater active 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P013A O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	Oxygen Sensors Rear Response Check	<ul style="list-style-type: none"> Gradient sensor voltage < 900.00 mV/s 	<ul style="list-style-type: none"> General conditions: Intrusive lambda ramp request not active Internal resistance O2S rear <= 700.00 Ohm Counter of integrated mass for fuel in oil < 255.00 [-] Catalyst monitor lambda modulation request active Vehicle speed 19 – 158 mph Barometric pressure >= 0.00 kPa Catalyst over-heating protection not active Turbine over-heating protection not active O2S rear ready O2S front ready ECT @ cylinder head > 60° C IA T @ manifold > -48° C Modeled catalyst temperature @ start of diagnosis > 510° C Modeled catalyst temperature @ during diagnosis 470 – 830° C Diff. between dynamic and stationary catalyst temperature -150 – 150° C Integrated air mass, catalyst temp. conditions fulfilled >= 0.0 g Modeled EGT @ O2S rear <= 900° C 	<ul style="list-style-type: none"> 0 FTP75: 50 s Once / DCY 	<ul style="list-style-type: none"> 1 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ➔ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> MAF per cylinder 22.50 – 150.00 kg/h Air mass , lower range ≥ 0.00 mg/rev Air mass , upper range ≤ 650.00 – 1,389.00 mg/rev And Engine load n.a. % Air mass setpoint n.a. g/rev Accelerator pedal value n.a. % For time n.a. s And Low dynamic conditions Dynamic engine speed < 50 rpm Dynamic air mass < 50.00 mg/rev Dynamic lambda controller output < 20.00 % And Integrated air mass after dynamic conditions are fulfilled > 20.0 g Time after a catalyst purge phase ≥ 1.0 s O2S rear voltage @ diagnosis start ≥ 0.55 V Integrated air mass ≥ 0.0 g Integrated heat energy ≥ 550 – 700 kJ Engine speed 1,088 – 3,008 rpm 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Deviation of lambda controller output < 50.00 % Proportional part of secondary fuel control loop not calibrated Coasting function not active O2S heater rear active Lambda adaptation not active Valve lift not active And Depending on Lambda control: Sum of integral and proportional part of secondary fuel control loop before diagnosis < 0.10 [-] Or Sum of integral and proportional part of secondary fuel control loop during diagnosis < 0.25 [-] Depending on canister purge: Canister load n.a. [-] Evap purge flow n.a. Or Canister load calculation n.a. Evap purge flow n.a. Or Evap purge valve n.a. Or Evap purge valve n.a. Or 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • Evap purge n.a. • Or • Depending on canister purge closing: • Canister purge (conditions) n.a. • Canister purge valve (closing time) n.a. s • And • Choice of: • Evap purge valve n.a. • Or • Evap purge valve n.a. • And • Modeled air mass integral > 50.0 g • Integrated air mass per cylinder $\geq 1.40 - 1.80$ kg 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P013B O2 Sensor Slow Response - Lean to Rich Bank 1 Sensor 2	Oxygen Sensors Rear Response Check	<ul style="list-style-type: none"> Gradient sensor voltage < 900.00 mV/s 	<ul style="list-style-type: none"> General conditions: Intrusive lambda ramp request not active Internal resistance O2S rear < 700.00 Ohm Counter of integrated mass for fuel in oil < 255.00 [-] Catalyst monitor lambda modulation request active Vehicle speed >= 19 mph Barometric pressure >= 0.00 kPa Catalyst over-heating protection not active Turbine over-heating protection not active O2S rear ready O2S front ready ECT @ cylinder head > 60° C IAT @ manifold > -48 ° C Modeled catalyst temperature @ start of diagnosis 510 – 1,775° C Modeled catalyst temperature @ during diagnosis 470 – 830° C Diff. between dynamic and stationary catalyst temperature -150 – 150° C Integrated air mass, catalyst temp. conditions fulfilled >= 0.0 g Modeled EGT @ O2S rear 0 – 900° C 	<ul style="list-style-type: none"> 0 FTP75: 50 s Once / DCY 	<ul style="list-style-type: none"> 1 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ➔ “3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking”, page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> MAF per cylinder 22.50 – 150.00 kg/h Air mass , lower range ≥ 0.00 mg/rev Air mass , upper range ≤ 650.00 – 1,389.00 mg/rev And Engine load n.a. % Air mass setpoint n.a. [g/rev] Accelerator pedal value n.a. % For time n.a. s And Low dynamic conditions Dynamic engine speed < 50 rpm Dynamic air mass $< 50,000$ mg/rev Dynamic lambda controller output < 20.00 % And Integrated air mass after dynamic conditions are fulfilled > 20.0 g Time after a catalyst purge phase ≥ 1.0 s O2S rear voltage @ diagnosis start ≥ 0.55 V Integrated air mass ≥ 0.0 g Integrated heat energy \geq kJ Engine speed 1,088 – 3,008 rpm Deviation of lambda controller output < 50.00 % 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Proportional part of secondary fuel control loop not calibrated % Coasting function not active O2S heater rear active Lambda adaptation not active Valve lift not active And Depending on Lambda control: Sum of integral and proportional part of secondary fuel control loop before diagnosis < 0.10 [-] Or Sum of integral and proportional part of secondary fuel control loop during diagnosis < 0.25 [-] Depending on canister purge: Canister load n.a. [-] Evap purge flow n.a. Or Canister load calculation n.a. Evap purge flow n.a. Or Evap purge valve n.a. Or Evap purge valve n.a. Or Evap purge n.a. Or 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Depending on canister purge closing: Canister purge (conditions) n.a. Canister purge valve (closing time) n.a. s And Choice of: Evap purge valve n.a. Or Evap purge valve n.a. And Modeled air mass integral > 50.0 g Integrated air mass per cylinder >= 1.45 – 1.80 kg 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P013E O2 Sensor Delayed Response - Rich to Lean Bank 1 Sensor 2	Oxygen Sensors Rear Delayed Response Monitoring, Delay Measurement	<ul style="list-style-type: none"> Sensor signal delay time > 0.9 s 	<ul style="list-style-type: none"> General conditions: Intrusive lambda ramp request not active Catalyst monitor lambda modulation request active Vehicle speed >= 19 mph Barometric pressure >= 0.00 kPa Catalyst over-heating protection not active Turbine over-heating protection not active O2S rear ready O2S front ready ECT @ cylinder head > 60° C IAT @ manifold > -48° C Modeled catalyst temperature @ start of diagnosis > 510° C Modeled catalyst temperature @ during diagnosis 470 – 830° C Diff. between dynamic and stationary catalyst temperature -150 – 150° C Integrated air mass, catalyst temp. conditions fulfilled >= 0.0 g Modeled EGT @ O2S rear <= 900° C MAF per cylinder 22.50 – 150.00 kg/h Air mass , lower range >= 0.00 mg/rev 	<ul style="list-style-type: none"> 0 FTP75: 50 s Once / DCY 	<ul style="list-style-type: none"> 1 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ➔ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Air mass , upper range $\leq 650.00 - 1,389.00$ mg/rev And Engine load n.a. % Air mass setpoint n.a. g/rev Accelerator pedal value n.a. % For time n.a. [s] And Low dynamic conditions Dynamic engine speed < 50 rpm Dynamic air mass < 50.00 mg/rev Dynamic lambda controller output $< 20.00\%$ And Integrated air mass after dynamic conditions are fulfilled > 20.0 g Time after a catalyst purge phase ≥ 1.0 s O2S rear voltage @ diagnosis start ≥ 0.55 V Integrated air mass ≥ 0.0 g Integrated heat energy \geq kJ Engine speed 1,088 – 3,008 rpm Deviation of lambda controller output $< 50.00\%$ Proportional part of secondary fuel control loop not calibrated [%] Coasting function not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • O2S heater rear active • Lambda adaptation not active • Valve lift not active • And • Depending on Lambda control: • Sum of integral and proportional part of secondary fuel control loop before diagnosis < 0.10 [-] • Or • Sum of integral and proportional part of secondary fuel control loop during diagnosis < 0.25 [-] • Depending on canister purge: • Canister load n.a. [-] • Evap purge flow n.a. • Or • Canister load calculation n.a. • Evap purge flow n.a. • Or • Evap purge valve n.a. • Or • Evap purge valve n.a. • Or • Evap purge n.a. • Or • Depending on canister purge closing: • Canister purge (conditions) n.a. 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Canister purge valve (closing time) n.a. [s] And Choice of: Evap purge valve n.a. Or Evap purge valve n.a. And Modeled air mass integral > 50.0 g Integrated air mass per cylinder >= 1.40 – 1.80 kg 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P013F O2 Sensor Delayed Response - Lean to Rich Bank 1 Sensor 2	Oxygen Sensors Rear Delayed Response Monitoring, Delay Measurement	<ul style="list-style-type: none"> Sensor signal delay time > 1.5 s 	<ul style="list-style-type: none"> General conditions: Intrusive lambda ramp request not active Catalyst monitor lambda modulation request active Vehicle speed >= 19 mph Barometric pressure >= 0.00 kPa Catalyst over-heating protection not active Turbine over-heating protection not active O2S rear ready O2S front ready ECT @ cylinder head > 60° C IAT @ manifold > -48° C Modeled catalyst temperature @ start of diagnosis > 510° C Modeled catalyst temperature @ during diagnosis 470 – 830° C Diff. between dynamic and stationary catalyst temperature -150 – 150° C Integrated air mass, catalyst temp. conditions fulfilled >= 0.0 g Modeled EGT @ O2S rear <= 900° C MAF per cylinder 22.50 – 150.00 kg/h Air mass , lower range >= 0.00 mg/rev 	<ul style="list-style-type: none"> 0 (FTP75: 50) s Once / DCY 	<ul style="list-style-type: none"> 1 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ➔ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Air mass , upper range ≤ 650.00 – $1,389.00$ mg/rev And Engine load n.a. % Air mass setpoint n.a. g/rev Accelerator pedal value n.a. % For time n.a. s And Low dynamic conditions Dynamic engine speed < 50 rpm Dynamic air mass < 50.00 mg/rev Dynamic lambda controller output < 20.00 % And Integrated air mass after dynamic conditions are fulfilled > 20.0 g Time after a catalyst purge phase ≥ 1.0 s O2S rear voltage @ diagnosis start ≥ 0.55 V Integrated air mass ≥ 0.0 g Integrated heat energy \geq kJ Engine speed $1,088$ – $3,008$ rpm Deviation of lambda controller output < 50.00 % Proportional part of secondary fuel control loop not calibrated Coasting function not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • O2S heater rear active • Lambda adaptation not active • Valve lift not active • And • Depending on Lambda control: • Sum of integral and proportional part of secondary fuel control loop before diagnosis < 0.10 [-] • Or • Sum of integral and proportional part of secondary fuel control loop during diagnosis < 0.25 [-] • Depending on canister purge: • Canister load n.a. [-] • Evap purge flow n.a. • Or • Canister load calculation n.a. • Evap purge flow n.a. • Or • Evap purge valve n.a. • Or • Evap purge valve n.a. • Or • Evap purge n.a. • Or • Depending on canister purge closing: • Canister purge (conditions) n.a. 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Canister purge valve (closing time) n.a. s And Choice of: Evap purge valve n.a. Or Evap purge valve n.a. And Modeled air mass integral > 50.0 g Integrated air mass per cylinder >= 1.40 – 1.80 kg 			
P0140 O2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	Oxygen Sensors Rear Open Circuit	<ul style="list-style-type: none"> Internal resistance of O2S (binary) > 25,000.0 Ohm 		<ul style="list-style-type: none"> 2.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0141 O2 Sensor Heater Circuit Bank 1 Sensor 2	Oxygen Sensors Heater Rear Out Of Range High	<ul style="list-style-type: none"> Internal resistance of O2S (binary) 700.0 – 25,000.0 Ohm 	<ul style="list-style-type: none"> O2S heater commanded on For time >= 10.0 s 	<ul style="list-style-type: none"> 20 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .
P0149 Fuel Timing Error	Injection Valves Supply Voltage Out Of Range Low Injection Valves Supply Voltage Out Of Range High	<ul style="list-style-type: none"> Boost voltage < 30.0 V Boost voltage <= 50.0 V Boost voltage > 75.0 V 	<ul style="list-style-type: none"> Engine running >= 0.3 s 	<ul style="list-style-type: none"> 3.6 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Control Module - J623- . Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0171 System Too Lean Bank 1	Fuel System, System Too Lean	<ul style="list-style-type: none"> Lambda controller output > 35.0 % 	<ul style="list-style-type: none"> Lambda control closed loop Mass air flow > 60.0 mg/rev Engine speed > 576 RPM ECT @ cylinder head > 20° C IAT at intake manifold > -48° C AAT > -48° C And Evap purge valve closed Or Canister load <= 1.20 [-] Evap purge flow at max. value Or Depending on canister purge min: Lower limit of lambda controller output n.a. Or Upper limit of lambda controller output n.a. And Evap purge flow at min. value 	<ul style="list-style-type: none"> 60 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the intake and vacuum hoses for leaks, Check the Positive Crankcase Ventilation, also make sure the oil dipstick is properly secured. Listen to and visually inspect the Exhaust system to insure there are no leaks. Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 . Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0172 System Too Rich Bank 1	Fuel System, System Too Rich	<ul style="list-style-type: none"> Lambda controller output < -35.0 % 	<ul style="list-style-type: none"> Lambda control closed loop Mass air flow > 60.0 mg/rev Engine speed > 576 RPM ECT @ cylinder head > 20° C IAT at intake manifold > -48° C AAT > -48° C Oil dilution not detected And Evap purge valve closed Or Canister load <= 1.20 [-] Evap purge flow at max. value Or Depending on canister purge min: Lower limit of lambda controller output n.a. Or Upper limit of lambda controller output n.a. And Evap purge flow at min. value 	<ul style="list-style-type: none"> 60 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430. Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427. Check the Fuel Injectors. Refer to "3.6.15 Fuel Injectors, Checking", page 396. Check the Evaporative Emission System for contamination. Refer to appropriate repair manual.
P0190 Fuel Pressure Regulator 1 Control Circuit/ Open	Fuel System Pressure Sensor High Pressure Side Short To Battery / Open Circuit	<ul style="list-style-type: none"> High fuel pressure sensor voltage > 4.80 V 		<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247-. Refer to "3.6.17 Fuel Pressure Sensor G247, Checking", page 400. Check the fuel pressure. Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0191 Fuel Rail Pressure Sensor Circuit Range/Performance Bank 1	Fuel Rail High Pressure Side Out Of Range High	<ul style="list-style-type: none"> Fuel pressure > 26,500.18 kPa 	<ul style="list-style-type: none"> Engine running Engine speed < 6,816 RPM Time after engine start > 10.0 s 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247 Checking", page 400 . Check the fuel pressure. Refer to appropriate repair manual.
P0192 Fuel Rail Pressure Sensor Circuit Low Bank 1	Fuel System Pressure Sensor High Pressure Side Short To Ground	<ul style="list-style-type: none"> High fuel pressure sensor voltage < 0.20 V 		<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247 Checking", page 400 . Check the fuel pressure. Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0201 Cylinder 1 Injector "A" Circuit	Injection Valves Electrical Error	<ul style="list-style-type: none"> Indeterminate fault pattern via power stage diagnosis detected And Injector low side voltage < 2.0 V Injector low side switch current driver stage internal value Or Injector low side voltage < 2.0 V Injector high side switch current driver stage internal value Or Injector low side voltage < 2.0 V Injector low side switch current (hardware values) driver stage internal value Or Injector voltage < 2.0 V Injector low side switch current driver stage internal value Or Injector voltage < 2.0 V Injector low side switch current (hardware values) driver stage internal value Or 	<ul style="list-style-type: none"> Engine running ECT @ cylinder head $\geq -30^{\circ}\text{C}$ Engine speed < 7,000 RPM Injection time $\geq 0.0\text{ s}$ 	<ul style="list-style-type: none"> 8,640.0 s CRK Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> • Injector load resistance to ground and battery > 20.0 Ohm • Injector low side switch current driver stage internal value • Or • Injector load resistance to ground and battery > 20.0 Ohm • Injector high side switch current driver stage internal value • Or • Power stage temperature > 150° C 				
	Injection Valves Electrical Error Open Circuit	<ul style="list-style-type: none"> • Fault pattern for open circuit via power stage diagnosis detected • Injector low side voltage < 2.0 V 	<ul style="list-style-type: none"> • Engine stop not active • ECT @ cylinder head $\geq -30^{\circ}\text{C}$ • Engine speed < 7,000 RPM • Injection time $\geq 0.0\text{ s}$ 			
	Injection Valves Electrical Error Short Circuit	<ul style="list-style-type: none"> • Fault pattern for short circuit via power stage diagnosis detected • Injector current rise time during peak phase < 0.064 ms 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0202 Cylinder 2 Injector "A" Circuit	Injection Valves Electrical Error	<ul style="list-style-type: none"> Indeterminate fault pattern via power stage diagnosis detected And Injector low side voltage < 2.0 V Injector low side switch current driver stage internal value Or Injector low side voltage < 2.0 V Injector high side switch current driver stage internal value Or Injector low side voltage < 2.0 V Injector low side switch current (hardware values) driver stage internal value Or Injector voltage < 2.0 V Injector low side switch current driver stage internal value Or Injector voltage < 2.0 V Injector low side switch current (hardware values) driver stage internal value Or 	<ul style="list-style-type: none"> Engine running ECT @ cylinder head >= -30° C Engine speed < 7,000 RPM Injection time >= 0.0 s 	<ul style="list-style-type: none"> 8,640.0 s CRK Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> • Injector load resistance to ground and battery > 20.0 Ohm • Injector low side switch current driver stage internal value • Or • Injector load resistance to ground and battery > 20.0 Ohm • Injector high side switch current driver stage internal value • Or • Power stage temperature > 150° C 				
	Injection Valves Electrical Error Open Circuit	<ul style="list-style-type: none"> • Fault pattern for open circuit via power stage diagnosis detected • Injector low side voltage < 2.0 V 	<ul style="list-style-type: none"> • Engine stop not active • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 s 			
	Injection Valves Electrical Error Short Circuit	<ul style="list-style-type: none"> • Fault pattern for short circuit via power stage diagnosis detected • Injector current rise time during peak phase < 0.064 ms 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0203 Cylinder 3 Injector "A" Circuit	Injection Valves Electrical Error	<ul style="list-style-type: none"> Indeterminate fault pattern via power stage diagnosis detected And Injector low side voltage < 2.0 V Injector low side switch current driver stage internal value Or Injector low side voltage < 2.0 V Injector high side switch current driver stage internal value Or Injector low side voltage < 2.0 V Injector low side switch current (hardware values) driver stage internal value Or Injector voltage < 2.0 V Injector low side switch current driver stage internal value Or Injector voltage < 2.0 V Injector low side switch current (hardware values) driver stage internal value Or 	<ul style="list-style-type: none"> Engine running ECT @ cylinder head >= -30° C Engine speed < 7,000 RPM Injection time >= 0.0 s 	<ul style="list-style-type: none"> 8,640.0 s CRK Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> • Injector load resistance to ground and battery > 20.0 Ohm • Injector low side switch current driver stage internal value • Or • Injector load resistance to ground and battery > 20.0 Ohm • Injector high side switch current driver stage internal value • Or • Power stage temperature > 150° C 				
	Injection Valves Electrical Error Open Circuit	<ul style="list-style-type: none"> • Fault pattern for open circuit via power stage diagnosis detected • Injector low side voltage < 2.0 V 	<ul style="list-style-type: none"> • Engine stop not active • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 s 			
	Injection Valves Electrical Error Short Circuit	<ul style="list-style-type: none"> • Fault pattern for short circuit via power stage diagnosis detected • Injector current rise time during peak phase < 0.064 ms 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0204 Cylinder 4 Injector "A" Circuit	Injection Valves Electrical Error	<ul style="list-style-type: none"> Indeterminate fault pattern via power stage diagnosis detected And Injector low side voltage < 2.0 V Injector low side switch current driver stage internal value Or Injector low side voltage < 2.0 V Injector high side switch current driver stage internal value Or Injector low side voltage < 2.0 V Injector low side switch current (hardware values) driver stage internal value Or Injector voltage < 2.0 V Injector low side switch current driver stage internal value Or Injector voltage < 2.0 V Injector low side switch current (hardware values) driver stage internal value Or 	<ul style="list-style-type: none"> Engine running ECT @ cylinder head >= -30° C Engine speed < 7,000 RPM Injection time >= 0.0 s 	<ul style="list-style-type: none"> 8,640.0 s CRK Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> • Injector load resistance to ground and battery > 20.0 Ohm • Injector low side switch current driver stage internal value • Or • Injector load resistance to ground and battery > 20.0 Ohm • Injector high side switch current driver stage internal value • Or • Power stage temperature > 150° C 				
	Injection Valves Electrical Error Open Circuit	<ul style="list-style-type: none"> • Fault pattern for open circuit via power stage diagnosis detected • Injector low side voltage < 2.0 V 	<ul style="list-style-type: none"> • Engine stop not active • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 s 			
	Injection Valves Electrical Error Short Circuit	<ul style="list-style-type: none"> • Fault pattern for short circuit via power stage diagnosis detected • Injector current rise time during peak phase < 0.064 ms 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0221 Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance	Throttle Position Sensor 2 Rationality Check	<ul style="list-style-type: none"> Normalized difference between measured and modeled value of mass air flow from TPS 2 ≥ 1.0 [-] Or Relative mass air flow integral from TPS 2 > 60.00 - 	<ul style="list-style-type: none"> Throttle adaptation (@ initial start or after detection of throttle exchange or checksum error) not active 	<ul style="list-style-type: none"> 0.01 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .
P0222 Throttle/Pedal Position Sensor/Switch "B" Circuit Low	Throttle Position Sensor 2 Short To Ground / Open Circuit	<ul style="list-style-type: none"> Throttle position sensor 2 voltage < 0.15 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .
P0223 Throttle/Pedal Position Sensor/Switch "B" Circuit High	Throttle Position Sensor 2 Short To Battery Voltage	<ul style="list-style-type: none"> Throttle position sensor 2 voltage > 4.85 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .
P0230 Fuel Pump Circuit	COM: Fuel Pump Control Module (FPCM) communication with FPCM	<ul style="list-style-type: none"> FP sensor: short to ground failure feedback ≥ 2.00 [-] FP sensor: open circuit failure feedback ≥ 2.00 [-] 	<ul style="list-style-type: none"> Engine on 	<ul style="list-style-type: none"> 2.0 s Continuous 2.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to "3.6.17 Fuel Pressure Sensor G247, Checking", page 400



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0236 Turbo-charger/ Super-charger Boost Sensor "A" Circuit Range/ Performance	Turbo-charger Boost Pressure Sensor Rationality Check	<ul style="list-style-type: none"> Diff. barometric pressure vs. upstream throttle pressure ≥ 8.50 kPa Diff. upstream throttle pressure vs. intake manifold pressure ≥ 8.50 kPa Or Diff. barometric pressure vs. intake manifold pressure < 8.50 kPa 	<ul style="list-style-type: none"> Case 1: Engine stop at start of DCY Engine stopped Vehicle speed < 1 mph Delay after engine stop ≥ 5.0 s Case 2: Engine stop during DCY Engine stopped Vehicle speed < 1 mph Delay after engine stop ≥ 5.0 s For time ≥ 10.0 s 	<ul style="list-style-type: none"> 3.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31, Checking", page 372 .
P0237 Turbo-charger/ Super-charger Boost Sensor "A" Circuit Low	Turbo-charger Boost pressure Sensor Short To Ground	<ul style="list-style-type: none"> Turbocharger boost pressure sensor voltage < 0.20 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31, Checking", page 372 .
P0238 Turbo-charger/ Super-charger Boost Sensor "A" Circuit High	Turbo-charger Boost pressure Sensor Short To Battery Voltage	<ul style="list-style-type: none"> Turbocharger boost pressure sensor voltage > 4.80 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Air Pressure Sensor - G31- . Refer to ⇒ "3.6.6 Charge Air Pressure Sensor G31, Checking", page 372 .
P025A Fuel Pump Module "A" Control Circuit/Open	Fuel Pump Open Circuit	<ul style="list-style-type: none"> Signal voltage, lower range $> 1.92 - 2.21$ V And Signal voltage, upper range (hardware values) $< 2.84 - 3.25$ V 	<ul style="list-style-type: none"> Commanded PWM 9.80 – 92.20 % Fuel pump commanded off 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538- . Refer to ⇒ "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P025C Fuel Pump Module "A" Control Circuit Low	Fuel Pump Short To Ground	<ul style="list-style-type: none"> Signal voltage (hardware values) < 1.92 – 2.21 V 	<ul style="list-style-type: none"> Commanded PWM 9.80 – 92.20 % Fuel pump commanded off 	<ul style="list-style-type: none"> 3.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538- . Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 .
P025D Fuel Pump Module "A" Control Circuit High	Fuel Pump Short To Battery Voltage	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Signal current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Commanded PWM 9.80 – 92.20 % Fuel pump commanded on 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538- . Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 .
P0261 Cylinder 1 Injector "A" Circuit Low	Injection Valves Short To Ground	<ul style="list-style-type: none"> Fault pattern for short to ground via powerstage diagnosis detected Injector voltage < 2.0 V 	<ul style="list-style-type: none"> Engine stop not active ECT @ cylinder head >= -30° C Engine speed < 7,000 RPM Injection time >= 0.0 ms 	<ul style="list-style-type: none"> 8,640.0° CRK Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .
	Injection Valves Short To Ground (High Side)	<ul style="list-style-type: none"> Injector driver voltage < 2 V And Injector driver high side switch current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Engine running ECT @ cylinder head >= -30° C Engine speed < 7,000 RPM Injection time >= 0.0 ms 	<ul style="list-style-type: none"> 720° CRK Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Injection Valves Short To Ground (Low Side)	<ul style="list-style-type: none"> • Injector driver voltage < 2 V • And • Injector driver high side switch current driver stage internal value • And • Injector driver low side switch current (hardware values) driver stage internal value 				
P0262 Cylinder 1 Injector "A" Circuit High	Injection Valves Short To Battery Plus	<ul style="list-style-type: none"> • Fault pattern for short to Battery plus via powerstage diagnosis detected • Injector voltage > 2.0 V 	<ul style="list-style-type: none"> • Engine stop not active • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 8,640.0^s CRK • Continuous 	2 DCY	– Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396
	Injection Valves Short To Battery Plus (High Side)	<ul style="list-style-type: none"> • Injector driver voltage > 2.0 V • And • Injector driver high side switch current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> • Engine running • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 720° CRK • Continuous 		
	Injection Valves Short To Battery Plus (Low Side)	<ul style="list-style-type: none"> • Injector driver voltage > 2.0 V • And • Injector driver low side switch current (hardware values) driver stage internal value 				
P0264 Cylinder 2 Injector "A" Circuit Low	Injection Valves Short To Ground	<ul style="list-style-type: none"> • Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V 	<ul style="list-style-type: none"> • Engine stop not active • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 8,640.0^s CRK • Continuous 	2 DCY	– Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Injection Valves Short To Ground (High Side)	<ul style="list-style-type: none"> • Injector driver voltage < 2 V • And • Injector driver high side switch current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> • Engine running • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 720° CRK • Continuous 		
	Injection Valves Short To Ground (Low Side)	<ul style="list-style-type: none"> • Injector driver voltage < 2 V • And • Injector driver high side switch current driver stage internal value • And • Injector driver low side switch current (hardware values) driver stage internal value 				
P0265 Cylinder 2 Injector "A" Circuit High	Injection Valves Short To Battery Plus	<ul style="list-style-type: none"> • Fault pattern for short to Battery plus via powerstage diagnosis detected • Injector voltage > 2.0 V 	<ul style="list-style-type: none"> • Engine stop not active • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 8,640.0° CRK • Continuous 	2 DCY	– Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .
	Injection Valves Short To Battery Plus (High Side)	<ul style="list-style-type: none"> • Injector driver voltage > 2.0 V • And • Injector driver high side switch current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> • Engine running • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 720° CRK • Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Injection Valves Short To Battery Plus (Low Side)	<ul style="list-style-type: none"> Injector driver voltage > 2.0 V And Injector driver low side switch current (hardware values) driver stage internal value 				
P0267 Cylinder 3 Injector "A" Circuit Low	Injection Valves Short To Ground	<ul style="list-style-type: none"> Fault pattern for short to ground via powerstage diagnosis detected Injector voltage < 2.0 V 	<ul style="list-style-type: none"> Engine stop not active ECT @ cylinder head >= -30° C Engine speed < 7,000 RPM Injection time >= 0.0 ms 	<ul style="list-style-type: none"> 8,640.0° CRK Continuous 	2 DCY	– Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396 .
	Injection Valves Short To Ground (High Side)	<ul style="list-style-type: none"> Injector driver voltage < 2 V And Injector driver high side switch current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Engine running ECT @ cylinder head >= -30° C Engine speed < 7,000 RPM Injection time >= 0.0 ms 	<ul style="list-style-type: none"> 720° CRK Continuous 		
	Injection Valves Short To Ground (Low Side)	<ul style="list-style-type: none"> Injector driver voltage < 2 V And Injector driver high side switch current driver stage internal value And Injector driver low side switch current (hardware values) driver stage internal value 				
P0268 Cylinder 3 Injector "A" Circuit High	Injection Valves Short To Battery Plus	<ul style="list-style-type: none"> Fault pattern for short to Battery plus via powerstage diagnosis detected Injector voltage > 2.0 V 	<ul style="list-style-type: none"> Engine stop not active ECT @ cylinder head >= -30° C Engine speed < 7,000 RPM Injection time >= 0.0 ms 	<ul style="list-style-type: none"> 8,640.0° CRK Continuous 	2 DCY	– Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Injection Valves Short To Battery Plus (High Side)	<ul style="list-style-type: none"> • Injector driver voltage > 2.0 V • And • Injector driver high side switch current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> • Engine running • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 720° CRK • Continuous 		
	Injection Valves Short To Battery Plus (Low Side)	<ul style="list-style-type: none"> • Injector driver voltage > 2.0 V • And • Injector driver low side switch current (hardware values) driver stage internal value 				
P0270 Cylinder 4 Injector "A" Circuit Low	Injection Valves Short To Ground	<ul style="list-style-type: none"> • Fault pattern for short to ground via powerstage diagnosis detected • Injector voltage < 2.0 V 	<ul style="list-style-type: none"> • Engine stop not active • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 8,640.0° CRK • Continuous 	2-DCY	– Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396
	Injection Valves Short To Ground (High Side)	<ul style="list-style-type: none"> • Injector driver voltage < 2 V • And • Injector driver high side switch current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> • Engine running • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 720° CRK • Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Injection Valves Short To Ground (Low Side)	<ul style="list-style-type: none"> • Injector driver voltage < 2 V • And • Injector driver high side switch current driver stage internal value • And • Injector driver low side switch current (hardware values) driver stage internal value 				
P0271 Cylinder 4 Injector "A" Circuit High	Injection Valves Short To Battery Plus	<ul style="list-style-type: none"> • Fault pattern for short to Battery plus via powerstage diagnosis detected • Injector voltage > 2.0 V 	<ul style="list-style-type: none"> • Engine stop not active • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 8,640.0° CRK • Continuous 	2 DCY	– Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking" , page 396 .
	Injection Valves Short To Battery Plus (High Side)	<ul style="list-style-type: none"> • Injector driver voltage > 2.0 V • And • Injector driver high side switch current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> • Engine running • ECT @ cylinder head >= -30° C • Engine speed < 7,000 RPM • Injection time >= 0.0 ms 	<ul style="list-style-type: none"> • 720° CRK • Continuous 		
	Injection Valves Short To Battery Plus (Low Side)	<ul style="list-style-type: none"> • Injector driver voltage > 2.0 V • And • Injector driver low side switch current (hardware values) driver stage internal value 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0300 Random/Multiple Cylinder Misfire Detected	Misfire Crankshaft Speed Fluctuation (Multiple)	<ul style="list-style-type: none"> Number of cylinders with emission threshold misfire within 4,000 revolutions ≥ 2.00 [-] Or Number of cylinders with emission threshold misfire within 1,000 revolutions ≥ 2.00 [-] 	<ul style="list-style-type: none"> Emission threshold misfire detected 	<ul style="list-style-type: none"> 1000 rev Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 . Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .
P0301 Cylinder 1 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	<ul style="list-style-type: none"> Catalyst damage misfire: Catalyst damaging misfire rate $> 5.20 - 20.83$ % Emission threshold misfire within 1,000 rev: Emission threshold misfire rate (MR) ≥ 2.05 % 	<ul style="list-style-type: none"> Initial engine speed > 550 RPM Engine speed > 550 RPM Engine speed $< 6,848$ for DCT: Time after engine start not calibrated Engine load $> 1.99 - 37.99$ % Depending on ECT @ cylinder head @ start ECT @ cylinder head @ start $\leq -48^{\circ} \text{C}$ Then activation if ECT @ cylinder head $\geq 20^{\circ} \text{C}$ Or ECT @ cylinder head @ engine start $> -48^{\circ} \text{C}$ And Fuel cut off not active 	<ul style="list-style-type: none"> 200 rev Continuous 1,000 rev Continuous 	<ul style="list-style-type: none"> Immediate 2 DCY 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 . Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Emission threshold mis-fire within 4,000 rev: Emission threshold mis-fire rate (MR) > 2.05 % 	<ul style="list-style-type: none"> Or Single fuel cut off not active Or Number of fade out cylinders < 2.00 [-] And Dynamic manifold air pressure not calibrated [kPa] Dynamic throttle position not calibrated And Dynamic of engine load not calibrated And Engine not calibrated Engine speed not calibrated [rpm] Dynamic of ignition angle @ idle speed not calibrated [°CRK] Or Dynamic of ignition angle not calibrated [°CRK] And Rough road not detected 	<ul style="list-style-type: none"> 4 x 1,000 rev Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0302 Cylinder 2 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	<ul style="list-style-type: none"> Catalyst damage misfire: Catalyst damaging misfire rate > 5.20 - 20.83 % Emission threshold misfire within 1000 rev: Emission threshold misfire rate (MR) >= 2.05 % 	<ul style="list-style-type: none"> Initial engine speed > 550 RPM Engine speed > 550 RPM Engine speed < 6,848 for DCT: Time after engine start not calibrated Engine load > 1.99 - 37.99 % Depending on ECT @ cylinder head @ start ECT @ cylinder head @ start <= -48° C Then activation if ECT @ cylinder head >= 20° C Or ECT @ cylinder head @ engine start > -48° C And Fuel cut off not active Or Single fuel cut off not active Or Number of fade out cylinders < 2.00 [-] And Dynamic manifold air pressure not calibrated [kPa] Dynamic throttle position not calibrated [°TPS/s] And Dynamic of engine load not calibrated [%] And 	<ul style="list-style-type: none"> 200 rev Continuous 1,000 rev Continuous 	<ul style="list-style-type: none"> Immediate 2 DCY 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396. Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Emission threshold misfire within 4000 rev: Emission threshold misfire rate (MR) > 2.05 % 	<ul style="list-style-type: none"> Engine not calibrated Engine speed not calibrated [rpm] Dynamic of ignition angle @ idle speed not calibrated [°CRK] Or Dynamic of ignition angle not calibrated [°CRK] And Rough road not detected 	<ul style="list-style-type: none"> 4 x 1,000 rev Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0303 Cylinder 3 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	<ul style="list-style-type: none"> Catalyst damage misfire: Catalyst damaging misfire rate > 5.20 - 20.83 % Emission threshold misfire within 1,000 rev: Emission threshold misfire rate (MR) >= 2.05 % 	<ul style="list-style-type: none"> Initial engine speed > 550 RPM Engine speed > 550 RPM Engine speed < 6,848 for DCT: Time after engine start not calibrated Engine load > 1.99 - 37.99 % Depending on ECT @ cylinder head @ start ECT @ cylinder head @ start <= -48° C Then activation if ECT @ cylinder head >= 20° C Or ECT @ cylinder head @ engine start > -48° C And Fuel cut off not active Or Single fuel cut off not active Or Number of fade out cylinders < 2.00 [-] And Dynamic manifold air pressure not calibrated kPa Dynamic throttle position not calibrated °TPS/s And Dynamic of engine load not calibrated % And 	<ul style="list-style-type: none"> 200 rev Continuous 1,000 rev Continuous 	<ul style="list-style-type: none"> Immediate 2 DCY 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 . Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none">Emission threshold mis-fire within 4,000 rev:Emission threshold mis-fire rate (MR) > 2.05 %	<ul style="list-style-type: none">Engine not calibratedEngine speed not calibrated [rpm]Dynamic of ignition angle @ idle speed not calibrated ° CRKOrDynamic of ignition angle not calibrated ° CRKAndRough road not detected	<ul style="list-style-type: none">4 x 1,000 revContinuous		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0304 Cylinder 4 Misfire Detected	Misfire Crankshaft Speed Fluctuation (Single Or Multiple)	<ul style="list-style-type: none"> Catalyst damage misfire: Catalyst damaging misfire rate > 5.20 - 20.83 % Emission threshold misfire within 1,000 rev: Emission threshold misfire rate (MR) >= 2.05 % 	<ul style="list-style-type: none"> Initial engine speed > 550 RPM Engine speed > 550 RPM Engine speed < 6,848 for DCT: Time after engine start not calibrated Engine load > 1.99 - 37.99 % Depending on ECT @ cylinder head @ start ECT @ cylinder head @ start <= -48° C Then activation if ECT @ cylinder head >= 20° C Or ECT @ cylinder head @ engine start > -48° C And Fuel cut off not active Or Single fuel cut off not active Or Number of fade out cylinders < 2.00 [-] And Dynamic manifold air pressure not calibrated [kPa] Dynamic throttle position not calibrated [°TPS/s] And Dynamic of engine load not calibrated [%] And 	<ul style="list-style-type: none"> 200 rev Continuous 1,000 rev Continuous 	<ul style="list-style-type: none"> Immediate 2 DCY 	<ul style="list-style-type: none"> Check the spark plugs visually. Check the intake system visually for leaks. Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors . Checking", page 396 Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Emission threshold mis-fire within 4,000 rev: Emission threshold mis-fire rate (MR) > 2.05 % 	<ul style="list-style-type: none"> Engine not calibrated Engine speed not calibrated [rpm] Dynamic of ignition angle @ idle speed not calibrated ° CRK Or Dynamic of ignition angle not calibrated ° CRK And Rough road not detected 	<ul style="list-style-type: none"> 4 x 1,000 rev Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0326 Knock/Combustion Vibration Sensor 1 Circuit Range/Performance Bank 1 or Single Sensor	Knock Sensor Rationality Check Low	<ul style="list-style-type: none"> Difference between knock sensor signal and average knock sensor signal < 0.00 – 0.12 V 	<ul style="list-style-type: none"> ECT @ cylinder head > 59° C MAF > 229.00 mg/rev 	<ul style="list-style-type: none"> 4.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Knock Sensor 1 - G61- . Refer to "3.6.24 Knock Sensor 1 G61, Checking", page 421 .
P0327 Knock/Combustion Vibration Sensor 1 Circuit Low Bank 1 or Single Sensor	Knock Sensor Out Of Range	<ul style="list-style-type: none"> Sensor signal < 0.12 – 0.31 V 	<ul style="list-style-type: none"> ECT @ cylinder head > 59° C MAF > 229.00 mg/rev Engine speed > 2,016 RPM 	<ul style="list-style-type: none"> 4.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Knock Sensor 1 - G61- . Refer to "3.6.24 Knock Sensor 1 G61, Checking", page 421 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0335 Crankshaft Position Sensor "A" Circuit	Crankshaft Position Sensor Activity Check	<ul style="list-style-type: none"> Case 1: Counted exhaust camshaft signals without synchronization ≥ 17.00 [-] Or Counted intake camshaft signals without synchronization ≥ 17.00 [-] Case 2: Counted exhaust camshaft signals without synchronization n.a. [-] Or Counted intake camshaft signals without synchronization n.a. [-] 	<ul style="list-style-type: none"> Signal edges @ selected camshaft signal detected Choice of: Ignition off Engine speed > 380 RPM Engine stalling ≥ 1.0 s Or Synchronization test incorrect Or Engine speed ≥ 380 RPM Or Engine running Engine stalling ≥ 5.0 s Or Backwards rotation not detected Or Engine speed ≥ 400 RPM Engine stop active 	<ul style="list-style-type: none"> 0.01 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Speed Sensor - G28- . Refer to ⇒ "3.6.11 Engine Speed Sensor G28, Checking", page 384 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0336 Crankshaft Position Sensor "A" Circuit Range/Performance	RPM Sensor Out Of Range	<ul style="list-style-type: none"> Segment adaptation ≥ 0.70 % 	<ul style="list-style-type: none"> Fuel cut off active Delay time $\geq 5,760.00^\circ$ CRK And Diff. actual air mass vs. previous air mass $\leq 20.01 - 39.99$ mg/rev Engine load ≤ 20.00 % Dynamic throttle position \leq TPS/s Rough road not detected Engine roughness signal not valid Segments in fuel cut-off mode ≥ 32.00 [-] Segment adaptation finished Engine speed 2,496 – 5,024 rpm Diff. between adapted value of cylinder 1 and cylinder 3 < 0.70 % Diff. between adapted value of cylinder 2 and cylinder 4 < 0.70 % 	<ul style="list-style-type: none"> 180.0° CRK Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Speed Sensor - G28- . Refer to "3.6.11 Engine Speed Sensor G28, Checking", page 384 .
		<ul style="list-style-type: none"> Counted teeth vs reference ≥ 1; ≤ 2 [-] 	<ul style="list-style-type: none"> Engine running 	<ul style="list-style-type: none"> 3,600.0° CRK Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Crankshaft Position Sensor Rationality Check	<ul style="list-style-type: none"> Case 1: Engine speed > 3,000 RPM Time between falling signal edges < 50 – 62.5 µs Case 2: Engine speed <= 3,000 RPM Time between signal edges < 30 µs 	<ul style="list-style-type: none"> Engine speed >= 400 RPM 	<ul style="list-style-type: none"> 4,5720° CRK Continuous 		
	Crankshaft Position Sensor Rationality Check	<ul style="list-style-type: none"> Crankshaft reference gap not detected 	<ul style="list-style-type: none"> General conditions: Reference gap of reluctor wheel detected And Case 1: Ignition off Engine speed > 380 RPM Engine stalling >= 1.0 s Or Case 2: Engine speed >= 380 RPM Or Engine running And Engine stalling >= 5.0 s Or Case 3: Backwards rotation not detected Or Case 4: Engine speed >= 400 RPM Engine stopped 	<ul style="list-style-type: none"> 2,160° CRK Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Crankshaft Position Sensor Rationality Check	<ul style="list-style-type: none"> Counted teeth vs. reference ≥ 1; ≤ 2 [-] 	<ul style="list-style-type: none"> General conditions: Engine speed > 320 RPM And Case 1: Ignition off Engine speed > 380 RPM Engine stalling ≥ 1.0 s Or Case 2: Engine speed ≥ 380 RPM Or Engine running And Engine stalling ≥ 5.0 s Or Case 3: Backwards rotation not detected Or Case 4: Engine speed ≥ 400 RPM Engine stopped 	<ul style="list-style-type: none"> $1,800^\circ$ CRK Continuous 		
P0340 Camshaft Position Sensor "A" Circuit Bank 1 or Single Sensor	Camshaft Position Sensor Intake Signal Activity Check	<ul style="list-style-type: none"> No change on signal ≥ 3 [-] 	<ul style="list-style-type: none"> Engine speed ≥ 400 RPM 	<ul style="list-style-type: none"> $4,680.0^\circ$ CRK Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Camshaft Position Sensor - G40. Refer to "3.6.5 Camshaft Position Sensor G40, Checking", page 368.





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0341 Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor	Camshaft Position Sensor Intake Rationality Check	<ul style="list-style-type: none"> Ratio between measured segment time ratio and specified camshaft angle ratio > 2.75 [-] Or Ratio between measured segment time ratio and specified camshaft angle ratio < 0.36 [-] Or Offset between camshaft and crankshaft < -79.0° CRK Or Offset between camshaft and crankshaft > 15.0° CRK 	<ul style="list-style-type: none"> Engine speed 400 – 8,160 RPM 	<ul style="list-style-type: none"> 990.0° CRK Continuous 	<ul style="list-style-type: none"> 2 DCY 	– Check the Camshaft Position Sensor - G40- . Refer to ⇒ "3.6.5 Camshaft Position Sensor G40, Checking", page 368 .
	Camshaft Position Sensor Intake Signal Activity Check	<ul style="list-style-type: none"> Segment time value < 50 [µs] 		<ul style="list-style-type: none"> 1,440.0° CRK Continuous 		
	Camshaft Position / Crankshaft Position (CMP/CKP) Intake Sensor out of range	<ul style="list-style-type: none"> Offset between camshaft and crankshaft < -79.00; OR > 15.0° CRK 	<ul style="list-style-type: none"> Engine synchronization not validated Failure by exhaust camshaft sensor detected 	<ul style="list-style-type: none"> 450.0° CRK Once / DCY 		
P0365 Camshaft Position Sensor "B" Circuit Bank 1	Camshaft Position (CMP) Exhaust Sensor	<ul style="list-style-type: none"> No change on signal >= 3 [-] 	<ul style="list-style-type: none"> Engine speed >= 400 rpm 	<ul style="list-style-type: none"> 1080.00° CRK Continuous 	<ul style="list-style-type: none"> 2 DCY 	– Check the Camshaft Position Sensor 3 - G300- . Refer to ⇒ "3.6.4 Camshaft Position Sensor 3 G300, Checking", page 364



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0366 Camshaft Position Sensor "B" Circuit Range/Performance Bank 1	Camshaft Position (CMP) Exhaust Sensor rationality check	<ul style="list-style-type: none"> Ratio between measured segment time ratio and specified camshaft angle ratio > 2.75 [-] Or Ratio between measured segment time ratio and specified camshaft angle ratio < 0.36 [-] Or Offset between camshaft and crankshaft < -24.00° CRK Or Offset between camshaft and crankshaft > 49.00° CRK 	<ul style="list-style-type: none"> Engine speed 400 – 8,160 rpm 	<ul style="list-style-type: none"> 990.00° CRK Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Camshaft Position Sensor 3 - G300-. Refer to "3.6.4 Camshaft Position Sensor 3 G300, Checking", page 364
	Camshaft Position (CMP) Exhaust Sensor signal activity check	<ul style="list-style-type: none"> Segment time value < 50 [µs] 	<ul style="list-style-type: none"> Engine speed 400 – 8,160 rpm 	<ul style="list-style-type: none"> 1440.00° CRK Continuous 	2 DCY	
	Camshaft Position / Crankshaft Position (CMP/CKP) Exhaust Sensor out of range	<ul style="list-style-type: none"> Offset between camshaft and crankshaft < -24.00° CRK Or Offset between camshaft and crankshaft > 49.00° CRK 	<ul style="list-style-type: none"> Engine synchronization via crankshaft and camshaft not finished Or Engine synchronization via crankshaft and camshaft lost 	<ul style="list-style-type: none"> 450.00° CRK Once / DCY" 	2 DCY	



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P039B Cylinder 1 Pressure Too High	Knock Control Function Check	<ul style="list-style-type: none"> • Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.00 – 3.00 [-] • For time >= 9,000.0 – 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.00 [-] • For time >= 5,760.0 – 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.00 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.00 – 3.00 [-] • For time >= 12,960.0 – 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-] 	<ul style="list-style-type: none"> • Engine running • ECT @ cylinder head > 59° C • Engine speed 1,216 – 6,720 RPM • Engine load n.a. % • Mass air flow > 501.00 – 599.00 mg/rev • Dynamic engine speed not active • Delay time 0.0 s 	<ul style="list-style-type: none"> • 900.0° CRK • Continuous 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> – Check the Knock Sensor 1 - G61- . Refer to ⇒ "3.6.24 Knock Sensor 1 G61, Checking", page 421 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 – 2.50 [-] For time \geq 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 – 4.50 [-] For time \geq 360.0° CRK Case 1: ratio between filtered engine roughness and misfire detection threshold \leq 0.41 – 0.59 [-] Or Case 2: Ratio between normalized engine roughness and misfire detection threshold \leq n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold \leq n.a. [-] Or Ratio between normalized engine roughness and misfire detection threshold \leq n.a. [-] 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P03A5 Cylinder 2 Pressure Too High	Knock Control Function Check	<ul style="list-style-type: none"> • Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.00 – 3.00 [-] • For time \geq 9,000.0 – 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.00 [-] • For time \geq 5,760.0 – 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.00 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.00 – 3.00 [-] • For time \geq 12,960.0 – 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-] 	<ul style="list-style-type: none"> • Engine running ECT @ cylinder head > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.00 – 447.00 mg/rev • Dynamic engine speed not active 	<ul style="list-style-type: none"> • 900.0° CRK • Continuous 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> – Check the Knock Sensor 1 - G61- . Refer to ⇒ "3.6.24 Knock Sensor 1 G61. Checking", page 421 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 – 2.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 – 4.50 [-] For time >= 360.0° CRK Case 1: ratio between filtered engine roughness and misfire detection threshold <= 0.41 – 0.59 [-] Or Case 2: Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-] 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	<ul style="list-style-type: none"> • Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.00 – 3.00 [-] • For time >= 9,000.0 – 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.00 [-] • For time >= 5,760.0 – 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.00 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.00 – 3.00 [-] • For time >= 12,960.0 – 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-] 	<ul style="list-style-type: none"> • Engine running ECT @ cylinder head > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.00 – 447.00 mg/rev • Dynamic engine speed not active 	<ul style="list-style-type: none"> • 900.0° CRK • Continuous 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> – Check the Knock Sensor 1 - G61- . Refer to ⇒ "3.6.24 Knock Sensor 1 G61, Checking", page 421 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 – 2.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 – 4.50 [-] For time >= 360.0° CRK Case 1: ratio between filtered engine roughness and misfire detection threshold <= 0.41 – 0.59 [-] Or Case 2: Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalized engine roughness and misfire detection threshold <= n.a. [-] 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P03B9 Cylinder 4 Pressure Too High	Knock Control Function Check	<ul style="list-style-type: none"> • Slow detection: • Ratio between knock sensor and knock threshold in main knock window > 2.00 – 3.00 [-] • For time >= 9,000.0 – 11,700.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.00 [-] • For time >= 5,760.0 – 6,840.0° CRK • Or • Ratio between knock sensor and noise level in pre knock window > 3.50 – 5.00 [-] • Ratio between knock sensor and knock threshold in main knock window > 2.00 – 3.00 [-] • For time >= 12,960.0 – 16,740.0° CRK • Or • Torque limitation factor < 0.90 [-] 	<ul style="list-style-type: none"> • Engine running ECT @ cylinder head > 60° C • Engine speed 1,216 – 6,400 RPM • Engine load n.a. % • Mass air flow > 403.00 – 447.00 mg/rev • Dynamic engine speed not active 	<ul style="list-style-type: none"> • 900.0° CRK • Continuous 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> – Check the Knock Sensor 1 - G61- . Refer to ⇒ "3.6.24 Knock Sensor 1 G61, Checking", page 421 .



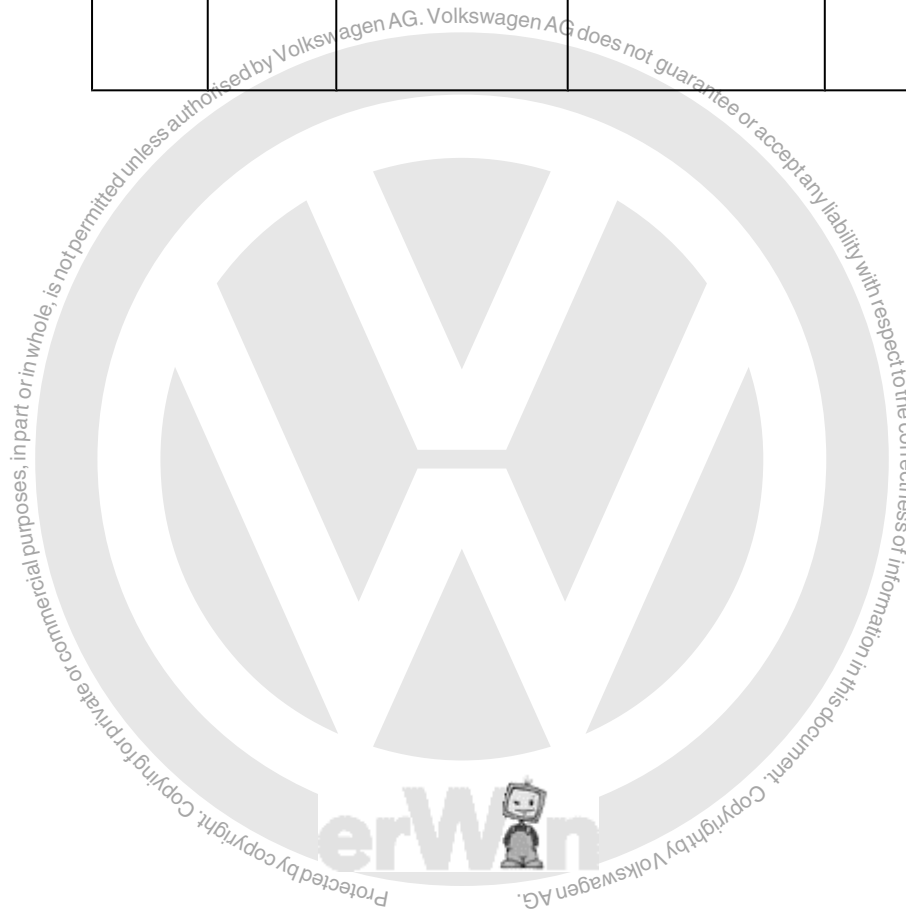
DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 – 2.50 [-] For time \geq 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 – 4.50 [-] For time \geq 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold \leq 0.41 – 0.59 [-] Or Case 2: Ratio between normalized engine roughness and misfire detection threshold \leq n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold \leq n.a. [-] Or Ratio between normalized engine roughness and misfire detection threshold \leq n.a. [-] 				



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0410 AIR System "A"	Secondary Air System Functional Check	<ul style="list-style-type: none"> Diff. pressure value after secondary air injection vs. pressure value before secondary air activation > 5.0 kPa 	<ul style="list-style-type: none"> General: Secondary air pump ready Catalyst heating active Secondary air injection finished MAF <= 140.0 kg/h ECT @ cylinder head >= -10; < 115° C IAT @ manifold >= -10; < 100° C Modeled catalyst temperature < 900° C Relative barometric pressure > 0.73 [-] And Diff. BARO vs. MAP n.a. kPa On Engine n.a. 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ "3.6.30 Secondary Air Injection Sensor 1 G609 / Secondary Air Injection Solenoid Valve N112 , Checking", page 436 . Check the Secondary Air Injection Pump Motor - V101- / Secondary Air Injection Pump Relay - J299- . Refer to ⇒ "3.6.29 Secondary Air Injection Pump Motor V101 / Secondary Air Injection Pump Relay J299 , Checking", page 433 .
P0413 AIR System Switching Valve "A" Circuit Open	Secondary Air Valve Open Circuit	<ul style="list-style-type: none"> Output voltage, lower range >= 1.92 – 2.21 V Output voltage, upper range (hardware values) <= 2.85 – 3.25 V 	<ul style="list-style-type: none"> Engine running Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ "3.6.30 Secondary Air Injection Sensor 1 G609 / Secondary Air Injection Solenoid Valve N112 , Checking", page 436 .
P0414 AIR System Switching Valve "A" Circuit Shorted	Secondary Air Valve Short To Ground	<ul style="list-style-type: none"> Output voltage (hardware values) < 1.92 – 2.21 V 	<ul style="list-style-type: none"> Engine running Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ "3.6.30 Secondary Air Injection Sensor 1 G609 / Secondary Air Injection Solenoid Valve N112 , Checking", page 436 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Secondary Air Valve Short To Battery Plus	<ul style="list-style-type: none"> • Actuator temperature > 160 – 200° C • Or • Output current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> • Engine running • Actuator commanded on 			
P0418 AIR System Control "A" Circuit	Secondary Air Injection Pump Relay Open Circuit	<ul style="list-style-type: none"> • Output voltage, lower range 1.92 – 2.21 V • Output voltage, upper range (hardware values) <= 2.85 – 3.25 V 	<ul style="list-style-type: none"> • Engine running • Actuator commanded off 	<ul style="list-style-type: none"> • 2.0 s • Continuous 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> – Check the Secondary Air Injection Pump Motor - V101- / Secondary Air Injection Pump Relay - J299- . Refer to "3.6.29 Secondary Air Injection Pump Motor V101 / Secondary Air Injection Pump Relay J299, Checking", page 433 .





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0420 Catalyst System Efficiency Below Threshold Bank 1	NMOG / NMHC Conversion Capability	<ul style="list-style-type: none"> Catalyst efficiency > 1.00 [-] 	<ul style="list-style-type: none"> Catalyst monitor lambda modulation request active General conditions: Vehicle speed >= 19 mph BARO >= 0.00 kPa Catalyst over-heating protection not active Turbine over-heating protection not active O2S rear ready O2S front ready ECT @ cylinder head > 60° C IAT @ manifold > -48° C modeled catalyst temperature @ start of diagnosis > 510° C Modeled catalyst temperature @ during diagnosis 470 – 830° C Difference between dynamic and stationary catalyst temperature -150 – 150° C Integrated MAF, catalyst temp. conditions fulfilled >= 0.0 g Modeled EGT @ O2S rear <= 900° C MAF per cylinder 22.50 – 150.00 kg/h Air mass, lower range >= 0.00 mg/rev Air mass, upper range <= 650.00 – 1,389.00 mg/rev 	<ul style="list-style-type: none"> 60.0 – 70.0 s Once / DCY 	<ul style="list-style-type: none"> 1 DCY 	<ul style="list-style-type: none"> Check the Three Way Catalytic Converter. Refer to appropriate repair manual. Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • And • Engine load n.a. [%] • Air mass setpoint n.a. [g/rev] • Accelerator pedal value n.a. [%] • For time n.a. [s] • And • Low dynamic conditions • Dynamic engine speed < 50 rpm • Dynamic air mass < 50.00 mg/rev • Dynamic lambda controller output < 20.00 % • And • Integrated air mass after dynamic conditions are fulfilled > 20.0 g • Time after a catalyst purge phase >= 1.0 s • O2S rear voltage @ diagnosis start >= 0.55 V • Integrated air mass >= 0.0 g • Integrated heat energy >= kJ • Engine speed 1,088 – 3,008 rpm • Deviation of lambda controller output < 50.00 % • Proportional part of secondary fuel control loop not calibrated % • Coasting function not active • O2S heater rear active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • Lambda adaptation not active • Valve lift not active • And • Depending on Lambda control: • Sum of integral and proportional part of secondary fuel control loop before diagnosis < 0.10 [-] • Or • Sum of integral and proportional part of secondary fuel control loop during diagnosis < 0.25 [-] • Depending on canister purge: • Canister load n.a. [-] • Evap purge flow n.a. • Or • Canister load calculation n.a. • Evap purge flow n.a. • Or • Evap purge valve n.a. • Or • Evap purge valve n.a. • Or • Evap purge n.a. • Or • Depending on canister purge closing: • Canister purge (conditions) n.a. • Canister purge valve (closing time) n.a. [s] • And 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Choice of: Evap purge valve n.a. Or Evap purge valve n.a. And Modeled air mass integral > 50.0 g Integrated air mass per cylinder >= 1.45 – 1.70 kg Internal resistance O2S rear <= 700.00 Ohm 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0441 EVAP System Incorrect Purge Flow	EVAP Purge Valve Functional Check: Stuck Close	<ul style="list-style-type: none"> Ratio actual intake manifold pressure and modeled set point intake manifold pressure < 0.10 [-] 	<ul style="list-style-type: none"> ECT @ cylinder head > 60° C Barometric pressure > 73.0 kPa AAT > 5° C AAT @ start >= 5° C Diff. barometric pressure vs. filtered intake manifold pressure n.a. Diff. barometric pressure vs. filtered intake manifold pressure > 28.00 kPa Ratio MAF @ intake manifold and MAF max. > 0.07 – 0.10 [-] Engine speed 1,180 – 2,800 RPM Vehicle speed >= 11 mph Diff. engine speed vs. filtered engine speed < 90 RPM Diff. ratio MAF @ intake manifold and MAF max vs. ratio filtered MAF @ intake manifold and MAF max < 0.15 [-] Diff. modeled intake manifold pressure vs. filtered modeled intake manifold pressure < 1.50 – 2.50 kPa And Integrated MAF since engine start >= 0.0 – 5,000.0 g Lambda control active Lambda control value -30.00 — 30.00 % 	<ul style="list-style-type: none"> 8.5 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to ⇒ "3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> O2S front 0.90 – 1.10 [-] or Fuel cut off not calibrated Case 1: Integrated MAF @ canister purge per driving cycle \geq n.a. g Case 2: Ratio MAF @ canister purge and MAF per cylinder \geq 0.00 [-] Or Canister purge sampling rate \geq 20.00 % And Integrated air mass @ canister purge valve \geq 31.9 g Depending on AAT: AAT \geq 30° C Canister load \leq 0.20 [-] Or AAT \geq 50; < 30° C Canister load \leq 0.20 [-] Or AAT < 50° C Canister load \leq 0.20 [-] 			
P0444 EVAP System Purge Control Valve "A" Circuit Open	EVAP Purge Valve Open Circuit	<ul style="list-style-type: none"> Output voltage, lower range \geq 1.92 – 2.21 V Output voltage, upper range (hardware values) \leq 2.85 – 3.25 V 	<ul style="list-style-type: none"> Engine start not active Engine running Evap purge valve opening signal (PWM) > 3.13; \leq 98.83 % Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to "3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392 .




DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0445 EVAP System Purge Control Valve "A" Circuit Shorted	EVAP Purge Valve Short To Ground	<ul style="list-style-type: none"> Output voltage (hardware values) 1.92 – 2.21 V 	<ul style="list-style-type: none"> Engine start not active Engine running Evap purge valve opening signal (PWM) $\leq 98.83\%$ Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to ⇒ "3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392 .
	EVAP Purge Valve Short To Battery Plus	<ul style="list-style-type: none"> Actuator temperature 160 – 200° C Or Output current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Engine start not active Engine running Evap purge valve opening signal (PWM) $\geq 3.13\%$ Actuator commanded on 			
P0450 EVAP System Pressure Sensor/Switch Circuit	NVLD Switch Open Circuit	<ul style="list-style-type: none"> Signal voltage 0.39 – 0.55 V 	<ul style="list-style-type: none"> Case 1: Engine running Case 2: Ignition off NVLD (EVAP-System) diagnostic mode active 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400- . Refer to ⇒ "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406 .
P0451 EVAP System Pressure Sensor/Switch Circuit Range/Performance	NVLD Switch Functional Check Stuck Close	<ul style="list-style-type: none"> Natural vacuum leak detection (NVLD) switch position closed 	<ul style="list-style-type: none"> Ignition off Fuel level $< 85.10\%$ Fuel temperature increase $\geq 5\text{ K}$ For time $\geq 1.0\text{ h}$ AAT $\geq 4^\circ\text{ C}$ Barometric pressure $\geq 73.0\text{ kPa}$ Time since ignition off $> 20; < 1,440\text{ min}$ 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400- . Refer to ⇒ "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0452 EVAP System Pressure Sensor/Switch Circuit Low	NVLD Switch Short To Ground	<ul style="list-style-type: none"> Signal voltage < 0.24 V 	<ul style="list-style-type: none"> Case 1: Engine running Case 2: Ignition off NVLD (EVAP-System) diagnostic mode active 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400- . Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406 .
P0453 EVAP System Pressure Sensor/Switch Circuit High	NVLD Switch Short To Battery Plus	<ul style="list-style-type: none"> Signal voltage > 3.0 V 	<ul style="list-style-type: none"> Case 1: Engine running Case 2: Ignition off NVLD (EVAP-System) diagnostic mode active 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400- . Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406 .
P0456 EVAP System Leak Detected (Very Small Leak)	EVAP System Small Leak Functional Check	<ul style="list-style-type: none"> Natural vacuum leak detection (NVLD) switch position = open 	<ul style="list-style-type: none"> Ignition off Fuel level < 85.10 % Fuel temperature drop ≥ 6 K For time > 1 h AAT $\geq 4^{\circ}$ C Barometric pressure > 73.00 kPa Diff. barometric pressure @ stop and barometric pressure @ start < 0.65 kPa Time since ignition off > 90 [min] ; < 600 min 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the EVAP System visually for any leaking hoses or damage to components. Check the EVAP Canister Purge Regulator Valve 1 - N80- . Refer to "3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392 . Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400- . Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0461 Fuel Level Sensor "A" Circuit Range/Performance	Fuel Level Plausibility Check	<ul style="list-style-type: none"> Diff. fuel consumption And Fuel level changes < -25.0; > 12.0 [-] 	<ul style="list-style-type: none"> General: Refueling or defueling not detected And Case 1: For tank full fuel level $\geq 96.09\%$ Fuel consumption since last refueling or last plausibility check > 44.0 [-] Case 2: For tank not full fuel level < 96.09 % Fuel consumption since last refueling or last plausibility check > 15.00 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Level Sensor - G- . Refer to appropriate repair manual.
P0462 Fuel Level Sensor "A" Circuit Low	CAN: Fuel Level Sensor 1 CAN Communication With Instrument Cluster Module	<ul style="list-style-type: none"> Instrument cluster module signal: short to ground failure Instrument cluster module signal: signal range check failure 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Level Sensor - G- . Refer to appropriate repair manual.
P0463 Fuel Level Sensor "A" Circuit High	CAN: Fuel Level Sensor 1 CAN Communication With Instrument Cluster Module	<ul style="list-style-type: none"> Instrument cluster module signal: short to battery / open circuit failure 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Level Sensor - G- . Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0491 AIR System Insufficient Flow Bank 1	Secondary Air System Functional Check	<ul style="list-style-type: none"> Case 1: Blockage: ratio relative measured secondary air pressure and modelled secondary air pressure [tube blocked] < 0.70 [-] Or Leakage: ratio relative measured secondary air pressure and modelled secondary air pressure [leak diagnosis] < 0.65 [-] Case 2: Diff. expected integrated secondary air pressure pulsations and actual integrated secondary air pressure pulsations n.a. kPa Case 3: Blockage: ratio relative measured secondary air pressure and modelled secondary air pressure [tube blocked] < 0.40 [-] Or Leakage: ratio relative measured secondary air pressure and modelled secondary air pressure [leak diagnosis] < 0.15 [-] 	<ul style="list-style-type: none"> General: Secondary air pump active Catalyst heating active Secondary air injection active MAF <= 140.0 kg/h ECT @ cylinder head >= -10; < 115° C IAT @ manifold >= -10; < 100° C Modelled catalyst temperature < 900° C Relative barometric pressure > 0.73 [-] And Diff. BARO vs. MAP n.a. kPa Or Engine n.a. 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112- . Refer to "3.6.30 Secondary Air Injection Sensor 1 G609 / Secondary Air Injection Solenoid Valve N112, Checking", page 436 . Check the Secondary Air Injection Pump Motor - V101- / Secondary Air Injection Pump Relay - J299- . Refer to "3.6.29 Secondary Air Injection Pump Motor V101 / Secondary Air Injection Pump Relay J299, Checking", page 433 .
P0501 Vehicle Speed Sensor "A" Circuit	CAN: Vehicle Speed Sensor CAN	<ul style="list-style-type: none"> Speed sensor fault value: Out of range high failure 		<ul style="list-style-type: none"> 0.5 s 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Vehicle Speed Signal. Refer to "3.6.33 Vehicle Speed Signal", page 433 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
Circuit Range/Performance	Communication With Vehicle Speed Sensor	• Speed sensor fault value: Out of range low failure		• Continuous		Signal, Checking", page 444
		• Speed sensor fault value: Rationality check high failure				
		• Speed sensor fault value: Rationality check low failure				
P0502 Vehicle Speed Sensor "A" Circuit Low	Vehicle Speed Sensor (VSS) short to ground	• Diagnostic signal from output driver failure		• 0.5 s • Continuous	• 2 DCY	– Check the Vehicle Speed Signal. Refer to ⇒ "3.6.33 Vehicle Speed Signal, Checking", page 444
	Vehicle Speed Sensor (VSS) open circuit					
	Vehicle Speed Sensor (VSS) short to battery plus					



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0506 Idle Control System RPM - Lower Than Expected	Idle Speed Control (ISC) function monitoring: engine speed deviation	<ul style="list-style-type: none"> Diff. actual engine speed vs. engine speed setpoint < -100 RPM Integrated I-part of idle speed controller n.a. 	<ul style="list-style-type: none"> General conditions: Vehicle speed = 0 mph Accelerator pedal released by driver Throttle actuator commanded on Evap purge flow < 4.00 kg/h Engine running Time after engine start > 0.0 s Clutch switch n.a. Barometric pressure > 70.00 kPa Catalyst heating not active ECT @ cylinder head > -48° C And Setpoint change n.a. rpm For time n.a. s And Additional after dynamic conditions fulfilled: Gear switch not active (A/T only) Accelerator pedal released by driver Vehicle speed 0 mph Engine load < 31.25 % (M/T only) For time >= 0.0 s 	<ul style="list-style-type: none"> 12.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0507 Idle Control System RPM - Higher Than Expected	Idle Speed Control (ISC) function monitoring: engine speed deviation	<ul style="list-style-type: none"> Diff. actual engine speed vs. engine speed setpoint > 90 RPM Integrated I-part of idle speed controller n.a. 	<ul style="list-style-type: none"> General conditions: Vehicle speed = 0 mph Accelerator pedal released by driver Throttle actuator commanded on Evap purge flow < 4.00 kg/h Engine running Time after engine start > 0.0 s Clutch switch n.a. Barometric pressure > 70.00 kPa Catalyst heating not active ECT @ cylinder head > -48° C And Setpoint change n.a. rpm For time n.a. s And Additional after dynamic conditions fulfilled: Gear switch not active (A/T only) Accelerator pedal released by driver Vehicle speed 0 mph (M/T only) For time >= 0.0 s 	<ul style="list-style-type: none"> 12 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P050A Cold Start Idle Control System Performance	Cold Idle Controller Function Monitoring: engine speed deviation	<ul style="list-style-type: none"> Positive engine speed vs. engine speed set point > 90 RPM Integrated I-part of idle speed controller n.a. 	<ul style="list-style-type: none"> General conditions: Vehicle speed = 0 mph Accelerator pedal released by driver Throttle actuator commanded on Evap purge flow < 4.00 kg/h Engine running Time after engine start > 0.0 s Clutch switch n.a. Barometric pressure > 70.00 kPa Catalyst heating active ECT @ cylinder head > -10° C And Setpoint change n.a. rpm For time n.a. s And Additional after dynamic conditions fulfilled: Gear switch not active (A/T only) Accelerator pedal released by driver Vehicle speed 0 mph For time >= 0.0 s 	<ul style="list-style-type: none"> 12 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Cold Idle Controller Function Monitoring: engine speed deviation	<ul style="list-style-type: none"> Negative engine speed deviation from set point < -100 RPM Integrated I-part of idle speed controller n.a. 	<ul style="list-style-type: none"> General conditions: Vehicle speed = 0 mph Accelerator pedal released by driver Throttle actuator commanded on Evap purge flow < 4.00 kg/h Engine running Time after engine start > 0.0 s Clutch switch n.a. Barometric pressure > 70.00 kPa Catalyst heating active ECT @ cylinder head > -10° C And Setpoint change n.a rpm For time n.a. s And Additional after dynamic conditions fulfilled: Gear switch not active (A/T only) Accelerator pedal released by driver Vehicle speed 0 mph Engine load < 31.25 % (M/T only) For time >= 0.0 s 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P050B Cold Start Ignition Timing Performance	Ignition Control Ignition Timing Monitor	<ul style="list-style-type: none"> Ratio between ignition angle efficiency integral and time at idle speed > 0.20 [-] 	<ul style="list-style-type: none"> Engine idle speed time @ idle speed > 5.0 s Ignition angle set-point ≤ 0.85 [-] Modeled pressure quotient ≤ 1.0 [-] Vehicle speed = 0 mph And Diff. air mass set point vs. filtered air mass set point for load dynamic detection < 99,999.00 mg/rev For time ≥ 0.0 s And Diff. engine speed vs. filtered engine speed for engine speed dynamic detection < 8,160 RPM For time ≥ 0.0 s 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check for any Engine Speed sensor or Ignition Coil faults and diagnose them first. Check the Engine Speed Sensor - G28- . Refer to "3.6.11 Engine Speed Sensor G28, Checking", page 384 . Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 . If NO other codes are set, check the ECM. Refer to appropriate repair manual. Check the Engine Control Module - J623- Refer to appropriate repair manual.
P052A Cold Start "A" Camshaft Position Timing Over-Advanced Bank 1	Cold Start Monitoring Variable Valve Timing (VVT) Intake Actuator rationality check	<ul style="list-style-type: none"> Camshaft position deviation > 9.00° CRK 	<ul style="list-style-type: none"> Modeled oil temperature -40 – 160° C Engine speed 608 – 6,016 rpm Camshaft position n.a. Camshaft position adjustment active Catalyst heating active Camshaft position deviation integrator (actual vs. setpoint position) ≥ 8.00° CRK's 	<ul style="list-style-type: none"> 0 (FTP75: 45) [s] once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to "3.6.3 Camshaft Adjustment Valve 1 N205, Checking", page 362 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P053F Cold Start Fuel Pressure Performance Bank 2	<ul style="list-style-type: none"> Fuel System Out Of Range High Fuel System Out Of Range Low 	<ul style="list-style-type: none"> Deviation between reference and actual fuel pressure < -2,999.90 kPa For time >= 3.0 s Deviation between reference and actual fuel pressure > 2,999.80 kPa For time >= 3.0 s 	<ul style="list-style-type: none"> General: Engine speed > 512 rpm Time after engine start > 10.0 s And Fuel mass set-point lower range > 5.00 mg/rev for time >= 10.0 s Fuel mass set-point upper range <= 187.17 – 229.23 mg/rev Fuel mass set-point gradient - mg/rev For time >= 5.0 s And Additional for catalyst heating: Catalyst heating active ECT @ cylinder head > -48° C Fuel mass set-point lower range >= 5.00 mg/rev For time >= 5.1 s 	<ul style="list-style-type: none"> 4.5 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the fuel pressure. Refer to appropriate repair manual. Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538- . Refer to ⇒ "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 . Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.16 Fuel Pressure Regulator Valve N276, Checking", page 398 . Check the Fuel Pressure Sensor - G247- . Refer to ⇒ "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 .
P054A Cold Start "B" Camshaft Position Timing Over-Advanced Bank 1	Cold Start Monitoring Variable Valve Timing (VVT) Exhaust Actuator rationality check	<ul style="list-style-type: none"> Camshaft position deviation > 9.00° CRK 	<ul style="list-style-type: none"> Modeled oil temperature -40...160° C Engine speed 608 – 6,016 rpm Camshaft position n.a. Camshaft position adjustment active Catalyst heating active Camshaft position deviation integrator (actual vs. setpoint position) >= 8.00° CRK's 	<ul style="list-style-type: none"> 0 (FTP75: 45) s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to ⇒ "3.6.14 Exhaust Camshaft Adjustment Valve 1 N318, Checking", page 394



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P064A Fuel Pump Control Module	COM: Fuel Pump Control Module (FPCM) communication with FPCM	<ul style="list-style-type: none"> FP signal: ROM / RAM failure feedback ≥ 2.00 [-] FP signal: power amplifier failure feedback ≥ 2.00 [-] 	<ul style="list-style-type: none"> Engine on 	<ul style="list-style-type: none"> 1.2 s Continuous 1.4 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538- . Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 .
P0601 Internal Control Module Memory Checksum Error	ECM: Checksum Verification	<ul style="list-style-type: none"> Calibration checksum incorrect Software checksum incorrect 		<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Control Module - J623- . Refer to appropriate repair manual.
P0603 Internal Control Module Keep Alive Memory (KAM) Error	Injection Valves Supply Voltage Internal Hardware Check	<ul style="list-style-type: none"> Hardware vs. software version check during initialization failure Calibration during initialization failure Hardware during initialization failure Time reference from micro controller during initialization failure Time reference from micro controller during initialization missing Communication between micro controller and SDI-Driver power stage failure Communication between micro controller and SDI-Driver power stage failure 		<ul style="list-style-type: none"> 4.9 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Control Module - J623- . Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	ECM: Communication Check	<ul style="list-style-type: none"> Device 1: SPI communication with AT-IC failure 		<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 1 DCY 	
P0606 Control Module Processor	Barometric Pressure Sensor engine standing: rationality check	<ul style="list-style-type: none"> Diff. barometric pressure vs. upstream throttle pressure ≥ 8.50 kPa Or Diff. barometric pressure vs. intake manifold pressure ≥ 8.50 kPa 	<ul style="list-style-type: none"> Case 1: engine stop at start of DCY Engine stopped Vehicle speed < 1 mph Delay after engine stop > 5.0 s Case 2: engine stop during DCY Engine stopped Vehicle speed < 1 mph Delay after engine stop ≥ 5.0 s For time ≥ 10.0 s 	<ul style="list-style-type: none"> 3.0 s Multiple 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Using scan tool, monitor the Barometric Pressure Sensor, located within the Engine Control Module - J623- . Check the Engine Control Module - J623- . Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Barometric Pressure Sensor Rationality Check During ECM Keep Alive-Time:	<ul style="list-style-type: none"> Case 1: Diff. barometric pressure vs. intake manifold pressure ≥ 8.50 kPa And Diff. barometric pressure vs. upstream throttle pressure ≥ 8.50 kPa Case 2: Diff. intake manifold pressure vs. intake manifold pressure @ idle or low part load n.a. kPa Diff. barometric pressure vs. intake manifold pressure n.a. kPa Diff. barometric pressure vs. upstream throttle pressure n.a. kPa Case 3: Diff. upstream throttle pressure @ full or high part load vs. upstream throttle pressure n.a. kPa Diff. barometric pressure vs. intake manifold pressure n.a. kPa Diff. barometric pressure vs. upstream throttle pressure n.a. kPa Diff. upstream throttle pressure vs. intake manifold pressure n.a. kPa 	<ul style="list-style-type: none"> Engine stopped Vehicle speed < 1 mph Ignition off Delay time in ECM keep alive-time > 10.0 s Delay after engine stop ≥ 5.0 s Barometric pressure sensor voltage $0.20 - 4.80$ V Intake manifold pressure sensor voltage $0.20 - 4.80$ V Turbocharger boost pressure sensor voltage $0.20 - 4.80$ V 	<ul style="list-style-type: none"> 3.0 s Once / DCY 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Barometric Pressure Sensor Out Of Range High	<ul style="list-style-type: none"> Measured barometric pressure > 115.0 kPa 		<ul style="list-style-type: none"> 5.0 s Continuous 		
	Barometric Pressure Sensor Out Of Range Low	<ul style="list-style-type: none"> Measured barometric pressure < 45.0 kPa 				
	Knock Control Functional Check	<ul style="list-style-type: none"> Knock control failure 	<ul style="list-style-type: none"> Engine running 	<ul style="list-style-type: none"> 6.4 s Continuous 		
	ECM: EEPROM Check	<ul style="list-style-type: none"> EEPROM information failure Decryption of NVMCrypt failed Finished NVMCrypt integrity error Communication between sample software and production hardware error RAM error detected Monitoring module check failed 		<ul style="list-style-type: none"> 1.0 s Once / DCY 		
	ECM: Communication Check	<ul style="list-style-type: none"> SPI communication with AT-IC failure 	<ul style="list-style-type: none"> Time after ignition on >= 1.0 s 	<ul style="list-style-type: none"> 10.0 s Continuous 		
	ECM: A/D Converter Function Monitoring: A/D Converter	<ul style="list-style-type: none"> Diff. A/D-channel 1 vs. A/D-channel 2 > 0.30 V 		<ul style="list-style-type: none"> 0.5 s Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	ECM: Electronic Throttle Control Module Function Monitoring: Torque	<ul style="list-style-type: none"> Monitoring of difference between actual and set point torque value engine torque overflow > 45.00 – 350.00 Nm Monitoring of torque difference integration integrated engine torque > 655.35 Nms 	<ul style="list-style-type: none"> Throttle actuator commanded on 	<ul style="list-style-type: none"> 0.5 s Continuous 0.01 s Continuous 		
	ECM: Electronic Throttle Control Module Function Monitoring: Engine Speed Limitation	<ul style="list-style-type: none"> Engine speed > 1,760 RPM 	<ul style="list-style-type: none"> Engine speed limitation active Injection active 	<ul style="list-style-type: none"> 0.5 s Continuous 		
	ECM: Electronic Throttle Control Module Function Monitoring: A/D Converter	<ul style="list-style-type: none"> Internal check failed 		<ul style="list-style-type: none"> 0.5 s Continuous 		
	CAN: Controller controller RAM check *	<ul style="list-style-type: none"> RAM error memory checksum error 	<ul style="list-style-type: none"> Initialization phase active Ignition on 	<ul style="list-style-type: none"> 0.2 s Once / DCY 		
P0607 Control Module Performance	Barometric Pressure Sensor Short To Ground	<ul style="list-style-type: none"> Barometric pressure sensor voltage < 0.20 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Using scan tool, monitor the Barometric Pressure Sensor, located within the Engine Control Module - J623-
	Barometric Pressure Sensor Short To Battery Plus	<ul style="list-style-type: none"> Barometric pressure sensor voltage > 4.80 V 				<ul style="list-style-type: none"> Check the Engine Control Module - J623- . Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0638 Throttle Actuator Control Range/ Performance Bank 1	Throttle Actuator Basic Settings Adaptation Value Monitoring	<ul style="list-style-type: none">Battery voltage <= 9.04 V <div><ul style="list-style-type: none">Accelerator pedal value > 99.90 %OrEngine speed > 64 RPMOrVehicle speed > 1 mphOrIAT @ throttle < 5° COrECT @ cylinder head < 5° COrECT @ cylinder head > 110° C</div>	<ul style="list-style-type: none">Throttle adaptation (@ initial start or after detection of throttle exchange or checksum error) active	<ul style="list-style-type: none">0.01 sOnce Per Life-time <div><ul style="list-style-type: none">0.01 sOnce Per Life-time</div>	2 DCY	<ul style="list-style-type: none">Check the Throttle Valve Control Module - GX3- . Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .
	Throttle Actuator Basic Settings Monitoring Of Position	<div><ul style="list-style-type: none">Actual TPS 1 or 2 voltage - voltage ref. point > 0.07 VActual TPS - ref. point > 0.503° TPSActual TPS - ref. point > 0.503° TPS</div>	<ul style="list-style-type: none">Throttle adaptation demandedAccelerator pedal value < 99.90 %Engine speed < 64 RPMVehicle speed < 1 mphModeled IAT @ throttle > 5° CECT @ cylinder head 5 – 110° C	<div><ul style="list-style-type: none">0.01 sOnce / DCY</div> <div><ul style="list-style-type: none">0.01 sOnce / DCY</div> <div><ul style="list-style-type: none">0.01 sOnce Per Life-time</div>		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Throttle position sensor 1 voltage < 0.40 V Or Throttle position sensor 2 voltage > 4.60 V Or Throttle position sensor 1 voltage > 0.80 V Or Throttle position sensor 2 voltage < 4.20 V 				
		<ul style="list-style-type: none"> Actual TPS 1 or 2 voltage - voltage ref. point > 0.07 V 				
		<ul style="list-style-type: none"> Actual TPS 1 or 2 voltage - voltage ref. point > 0.25 V 				
		<ul style="list-style-type: none"> Actual TPS - ref. point > 0.503° TPS 				
		<ul style="list-style-type: none"> Actual TPS 1 or 2 voltage - voltage ref. point > 0.07 V 				
P0642 Sensor Reference Voltage "A" Circuit Low	ECM: 5V Supply Voltage Out Of Range Low	<ul style="list-style-type: none"> Analog output 1 supply voltage < 4.62 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0643 Sensor Reference Voltage "A" Circuit High	ECM: 5V Supply Voltage Out Of Range High	<ul style="list-style-type: none"> Analog output 1 supply voltage > 5.43 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0652 Sensor Reference Voltage "B" Circuit Low	ECM: 5V Supply Voltage Out Of Range Low	<ul style="list-style-type: none"> Analog output 2 supply voltage < 4.62 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0653 Sensor Reference Voltage "B" Circuit High	ECM: 5V Supply Voltage Out Of Range High	<ul style="list-style-type: none"> Analog output 2 supply voltage > 5.43 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0657 Actuator Supply Voltage "A" Circuit/ Open	Supply Voltage Relay Engine Components Open Circuit	<ul style="list-style-type: none"> Output voltage, lower range \geq 1.90 – 2.30 V Output voltage, upper range (hardware values) \leq 2.80 – 3.20 V 	<ul style="list-style-type: none"> Relay commanded off 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Component Power Supply Relay - J757- . Refer to ⇒ "3.6.8 Engine Component Power Supply Relay J757- . Checking", page 378 .
P0658 Actuator Supply Voltage "A" Circuit Low	Supply Voltage Relay Engine Components Short To Ground	<ul style="list-style-type: none"> Output voltage (hardware values) < 1.90 – 2.30 V 	<ul style="list-style-type: none"> Relay commanded off 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0659 Actuator Supply Voltage "A" Circuit High	Supply Voltage Relay Engine Components Short To Battery Voltage	<ul style="list-style-type: none"> Output current driver stage internal value Or Actuator temperature (hardware values) > 175 – 195° C 	<ul style="list-style-type: none"> Relay commanded on 			
P0686 ECM/ PCM Power Relay Control Circuit Low	Main Relay Rationality Check During Engine Off	<ul style="list-style-type: none"> Sensed circuit voltage > 6.00 V 	<ul style="list-style-type: none"> Main relay commanded off For time >= 0.3 s 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Motronic Engine Control Module Power Supply Relay - J271- . Refer to ⇒ "3.6.25 Motronic Engine Control Module Power Supply Relay J271, Checking", page 423 .
P0687 ECM/ PCM Power Relay Control Circuit High	Main Relay Rationality Check During Engine Running	<ul style="list-style-type: none"> Sensed circuit voltage < 5.00 V 	<ul style="list-style-type: none"> Main relay commanded on For time >= 0.1 s 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Motronic Engine Control Module Power Supply Relay - J271- . Refer to ⇒ "3.6.25 Motronic Engine Control Module Power Supply Relay J271, Checking", page 423 .
	Main Relay Short To Battery Plus	<ul style="list-style-type: none"> Main relay driver temperature > 175 – 195° C Or Main relay output current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Main relay commanded on For time >= 0.4 s 	<ul style="list-style-type: none"> 0.2 s Continuous 		
P0698 Sensor Reference Voltage "C" Circuit Low	ECM: 5V Supply Voltage Out Of Range Low	<ul style="list-style-type: none"> Analog output 3 supply voltage < 4.62 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0699 Sensor Reference Voltage "C" Circuit High	ECM: 5V Supply Voltage Out Of Range High	<ul style="list-style-type: none"> Analog output 3 supply voltage > 5.43 V 		<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P11A1 Cam Shift Actuator "A" Cylinder 1 Circuit/ Open	Variable Valve Lift (VVL) short to ground Variable Valve Lift (VVL) open circuit	<ul style="list-style-type: none"> Output voltage < 1.92 – 2.21 V (hardware values) Output voltage, lower range < 1.92 – 2.21 V Output voltage, upper range > 2.85 – 3.25 V 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 1 Exhaust Camshaft Adjuster A - N580- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators, Checking", page 359
P11A2 Cam Shift Actuator "A" Cylinder 1 Range/ Performance	Variable Valve Lift (VVL) rationality check low	<ul style="list-style-type: none"> Actuator feedback signal voltage permanently low [-] 	<ul style="list-style-type: none"> Modeled oil temperature < 20° C 	<ul style="list-style-type: none"> 6.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 1 Exhaust Camshaft Adjuster A - N580- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators, Checking", page 359
P11A3 Cam Shift Actuator "B" Cylinder 1 Circuit/ Open	Variable Valve Lift (VVL) short to ground Variable Valve Lift (VVL) open circuit	<ul style="list-style-type: none"> Output voltage < 1.92 – 2.21 V (hardware values) Output voltage, lower range < 1.92 – 2.21 V Output voltage, upper range > 2.85 – 3.25 V 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 1 Exhaust Camshaft B - N581- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators, Checking", page 359
P11A4 Cam Shift Actuator "B" Cylinder 1 Range/ Performance	Variable Valve Lift (VVL) rationality check low	<ul style="list-style-type: none"> Actuator feedback signal voltage permanently low [-] 	<ul style="list-style-type: none"> Modeled oil temperature < 20° C 	<ul style="list-style-type: none"> 6.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 1 Exhaust Camshaft B - N581- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators, Checking", page 359
P11A5 Cam Shift Actuator "A" Cylinder 1	Variable Valve Lift (VVL) short to ground	<ul style="list-style-type: none"> Output voltage < 1.92 – 2.21 V (hardware values) 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 2 Exhaust Camshaft Adjuster A - N588- . Refer to



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
Under 2 Circuit/ Open	Variable Valve Lift (VVL) open circuit	<ul style="list-style-type: none"> Output voltage, lower range < 1.92 – 2.21 V Output voltage, upper range > 2.85 – 3.25 V 			<ul style="list-style-type: none"> 2 DCY 	⇒ “3.6.2 Cam Adjustment Actuators , Checking” , page 359
P11A6 Cam Shift Actuator "A" Cylinder 2 Range/ Performance	Variable Valve Lift (VVL) rationality check low	<ul style="list-style-type: none"> Actuator feedback signal voltage permanently low [-] 	<ul style="list-style-type: none"> Modeled oil temperature < 20° C 	<ul style="list-style-type: none"> 6.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 2 Exhaust Camshaft Adjuster A - N588- . Refer to ⇒ “3.6.2 Cam Adjustment Actuators , Checking”, page 359
P11A7 Cam Shift Actuator "B" Cylinder 2 Circuit/ Open	Variable Valve Lift (VVL) short to ground	Output voltage < 1.92 – 2.21 V (hardware values)	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 0.5 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Cylinder 2 Exhaust Camshaft B - N589- . Refer to ⇒ “3.6.2 Cam Adjustment Actuators , Checking”, page 359
	Variable Valve Lift (VVL) open circuit	<ul style="list-style-type: none"> Output voltage, lower range < 1.92 – 2.21 V Output voltage, upper range > 2.85 – 3.25 V 			2 DCY	
P11A8 Cam Shift Actuator "B" Cylinder 2 Range/ Performance	Variable Valve Lift (VVL) rationality check low	<ul style="list-style-type: none"> Actuator feedback signal voltage permanently low [-] 	<ul style="list-style-type: none"> Modeled oil temperature < 20° C 	<ul style="list-style-type: none"> 6.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Cylinder 2 Exhaust Camshaft B - N589- . Refer to ⇒ “3.6.2 Cam Adjustment Actuators , Checking”, page 359
P11A9 Cam Shift Actuator "A" Cylinder 3 Circuit/ Open	Variable Valve Lift (VVL) short to ground	Output voltage < 1.92 – 2.21 V (hardware values)	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 0.5 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Cylinder 3 Exhaust Camshaft Adjuster A - N596- . Refer to ⇒ “3.6.2 Cam Adjustment Actuators , Checking”, page 359
	Variable Valve Lift (VVL) open circuit	<ul style="list-style-type: none"> Output voltage, lower range < 1.92 – 2.21 V Output voltage, upper range > 2.85 – 3.25 V 			2 DCY	



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P11AA Cam Shift Actuator "A" Cylinder 3 Range/Performance	Variable Valve Lift (VVL) rationality check low	<ul style="list-style-type: none"> Actuator feedback signal voltage permanently low [-] 	<ul style="list-style-type: none"> Modeled oil temperature < 20° C 	<ul style="list-style-type: none"> 6.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 3 Exhaust Camshaft Adjuster A - N596- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators, Checking", page 359
P11AB Cam Shift Actuator "B" Cylinder 3 Circuit/Open	Variable Valve Lift (VVL) short to ground	<ul style="list-style-type: none"> Output voltage < 1.92 – 2.21 V (hardware values) 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 3 Exhaust Camshaft B - N597- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators, Checking", page 359
	Variable Valve Lift (VVL) open circuit	<ul style="list-style-type: none"> Output voltage, lower range < 1.92 – 2.21 V Output voltage, upper range > 2.85 – 3.25 V 			<ul style="list-style-type: none"> 2 DCY 	
P11AC Cam Shift Actuator "B" Cylinder 3 Range/Performance	Variable Valve Lift (VVL) rationality check low	<ul style="list-style-type: none"> Actuator feedback signal voltage permanently low [-] 	<ul style="list-style-type: none"> Modeled oil temperature < 20° C 	<ul style="list-style-type: none"> 6.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 3 Exhaust Camshaft B - N597- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators, Checking", page 359
P11AD Cam Shift Actuator "A" Cylinder 4 Circuit/Open	Variable Valve Lift (VVL) short to ground	<ul style="list-style-type: none"> Output voltage < 1.92 – 2.21 V (hardware values) 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 4 Exhaust Camshaft Adjuster A - N604- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators, Checking", page 359
	Variable Valve Lift (VVL) open circuit	<ul style="list-style-type: none"> Output voltage, lower range < 1.92 – 2.21 V Output voltage, upper range > 2.85 – 3.25 V 			<ul style="list-style-type: none"> 2 DCY 	
P11AE Cam Shift Actuator "A" Cylinder 4 Range/Performance	Variable Valve Lift (VVL) rationality check low	<ul style="list-style-type: none"> Actuator feedback signal voltage permanently low [-] 	<ul style="list-style-type: none"> Modeled oil temperature < 20° C 	<ul style="list-style-type: none"> 6.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 4 Exhaust Camshaft Adjuster A - N604- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators, Checking", page 359
P11AF Cam Shift Actuator "B" Cylinder 4	Variable Valve Lift (VVL) short to ground	<ul style="list-style-type: none"> Output voltage < 1.92 – 2.21 V (hardware values) 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 4 Exhaust Camshaft B - N605- . Refer to ⇒ "3.6.2 Cam Adjustment Ac-



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
Circuit/ Open	Variable Valve Lift (VVL) open circuit	<ul style="list-style-type: none"> Output voltage, lower range < 1.92 – 2.21 V Output voltage, upper range > 2.85 – 3.25 V 			<ul style="list-style-type: none"> 2 DCY 	tuators , Checking", page 359
P11B0 Cam Shift Actuator "B" Cylinder 4 Range/ Performance	Variable Valve Lift (VVL) rationality check low	<ul style="list-style-type: none"> Actuator feedback signal voltage permanently low [-] 	<ul style="list-style-type: none"> Modeled oil temperature < 20° C 	<ul style="list-style-type: none"> 6.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 4 Exhaust Camshaft B - N605- . Refer to "3.6.2 Cam Adjustment Actuators , Checking", page 359
P11BF Cam Shift Actuator Outlet "A" Cylinder 1 Range/ Performance	Variable Valve Lift (VVL) short to battery plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current driver stage internal value (hardware values) 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 1 Exhaust Camshaft Adjuster A - N580- . Refer to "3.6.2 Cam Adjustment Actuators , Checking", page 359
P11C0 Cam Shift Actuator Outlet "B" Cylinder 1 Circuit/ Open	Variable Valve Lift (VVL) short to battery plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current driver stage internal value (hardware values) 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 1 Exhaust Camshaft B - N581- . Refer to "3.6.2 Cam Adjustment Actuators , Checking", page 359
P11C1 Cam Shift Actuator Outlet "A" Cylinder 2 Range/ Performance	Variable Valve Lift (VVL) short to battery plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current driver stage internal value (hardware values) 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 2 Exhaust Camshaft Adjuster A - N588- . Refer to "3.6.2 Cam Adjustment Actuators , Checking", page 359
P11C2 Cam Shift Actuator Outlet "B" Cylinder 2 Circuit/ Open	Variable Valve Lift (VVL) short to battery plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current driver stage internal value (hardware values) 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 2 Exhaust Camshaft B - N589- . Refer to "3.6.2 Cam Adjustment Actuators , Checking", page 359



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P11C3 Cam Shift Actuator Outlet "A" Cylinder 3 Range/Performance	Variable Valve Lift (VVL) short to battery plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current driver stage internal value (hardware values) 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 3 Exhaust Camshaft Adjuster A - N596- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators , Checking", page 359
P11C4 Cam Shift Actuator Outlet "B" Cylinder 3 Circuit/ Open	Variable Valve Lift (VVL) short to battery plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current driver stage internal value (hardware values) 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 3 Exhaust Camshaft B - N597- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators , Checking", page 359
P11C5 Cam Shift Actuator Outlet "A" Cylinder 4 Range/Performance	Variable Valve Lift (VVL) short to battery plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current driver stage internal value (hardware values) 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 4 Exhaust Camshaft Adjuster A - N604- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators , Checking", page 359
P11C6 Cam Shift Actuator Outlet "B" Cylinder 4 Circuit/ Open	Variable Valve Lift (VVL) short to battery plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current driver stage internal value (hardware values) 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Cylinder 4 Exhaust Camshaft B - N605- . Refer to ⇒ "3.6.2 Cam Adjustment Actuators , Checking", page 359



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P12A1 Fuel Rail Pressure Sensor Inappropriately Low	Fuel System Pressure Sensor, High Pressure Side Rationality Check Low	<ul style="list-style-type: none"> Deviation lambda of controller included adaptation < -22.50% And High pressure controller output > 40 mg 	<ul style="list-style-type: none"> General: Engine speed 512 – 6,816 rpm Fuel mass setpoint 5.00 – 1,389.00 mg/rev Time after change to DFI not equipped s Time after engine start > 10.0 s Engine warm-up not active Catalyst heating not active Full load not active Catalyst purge not active Lambda control closed loop Evap purge functionality diagnosis not active Fuel pressure setpoint <= 34,777.60 kPa And Depending on low dynamic conditions: Fuel mass setpoint lower range > 5.00 mg/rev For time >= 10.0 s Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev Fuel mass setpoint gradient - mg/rev For time >= 5.0 s And Depending on canister purge: Canister load <= 1.00 [-] Or 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 . Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538- . Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 . Check the fuel pressure. Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">Evap purge valve not active or closed			





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P12A2 Fuel Rail Pressure Sensor Inappropriately High	Fuel System Pressure Sensor, High Pressure Side Rationality Check High	<ul style="list-style-type: none"> Deviation lambda of controller included adaptation > 30.00% And High pressure controller output < -35 mg 	<ul style="list-style-type: none"> General: Engine speed 608 – 6,816 rpm Fuel mass setpoint 5.00 – 1,389.00 mg/rev Time after change to DFI not equipped s Time after engine start > 10.0 s Engine warm-up not active Catalyst heating not active Full load not active Catalyst purge not active Lambda control closed loop Evap purge functionality diagnosis not active Fuel pressure setpoint <= 34,777.60 [kPa] And Depending on low dynamic conditions: Fuel mass setpoint lower range > 5.00 mg/rev For time >= 10.0 s Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev Fuel mass setpoint gradient - mg/rev For time >= 5.0 s And Depending on canister purge: Canister load <= 1.00 [-] Or 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 . Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538- . Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 . Check the fuel pressure. Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">Evap purge valve not active or closed			





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P12A4 Fuel Rail Pump Control Valve Stuck Closed	Fuel System Pressure Sensor, High Pressure Side Out Of Range High	<ul style="list-style-type: none"> Deviation between fuel pressure setpoint and current fuel pressure < -2999.90 kPa Deviation lambda of controller included adaption -50.00 – 50.00 % Case 1: High pressure controller output < -45 mg Case 2: Flow control valve open Mass fuel flow setpoint > 15.01 mg/rev 	<ul style="list-style-type: none"> General: Engine speed 608 – 6,816 rpm Fuel mass setpoint 5.00 – 1,389.00 mg/rev Time after engine start > 10.0 s Engine warm-up not calibrated Catalyst heating not calibrated Full load not calibrated Catalyst purge not calibrated Lambda control not calibrated Evap purge functionality diagnosis not calibrated Fuel pressure setpoint gradient <= 34,777.60 kPa And Depending on low dynamic conditions: Fuel mass setpoint lower range > 5.00 mg/rev For time >= 10.0 s Fuel mass setpoint upper range < 187.17 – 229.23 mg/rev Fuel mass setpoint gradient - mg/rev For time >= 5.0 s And Depending on canister purge: Canister load not calibrated [-] Or Evap purge valve not calibrated 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Pressure Sensor - G247- . Refer to "3.6.17 Fuel Pressure Sensor G247, Checking", page 400 . Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538- . Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 . Check the fuel pressure. Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P13EA Cold Start Ignition Timing Performance Off Idle	Ignition Control Ignition Timing Monitor	<ul style="list-style-type: none"> Ratio between ignition angle efficiency integral and time at part load > 0.16 [-] 	<ul style="list-style-type: none"> Engine part load Time @ part load > 5.0 s Ignition angle set-point ≤ 0.90 [-] Vehicle speed > 2 mph And Diff. air mass set-point vs. filtered air mass setpoint for load dynamic detection < 99999.00 mg/rev For time ≥ 0.0 s And Diff. engine speed vs. filtered engine speed for engine speed dynamic detection < 8160 rpm For time ≥ 0.0 s 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Speed Sensor - G28- . Refer to ⇒ "3.6.11 Engine Speed Sensor G28, Checking", page 384 . Check the Ignition Coils with Power Output Stage . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage, Checking", page 409 . Check for any Engine Speed sensor or Ignition Coil faults and diagnose them first. If NO other codes are set, check the ECM. Refer to appropriate repair manual.
P1545 Throttle Actuator "A" Control Motor Circuit Range/Performance	Throttle Actuator Out Of Range	<ul style="list-style-type: none"> Control duty cycle > 98.0 % 	<ul style="list-style-type: none"> Throttle position not at min. value Throttle adaptation not active Throttle actuator commanded on 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3- . Refer to ⇒ "3.6.31 Throttle Valve Control Module GX3, Checking", page 439 .
	Throttle Actuator Rationality Check	<ul style="list-style-type: none"> Difference between throttle position set point and throttle flap opening angle for electronic throttle control > 2.998 – 24.982° TPS 	<ul style="list-style-type: none"> Throttle adaptation (@ initial start or after detection of throttle exchange or checksum error) not active Throttle actuator commanded on Difference between throttle position set point and throttle flap opening angle ≤ 1.999; > -1.999° TPS 	<ul style="list-style-type: none"> 0.5 s Continuous 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P169A Loading Mode Active	ECM: Transport Mode Function Monitoring: Mode Change	<ul style="list-style-type: none"> Transport mode active 	<ul style="list-style-type: none"> Vehicle speed < 3 mph Max trip mileage since initial vehicle start-up < 62.15 miles During ECM keep alive-time after ignition off engine speed 0 RPM Production mode not active For hybrid: Drive motor off 	<ul style="list-style-type: none"> 0.01 s Continuous 	<ul style="list-style-type: none"> 1 DCY 	<ul style="list-style-type: none"> Perform readiness check. Refer to "3.2 Readiness Code", page 19.
P2004 Intake Manifold Runner Control Stuck Open Bank 1	Intake Manifold Runner Control (IMRC) Actuator Stuck Open	<ul style="list-style-type: none"> Signal voltage > 1.89 V For time >= 1.5 s 	<ul style="list-style-type: none"> Flap commanded off Time after engine start > 5.0 s 	<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Control Valve - N316-. Refer to "3.6.21 Intake Manifold Runner Control Valve N316, Checking", page 411.
P2006 Intake Manifold Runner Control Stuck Closed Bank 1	Intake Manifold Runner Control (IMRC) Actuator Stuck Close	<ul style="list-style-type: none"> Signal voltage < 3.10 V For time >= 1.5 s 	<ul style="list-style-type: none"> Flap commanded on Time after engine start > 5.0 s 	<ul style="list-style-type: none"> 0.2 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Control Valve - N316-. Refer to "3.6.21 Intake Manifold Runner Control Valve N316, Checking", page 411.
P2008 Intake Manifold Runner Control Circuit/ Open Bank 1	Intake Manifold Runner Control (IMRC) Actuator Open Circuit	<ul style="list-style-type: none"> Output voltage lower range 1.92 – 2.21 V Output voltage upper range (hardware values) 2.85 – 3.25 V 	<ul style="list-style-type: none"> Engine running Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Control Valve - N316-. Refer to "3.6.21 Intake Manifold Runner Control Valve N316, Checking", page 411.
P2009 Intake Manifold Runner Control Circuit Low Bank 1	Intake Manifold Runner Control (IMRC) Actuator Short To Ground	<ul style="list-style-type: none"> Output voltage (hardware values) < 1.92 – 2.21 V 	<ul style="list-style-type: none"> Engine running Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Control Valve - N316-. Refer to "3.6.21 Intake Manifold Runner Control Valve N316, Checking", page 411.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2010 Intake Manifold Runner Control Circuit High Bank 1	Intake Manifold Runner Control (IMRC) Actuator Short To Battery Plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Engine running Actuator commanded on 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Control Valve - N316- . Refer to ⇒ "3.6.21 Intake Manifold Runner Control Valve N316 , Checking", page 411 .
P2014 Intake Manifold Runner Position Sensor/ Switch Circuit Bank 1	Intake Manifold Runner Control (IMRC) Position Sensor Short To Ground / Open Circuit	<ul style="list-style-type: none"> Intake manifold runner flap position sensor voltage < 0.20 V 	<ul style="list-style-type: none"> Engine start not active 	<ul style="list-style-type: none"> 0.04 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Position Sensor - G336- . Refer to ⇒ "3.6.22 Intake Manifold Runner Position Sensor G336 , Checking", page 413 .
P2015 Intake Manifold Runner Position Sensor/ Switch Circuit Range/ Performance Bank 1	Intake Manifold Runner Control (IMRC) Actuator Adaptation Value Monitoring	<ul style="list-style-type: none"> Diff. actual value vs. substitution value @ lower mechanical thresh hold > 0.70 V Or Diff. actual value vs. substitution value @ upper mechanical thresh hold > 0.70 V Failed adaptations >= 1.00 [-] 	<ul style="list-style-type: none"> Modeled air temperature < 0.75 [-] Engine running Engine speed > 640; < 1,504 RPM ECT @ cylinder head > -30° C Intake manifold runner flap adaptation not finished 	<ul style="list-style-type: none"> 0.04 s Once per life-time 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Position Sensor - G336- . Refer to ⇒ "3.6.22 Intake Manifold Runner Position Sensor G336 , Checking", page 413 .
P2017 Intake Manifold Runner Position Sensor/ Switch Circuit High Bank 1	Intake Manifold Runner Control (IMRC) Position Sensor Short To Battery Voltage	<ul style="list-style-type: none"> Intake manifold runner flap position sensor voltage > 4.80 V 	<ul style="list-style-type: none"> Engine start not active 	<ul style="list-style-type: none"> 0.04 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Intake Manifold Runner Position Sensor - G336- . Refer to ⇒ "3.6.22 Intake Manifold Runner Position Sensor G336 , Checking", page 413 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2024 EVAP Fuel Vapor Temperature Sensor Circuit	Smart Temperature Sensor Open Circuit	<ul style="list-style-type: none"> NVLD output voltage lower range $\geq 1.92 - 2.21$ V NVLD output voltage upper range $\leq 2.85 - 3.25$ V 	<ul style="list-style-type: none"> Case 1: Ignition on Case 2: Ignition off (during ECM keep alive-time) 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400-. Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400-, Checking", page 406 .
P2025 EVAP Fuel Vapor Temperature Sensor Performance	Smart Temperature Sensor Functional Check	<ul style="list-style-type: none"> Diff. time between ECU and smart module > 3.0 s Reset counter > 3.00 [-] 	<ul style="list-style-type: none"> Ignition off ECM keep alive time active Engine running Last ECM keep alive mode finished 	<ul style="list-style-type: none"> 3.0 s Once / DCY 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 3 DCY 	Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400-. Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400-, Checking", page 406 .
	Smart Temperature Sensor Out Of Range High	<ul style="list-style-type: none"> Smart module temperature $> 119^{\circ}$ C 	<ul style="list-style-type: none"> Ignition off NVLD (EVAP-System) diagnostic mode = active Fuel level $< 85.10\%$ Engine Running 	<ul style="list-style-type: none"> 300 s Continuous 30 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	
	Smart Temperature Sensor Out Of Range Low	<ul style="list-style-type: none"> Smart module temperature $< -39^{\circ}$ C 	<ul style="list-style-type: none"> Engine off time ≥ 360.00 min ECT @ cylinder head $> -23^{\circ}$ C IAT cross check finished ECT cross check finished Fuel level $< 85.10\%$ 	<ul style="list-style-type: none"> 1.0 s Once / DCY 		



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Smart Temperature Sensor Cross Check	<ul style="list-style-type: none"> Diff. between smart temperature @ engine start and ECT @ cylinder head @ engine start ≥ 25.5 K And Diff. between smart temperature @ engine start and IAT @ manifold @ engine start ≥ 25.5 K 	<ul style="list-style-type: none"> Engine off time ≥ 360.00 min IAT cross check finished ECT cross check finished Fuel level $< 85.10\%$ 			
	Smart Temperature Sensor Signal Dynamic Check	<ul style="list-style-type: none"> Gradient smart temperature > 20 K/10min 	<ul style="list-style-type: none"> Ignition off Fuel level $< 85.10\%$ NVLD (EVAP-System) diagnostic mode active 	<ul style="list-style-type: none"> 300 s Once / DCY 		
	Smart Temperature Sensor Communication with Smart Temperature Sensor	<ul style="list-style-type: none"> Response time > 1.0 s And Number of checks > 3.00 [-] Or Security bit incorrect And Number of checks > 3.00 [-] 	<ul style="list-style-type: none"> Case 1: Ignition on Engine running Case 2: Ignition off (during ECM keep alive-time) 	<ul style="list-style-type: none"> 5.0 s Continuous 		
P2026 EVAP Fuel Vapor Temperature Sensor Circuit Low Voltage	Smart Temperature Sensor Short To Ground	<ul style="list-style-type: none"> NVLD output voltage $< 1.92 - 2.21$ V 	<ul style="list-style-type: none"> Case 1: Ignition on Case 2: Ignition off (during ECM keep alive-time) 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400- . Refer to ⇒ "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2027 EVAP Fuel Vapor Temperature Sensor Circuit High Voltage	Smart Temperature Sensor Short To Battery Voltage	<ul style="list-style-type: none"> NVLD output temperature > 160.0 – 200.0° C Or NVLD output current driver stage internal value 	<ul style="list-style-type: none"> Case 1: Ignition on Case 2: Ignition off (during ECM keep alive-time) 	<ul style="list-style-type: none"> 0.5 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400- . Refer to "3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400, Checking", page 406 .
P2067 Fuel Level Sensor "B" Circuit Low	COM: Fuel Level (FL) Sensor 2 communication with IPC	<ul style="list-style-type: none"> Instrument cluster module signal: short to ground failure Instrument cluster module signal: signal range check failure 		<ul style="list-style-type: none"> 0.5 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Fuel Level Sensor - G- . Refer to appropriate repair manual.
P2068 Fuel Level Sensor "B" Circuit High	COM: Fuel Level (FL) Sensor 2 communication with IPC	<ul style="list-style-type: none"> Instrument cluster module signal: short to battery / open circuit failure 		<ul style="list-style-type: none"> 0.5 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Fuel Level Sensor - G- . Refer to appropriate repair manual.
P2088 "A" Camshaft Position Actuator Control Circuit Low Bank 1	VVT Actuator Intake Short To Ground	<ul style="list-style-type: none"> Output voltage (hardware values) < 1.92 – 2.21 V 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to "3.6.3 Camshaft Adjustment Valve 1 N205, Checking", page 362 .
P2089 "A" Camshaft Position Actuator Control Circuit High Bank 1	VVT Actuator Intake Short To Battery Plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 2.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Camshaft Adjustment Valve 1 - N205- . Refer to "3.6.3 Camshaft Adjustment Valve 1 N205, Checking", page 362 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2090 "B" Camshaft Position Actuator Control Circuit Low Bank 1	Variable Valve Timing (VVT) Exhaust Actuator short to ground	<ul style="list-style-type: none"> Output voltage < 1.92 – 2.21 V (hardware values) 	<ul style="list-style-type: none"> Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to ⇒ "3.6.14 Exhaust Camshaft Adjustment Valve 1 N318- , Checking", page 394
P2091 "B" Camshaft Position Actuator Control Circuit High Bank 1	Variable Valve Timing (VVT) Exhaust Actuator short to battery plus	<ul style="list-style-type: none"> Power stage temperature > 160 – 200° C Or Output current driver stage internal value (hardware values) 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to ⇒ "3.6.14 Exhaust Camshaft Adjustment Valve 1 N318- , Checking", page 394
P2096 Post Catalyst Fuel Trim System Too Lean Bank 1	Fuel System Out Of Range Low	<ul style="list-style-type: none"> Adaptation value < -0.05 [-] 	<ul style="list-style-type: none"> 2nd lambda control n.a. Catalyst purge not active Injection mode change (DFI/MFI) not active Engine speed >= 896 RPM Counter of integrated mass for fuel in oil < 255.00 [-] Choice of: O2S rear (binary) check not active Or O2S rear (binary) check finished 	<ul style="list-style-type: none"> 0.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check exhaust system visually for leaks first and correct as necessary. Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2097 Post Catalyst Fuel Trim System Too Rich Bank 1	Fuel System Out Of Range High	<ul style="list-style-type: none"> Adaptation value > 0.05 [-] 	<ul style="list-style-type: none"> 2nd lambda control n.a. Catalyst purge not active Injection mode change (DFI/MFI) not active Engine speed >= 896 RPM Counter of integrated mass for fuel in oil < 255.00 [-] Choice of: O2S rear (binary) check not active Or O2S rear (binary) check finished 	<ul style="list-style-type: none"> 0.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check exhaust system visually for leaks first and correct as necessary. Check the Oxygen Sensor 1 After Catalytic Converter - GX7. Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427.
P2100 Throttle Actuator "A" Control Motor Circuit/ Open	Throttle Actuator Open Circuit	<ul style="list-style-type: none"> Electronic throttle valve driver load resistance > 200.0 kOhm 	<ul style="list-style-type: none"> Difference between measured and filtered throttle position <= 0.073° TPS Actuator commanded off 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3. Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439.
P2101 Throttle Actuator "A" Control Motor Circuit Range/ Performance	Throttle Actuator Over Temperature	<ul style="list-style-type: none"> Electronic throttle valve driver temperature (hardware values) > 170.0 – 190.0° C 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3. Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439.
P2103 Throttle Actuator "A" Control Motor Circuit High	Throttle Actuator Short Circuit	<ul style="list-style-type: none"> Electronic throttle valve driver current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Actuator commanded on 	<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Throttle Valve Control Module - GX3. Refer to "3.6.31 Throttle Valve Control Module GX3, Checking", page 439.
P2122 Throttle/ Pedal Position Sensor/ Switch "D" Circuit Low	Accelerator Pedal Position Sensor 1 Out Of Range Low	<ul style="list-style-type: none"> Signal voltage sensor 1 < 0.40 V 		<ul style="list-style-type: none"> 0.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Accelerator Pedal Module - GX2. Refer to "3.6.1 Accelerator Pedal Module GX2, Checking", page 357.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2123 Throttle/ Pedal Position Sensor/ Switch "D" Circuit High	Accelerator Pedal Position Sensor 1 Out Of Range High	<ul style="list-style-type: none"> Signal voltage sensor 1 > 4.82 V 		<ul style="list-style-type: none"> 0.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Accelerator Pedal Module - GX2- . Refer to ⇒ "3.6.1 Accelerator Pedal Module GX2, Checking", page 357 .
P2127 Throttle/ Pedal Position Sensor/ Switch "E" Circuit Low	Accelerator Pedal Position Sensor 2 Out Of Range Low	<ul style="list-style-type: none"> Signal voltage sensor 2 < 0.20 V 		<ul style="list-style-type: none"> 0.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Accelerator Pedal Module - GX2- . Refer to ⇒ "3.6.1 Accelerator Pedal Module GX2, Checking", page 357 .
P2128 Throttle/ Pedal Position Sensor/ Switch "E" Circuit High	Accelerator Pedal Position Sensor 2 Out Of Range High	<ul style="list-style-type: none"> Signal voltage sensor 2 > 2.80 V 		<ul style="list-style-type: none"> 0.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Accelerator Pedal Module - GX2- . Refer to ⇒ "3.6.1 Accelerator Pedal Module GX2, Checking", page 357 .
P2138 Throttle/ Pedal Position Sensor/ Switch "D"/"E" Voltage Correlation	Accelerator Pedal Position Sensor 1 And 2 Rationality Check	<ul style="list-style-type: none"> Difference between signal voltage sensor 1 and sensor 2 > 0.10 – 0.12 V 		<ul style="list-style-type: none"> 0.4 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Accelerator Pedal Module - GX2- . Refer to ⇒ "3.6.1 Accelerator Pedal Module GX2, Checking", page 357 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2177 System Too Lean Off Idle Bank 1	Fuel System Direct Fuel Injection system too lean @ part load	<ul style="list-style-type: none"> Adaptive value $\geq 28.0\%$ 	<ul style="list-style-type: none"> MAF > 60.0 mg/rev ECT @ cylinder head $> 20^{\circ}\text{C}$ IAT @ manifold $> -48^{\circ}\text{C}$ AAT $> -48^{\circ}\text{C}$ Lambda set point $0.97 - 1.05 [-]$ Lambda control closed loop Integrated MAF $\geq g$ Fuel mass $15.01 - 50.00$ mg/rev Engine speed $1,024 - 3,744$ rpm Low dynamic conditions: Diff. engine speed vs. averaged engine speed for engine speed dynamic detection $< 60 - 130$ rpm Diff. air mass vs. averaged air mass for load dynamic detection $< 16.00 - 30.01$ mg/rev Diff. between reference and actual fuel pressure, high side ≤ 2000.10 kPa Integrated air mass $> 5.0 - 25.0$ g And Evap purge valve closed or canister load $\leq 1.20 [-]$ Evap purge flow at max. value Or Dependence on canister purge min: 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the intake and vacuum hoses visually for leaks. Check the Positive Crankcase Ventilation visually. Also make sure the oil dipstick is properly secured. Listen to and visually inspect the exhaust system to insure there are no leaks. Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430. Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427. Check the Intake Manifold Sensor - GX9-. Refer to "3.6.23 Intake Manifold Sensor GX9, Checking", page 417. Check the EVAP Canister Purge Regulator Valve 1 - N80-. Refer to "3.6.13 EVAP Canister Purge Regulator Valve 1 N80, Checking", page 392. Check the Fuel Injectors. Refer to



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">• Lower limit of lambda controller output n.a.• Or• Upper limit of lambda controller output n.a.• And• Evap purge flow at min. value			⇒ "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2178 System Too Rich Off Idle Bank 1	Fuel System Direct Fuel Injection system too rich @ part load	<ul style="list-style-type: none"> Adaptive value $\leq -28.0\%$ 	<ul style="list-style-type: none"> Air mass > 60.00 mg/rev ECT @ cylinder head $> 20^{\circ}\text{C}$ IAT @ manifold $> -48^{\circ}\text{C}$ AAT $> -48^{\circ}\text{C}$ Lambda setpoint $0.97 - 1.05 [-]$ Lambda control closed loop Integrated air mass $\geq \text{g}$ Fuel mass $15.01 - 50.00$ mg/rev Engine speed $1,024 - 3,744$ rpm Low dynamic conditions: Diff. engine speed vs. averaged engine speed for engine speed dynamic detection $< 60 - 130$ rpm Diff. air mass vs. averaged air mass for load dynamic detection $< 16.00 - 30.01$ mg/rev Diff. between reference and actual fuel pressure, high side $\leq 2,000.10$ kPa Integrated air mass $> 5.0 - 25.0$ g And Evap purge valve closed Or Canister load $\leq 1.20 [-]$ Evap purge flow at max. value Or 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Evaporative Emission (EVAP) System visually for contamination. Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 . Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 . Check the Intake Manifold Sensor - GX9- . Refer to "3.6.23 Intake Manifold Sensor GX9, Checking", page 417 . Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">• Dependence on canister purge min.• Lower limit of lambda controller output n.a.• Or• Upper limit of lambda controller output n.a.• And• Evap purge flow at min. value			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2181 Cooling System Performance	Engine Cooling System Rationality Check	<ul style="list-style-type: none"> Modeled ECT @ cylinder head > 66 – 70° C Choice of: ECT @ cylinder head < 65 – 69° C Or ECT @ radiator outlet < n.a.° C 	<ul style="list-style-type: none"> ECT @ cylinder head @ first start >= -10° C ECT @ cylinder head @ first start <= 50 – 55° C AAT > -10° C Ratio accumulated time fuel cut off vs. time since engine start <= 10.16 % Ratio accumulated time engine load condition vs. time since engine start <= 39.84 % Determination engine load condition: Engine load (lower threshold) <= 2.50 % engine load (upper threshold) >= 100.00 % Ratio accumulated time high speed condition <= 14.84 % Determination high speed condition: Vehicle speed > 75 mph Ratio accumulated time start-stop active <= 16.02 % Setpoint of RVC in measurement window < 99.61 % Case 1: Engine speed < 8,160 rpm Case 2: Engine speed >= 8,160 rpm Diff. ECT@ cylinder head during measurement < 256° C 	<ul style="list-style-type: none"> 1.0 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check cooling system visually for leaks or damaged components. Check the Engine Temperature Control Actuator - N493- . Refer to "3.6.12 Engine Temperature Control Actuator N493, Checking", page 388 . Check the Engine Coolant Temperature Sensor - G62- . Refer to "3.6.9 Engine Coolant Temperature Sensor G62, Checking", page 380 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Engine Cooling System Rationality Check	<ul style="list-style-type: none"> ECT @ cylinder head < 60° C For time >= 0.0 s 	<ul style="list-style-type: none"> For time >= 0.0 s Engine running Or Engine stopped And ECT @ cylinder head once after start > 65° C Or ECT @ radiator outlet once after engine start not calibrated [°C] And AAT sensor signal valid AAT > -10° C Relative actual MAF > 5.00 % ECT @ cylinder head @ first start lower limit >= -40° C ECT @ cylinder head @ first start upper limit <= 215° C Vehicle speed >= 0 mph Modeled ECT @ cylinder head > 60° C Start-stop cycles <= 255.00 [-] For time >= 15.0 s 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2183 Engine Coolant Temperature Sensor 2 Circuit Range/Performance	Engine Coolant Temperature Sensor @ Radiator Outlet Cross Check	<ul style="list-style-type: none"> High side: reference measuring Diff. ECT @ radiator outlet @ cold start vs. IAT @ manifold @ cold start > 25.0 K Diff. ECT @ radiator outlet @ cold start vs. ECT @ cylinder head @ cold start n.a. K Diff. ECT @ radiator outlet @ cold start vs. AAT @ cold start > 25.0 K Min. amount of faulty reference measurements to detect defective sensor 2.00 [-] Or Low side: reference measuring Diff. IAT @ manifold @ cold start vs. ECT @ radiator outlet @ cold start > 25.0 K Diff. ECT @ cylinder head @ cold start vs. ECT @ radiator outlet @ cold start n.a. K Diff. AAT @ cold start vs. ECT @ radiator outlet @ cold start > 25.0 K Min. amount of faulty reference measurements to detect defective sensor 2.00 [-] 	<ul style="list-style-type: none"> Engine off time >= 360.00 min Engine off time plausible Time after engine start <= 1,400.0 s Depending on temperature slope Diff. actual vs previous IAT < 256.0 K Diff. actual vs previous ECT @ cylinder head n.a. K Diff. actual vs previous ECT @ radiator outlet < 256.0 K Diff. actual vs previous AAT < 256.0 K For time >= 1.0 s Depending on mean value condition Mean value of all temperature sensors @ cold start >= -256° C Number of valid sensors >= 2.00 [-] Depending on block heater / solar radiation detection Time after engine start >= 0.5 s Vehicle speed >= 22 mph For time >= 20.0 s Diff. actual IAT @ manifold vs. min. IAT @ manifold < 5.0 K Diff. actual ECT @ cylinder head vs. min. ECT @ cylinder head n.a. K 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to "3.6.10 Engine Coolant Temperature Sensor On Radiator Outlet G83. Checking", page 382 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Diff. actual AAT vs. min. AAT < 4.0 K Diff. actual ECT @ radiator outlet vs. min. ECT @ radiator outlet < 1.1 K 			
P2184 Engine Coolant Temperature Sensor 2 Circuit Low	Engine Coolant Temperature Sensor @ Radiator Outlet Short To Ground	<ul style="list-style-type: none"> Sensor voltage < 0.30 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83-. Refer to ⇒ "3.6.10 Engine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 382.
P2185 Engine Coolant Temperature Sensor 2 Circuit High	Engine Coolant Temperature Sensor @ Radiator Outlet Short To Battery / Open Circuit	<ul style="list-style-type: none"> Sensor voltage > 4.90 V 	<ul style="list-style-type: none"> IAT @ throttle >= -33° C Time after engine start > 60 s 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83-. Refer to ⇒ "3.6.10 Engine Coolant Temperature Sensor On Radiator Outlet G83, Checking", page 382.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2187 System Too Lean at Idle Bank 1	Fuel System Direct Fuel Injection System Too Lean	<ul style="list-style-type: none"> Case 1: Adaptive value ≥ 3.01 mg/rev Case 2: Adaptive value n.a. 	<ul style="list-style-type: none"> Air mass > 60.00 mg/rev ECT @ cylinder head $> 20^{\circ}\text{C}$ IAT @ manifold $> -48^{\circ}\text{C}$ AAT $> -48^{\circ}\text{C}$ Lambda setpoint $0.97 - 1.05 [-]$ Lambda control closed loop Integrated air mass $\geq \text{g}$ Vehicle speed < 4 mph Low dynamic conditions: Diff. engine speed vs. averaged engine speed for engine speed dynamic detection $< 60 - 130$ rpm Diff. air mass vs. averaged air mass for load dynamic detection $< 16.00 - 30.01$ mg/rev Diff. between reference and actual fuel pressure, high side ≤ 2000.10 kPa Integrated air mass $> 5.0 - 25.0$ g And Fuel mass lower range > 4.01 mg/rev Fuel mass upper range $< 17.00 - 19.01$ mg/rev Engine speed $704 - 927$ rpm Or Engine n.a. And 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the intake and vacuum hoses visually for leaks. Check the Positive Crankcase Ventilation visually. Also make sure the oil dipstick is properly secured. Listen to and visually inspect the exhaust system to insure there are no leaks. Check the Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430. Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427. Check the Intake Manifold Sensor - GX9-. Refer to "3.6.23 Intake Manifold Sensor GX9, Checking", page 417. Check the EVAP Canister Purge Regulator Valve 1 - N80-. Refer to "3.6.13 EVAP Canister Purge Regulator Valve 1 N80, Checking", page 392. Check the Fuel Injectors. Refer to



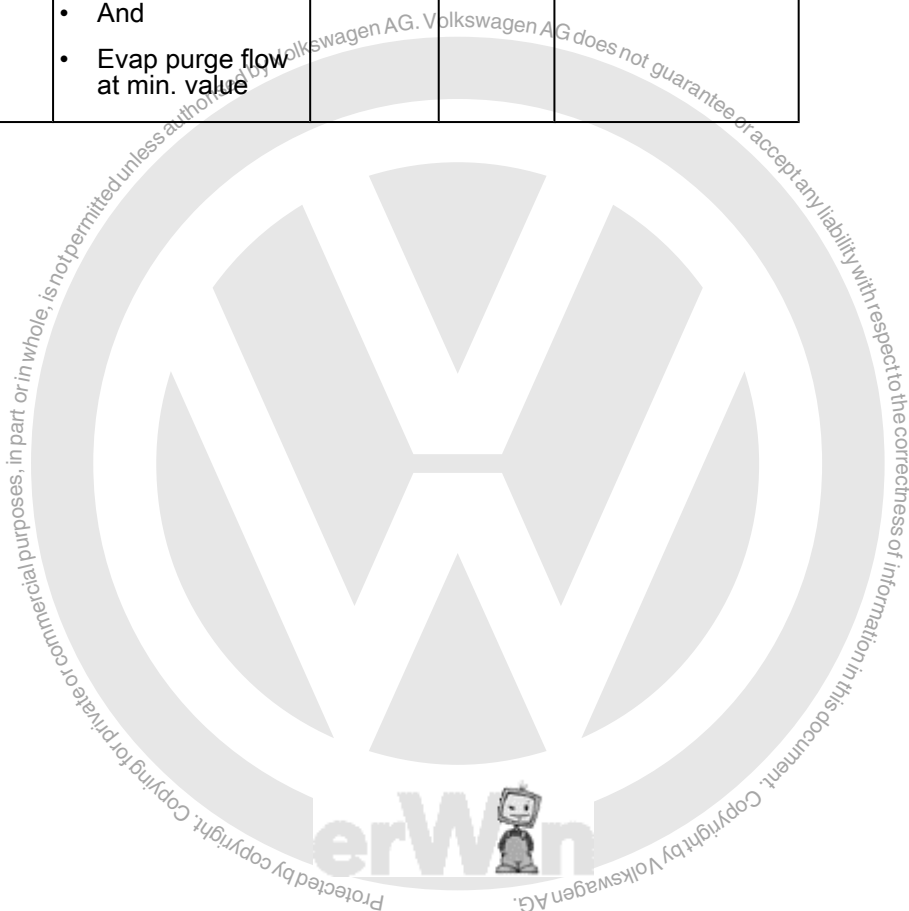
DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">• Evap purge valve closed• Or• Canister load ≤ 1.20 [-]• Evap purge flow at max. value• Or• Depending on canister purge min:• Lower limit of lambda controller output n.a.• Or• Upper limit of lambda controller output n.a.• And• Evap purge flow at min. value			⇒ "3.6.15 Fuel Injectors, Checking", page 396.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2188 System Too Rich at Idle Bank 1	Fuel System Direct Fuel Injection system too rich @ idle	<ul style="list-style-type: none"> Case 1: Adaptive value ≤ -3.01 mg/rev Case 2: Adaptive value \leq n.a. kg/h 	<ul style="list-style-type: none"> Air mass > 60.00 mg/rev ECT @ cylinder head $> 20^{\circ}\text{C}$ IAT @ manifold $> -48^{\circ}\text{C}$ AAT $> -48^{\circ}\text{C}$ Lambda setpoint $0.97 - 1.05 [-]$ Lambda control closed loop Oil dilution not detected Integrated air mass \geq g Vehicle speed < 4 mph Low dynamic conditions: Diff. engine speed vs. averaged engine speed for engine speed dynamic detection $< 60 - 130$ rpm Diff. air mass vs. averaged air mass for load dynamic detection $< 16.00 - 30.01$ mg/rev Diff. between reference and actual fuel pressure, high side ≤ 2000.10 kPa Integrated air mass $> 5.0 - 25.0$ g And Fuel mass lower range > 4.01 mg/rev Fuel mass upper range $< 17.00 - 19.01$ mg/rev Engine speed $704 - 927$ rpm Or Engine n.a. 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Evaporative Emission (EVAP) System visually for contamination. Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 . Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 . Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">• And• Evap purge valve closed• Or• Canister load ≤ 1.20 [-]• Evap purge flow at max. value• Or• Depending on canister purge min:<ul style="list-style-type: none">• Lower limit of lambda controller output n.a.• Or• Upper limit of lambda controller output n.a.• And• Evap purge flow at min. value			





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2195 O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1	Oxygen Sensors Front Rationality Check	<ul style="list-style-type: none"> Plausibility signal check O2S front and O2S rear: Lambda value > 1.15 [-] And O2S signal rear >= 0.91 [V] 	<ul style="list-style-type: none"> O2S front ready O2S rear ready ECT @ cylinder head >= -48° C MAF > 0.0; < 2,047.97 kg/h Catalyst purge not active Integrated MAF after end of catalyst purge 10.0 g Engine speed > 0 RPM Modeled EGT @ O2S front > -273; < 850° C Injection mode change (DFI/MFI) not active Integrated MAF > 40.0 g Dynamic lambda controller output < 3.0 % Dynamic MAF < 0.05 g/rev Dynamic engine speed < 200 RPM And Second control loop active: MAF 0.06 – 0.75 g/rev Engine speed 576 – 4,512 RPM 	<ul style="list-style-type: none"> 67.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10- , Checking", page 430 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2196 O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 1	Oxygen Sensors Front Rationality Check	<ul style="list-style-type: none"> Plausibility signal check O2S front and O2S rear: Lambda value < 0.85 [-] And O2S signal rear <= 0.17 V 	<ul style="list-style-type: none"> O2S front ready O2S rear ready ECT @ cylinder head >= -48° C MAF > 0.00; < 2,047.97 kg/h Catalyst purge not active Integrated air mass after end of catalyst purge 10.0 g Engine speed > 0 rpm Modeled EGT @ O2S front > -273; < 850° C Injection mode change (DFI/MFI) not active Integrated air mass > 40.0 g Dynamic lambda controller output < 3.00 % Dynamic air mass < 0.05 g/rev Dynamic engine speed < 200 rpm And Second control loop active: Air mass 0.06 – 0.75 g/rev Engine speed 576 – 4,512 rpm 	<ul style="list-style-type: none"> 67.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10, Checking", page 430 .
P219C Cylinder 1 Air-Fuel Ratio Imbalance	Air Fuel Imbalance Monitoring Out Of Range High	<ul style="list-style-type: none"> Cylinder 1: Weighted adaptive value > 10.0 % 	<ul style="list-style-type: none"> Fuel pressure setpoint not calibrated kPa Modeled catalyst temperature @ start <= 850° C Lambda set value 0.97 – 1.03 [-] Catalyst heating not active Engine roughness signal valid 	<ul style="list-style-type: none"> 90 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Air Fuel Imbalance Monitoring Out Of Range Low	<ul style="list-style-type: none"> Cylinder 1: Weighted adaptive value < -15.0 % 	<ul style="list-style-type: none"> Cylinder shut off not active AAT >= -48° C Barometric pressure >= 73.0 kPa min. injection time not reached And Choice of: Catalyst diagnosis n.a. Or Catalyst diagnosis n.a. Depending on catalyst diagnosis: Canister purge (conditions) n.a. Or Evap purge valve n.a. Or Evap purge n.a. And O2S dynamic diagnosis n.a. O2S delay diagnosis n.a. Lambda control closed loop Catalyst purge not active Canister load <= 2.00 [-] Engine no full load Segment adaptation finished Catalyst damaging misfire not detected Emission threshold misfire not detected 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> No gear switch for segments ≥ 90.00 [-] Segments after start > 0.00 [-] Time after engine start > 0.0 s Rough road not detected Min. fuel mass ≥ 0.00 mg/rev Intake manifold runner flap position change not active Injection mode change (DFI/MFI) not equipped Valve lift position change not active Depending on gear: <ul style="list-style-type: none"> 1st gear not active 2nd gear not active 3rd gear not active 4th gear active 5th gear active 6th gear active 7th gear active 8th gear not active And Integrated MAF $\geq 1.0 - 12.0$ kg Diff. engine speed vs. dynamic engine speed < 200 RPM Diff. MAF vs. dynamic MAF < 29.99 mg/rev ECT @ cylinder head $60 - 143^{\circ}$ C Adaptation cycles ≤ 255 [-] 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Engine speed 1,312 – 3,008 RPM And Mass fuel flow lower range ≥ 11.00 mg/rev Mass fuel flow upper range ≤ 32.00 mg/rev 			
P219D Cylinder 2 Air-Fuel Ratio Imbalance	Air Fuel Imbalance Monitoring Out Of Range High	<ul style="list-style-type: none"> Cylinder 1: Weighted adaptive value > 10.0 % 	<ul style="list-style-type: none"> Fuel pressure setpoint not calibrated kPa Modeled catalyst temperature @ start $\leq 850^{\circ}\text{C}$ Lambda set value 0.97 – 1.03 [-] Catalyst heating not active Engine roughness signal valid Cylinder shut off not active AAT $\geq -48^{\circ}\text{C}$ Barometric pressure ≥ 73.0 kPa Min. injection time not reached And Choice of: <ul style="list-style-type: none"> Catalyst diagnosis n.a. Or Catalyst diagnosis n.a. Depending on catalyst diagnosis: Canister purge (conditions) n.a. Or Evap purge valve n.a. Or Evap purge n.a. And 	<ul style="list-style-type: none"> 90 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Air Fuel Imbalance Monitoring Out Of Range Low	<ul style="list-style-type: none"> Cylinder 2: Weighted adaptive value < -15.0 % 	<ul style="list-style-type: none"> O2S dynamic diagnosis n.a. O2S delay diagnosis n.a. Lambda control closed loop Catalyst purge not active Canister load <= 2.00 [-] Engine no full load Segment adaptation finished Catalyst damaging misfire not detected Emission threshold misfire not detected No gear switch for segments >= 90.00 [-] Segments after start > 0.00 [-] Time after engine start > 0.0 [s] Rough road not detected Min. fuel mass >= 0.00 mg/rev Intake manifold runner flap position change not active Injection mode change (DFI/MFI) not equipped Valve lift position change not active Depending on gear: <ul style="list-style-type: none"> 1st gear not active 2nd gear not active 3rd gear not active 4th gear active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> 5th gear active 6th gear active 7th gear active 8th gear not active And Integrated MAF $\geq 1.0 - 12.0$ kg Diff. engine speed vs. dynamic engine speed < 200 RPM Diff. MAF vs. dynamic MAF < 29.99 mg/rev ECT @ cylinder head $60 - 143^{\circ}$ C Adaptation cycles ≤ 255 [-] Engine speed $1,312 - 3,008$ RPM And Mass fuel flow lower range ≥ 11.00 mg/rev Mass fuel flow upper range ≤ 32.00 mg/rev 			
P219E Cylinder 3 Air-Fuel Ratio Imbalance	Air Fuel Imbalance Monitoring Out Of Range High	<ul style="list-style-type: none"> Cylinder 1: Weighted adaptive value > 10.0 % 	<ul style="list-style-type: none"> Fuel pressure setpoint not calibrated [kPa] Modeled catalyst temperature @ start $\leq 850^{\circ}$ C Lambda set value $0.97 - 1.03$ [-] Catalyst heating not active Engine roughness signal valid Cylinder shut off not active AAT $\geq -48^{\circ}$ C Barometric pressure ≥ 73.0 kPa Min. injection time not reached 	<ul style="list-style-type: none"> 90 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Air Fuel Imbalance Monitoring Out Of Range Low	<ul style="list-style-type: none"> Cylinder 3: Weighted adaptive value < -15.0 % 	<ul style="list-style-type: none"> And Choice of: Catalyst diagnosis n.a. Or Catalyst diagnosis n.a. Depending on catalyst diagnosis: Canister purge (conditions) n.a. Or Evap purge valve n.a. Or Evap purge n.a. And O2S dynamic diagnosis n.a. O2S delay diagnosis n.a. Lambda control closed loop Catalyst purge not active Canister load ≤ 2.00 [-] Engine no full load Segment adaptation finished Catalyst damaging misfire not detected Emission threshold misfire not detected No gear switch for segments ≥ 90.00 [-] Segments after start > 0.00 [-] Time after engine start > 0.0 [s] Rough road not detected 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Min. fuel mass ≥ 0.00 [mg/rev] Intake manifold runner flap position change not active Injection mode change (DFI/MFI) not equipped Valve lift position change not active Depending on gear 1st gear not active 2nd gear not active 3rd gear not active 4th gear active 5th gear active 6th gear active 7th gear active 8th gear not active And Integrated MAF $\geq 1.0 - 12.0$ kg Diff. engine speed vs. dynamic engine speed < 200 RPM Diff. MAF vs. dynamic MAF < 29.99 mg/rev ECT @ cylinder head $60 - 143^{\circ} \text{C}$ Adaptation cycles ≤ 255 [-] Engine speed $1,312 - 3,008$ RPM And Mass fuel flow lower range ≥ 11.00 mg/rev Mass fuel flow upper range ≤ 32.00 mg/rev 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P219F Cylinder 4 Air-Fuel Ratio Imbalance	Air Fuel Imbalance Monitoring Out Of Range High	<ul style="list-style-type: none"> Cylinder 1: Weighted adaptive value > 10.0 % 	<ul style="list-style-type: none"> Fuel pressure setpoint not calibrated [kPa] Modeled catalyst temperature @ start <= 850° C Lambda set value 0.97 – 1.03 [-] Catalyst heating not active Engine roughness signal valid Cylinder shut off not active AAT >= -48° C Barometric pressure >= 73.0 kPa Min. injection time not reached And Choice of: Catalyst diagnosis n.a. Or Catalyst diagnosis n.a. Depending on catalyst diagnosis: Canister purge (conditions) n.a. Or Evap purge valve n.a. Or Evap purge n.a. And O2S dynamic diagnosis n.a. O2S delay diagnosis n.a. Lambda control closed loop Catalyst purge not active Canister load <= 2.00 [-] 	<ul style="list-style-type: none"> 90 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Air Fuel Imbalance Monitoring Out Of Range Low	<ul style="list-style-type: none"> Cylinder 4: Weighted adaptive value < -15.0 % 	<ul style="list-style-type: none"> Engine no full load Segment adaptation finished Catalyst damaging misfire not detected Emission threshold misfire not detected No gear switch for segments >= 90.00 [-] Segments after start > 0.00 [-] Time after engine start > 0.0 [s] Rough road not detected Min. fuel mass >= 0.00 [mg/rev] Intake manifold runner flap position change not active Injection mode change (DFI/MFI) not equipped Valve lift position change not active Depending on gear: <ul style="list-style-type: none"> 1st gear not active 2nd gear not active 3rd gear not active 4th gear active 5th gear active 6th gear active 7th gear active 8th gear not active And Integrated MAF >= 1.0 – 12.0 kg 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">• Diff. engine speed vs. dynamic engine speed < 200 RPM• Diff. MAF vs. dynamic MAF < 29.99 mg/rev• ECT @ cylinder head 60 – 143° C• Adaptation cycles <= 255 [-]• Engine speed 1,312 – 3,008 RPM• And• Mass fuel flow lower range >= 11.00 mg/rev• Mass fuel flow upper range <= 32.00 mg/rev			





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2237 O2 Sensor Positive Current Control Circuit/ Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Pump Voltage (VIP)	<ul style="list-style-type: none"> Diff. pump voltage (VIP) vs. virtual ground voltage (VG) ≤ 1.20 V Diff. nernst voltage (VN) vs. virtual ground voltage (VG) ≤ 1.20 V And Choice of: <ul style="list-style-type: none"> Nernst voltage (VN) > 4.40 V Or Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 2.35 V Diff. pump voltage (VIP) vs. virtual ground voltage (VG) < -2.35 V Or Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.60 V Diff. nernst voltage (VN) vs. virtual ground voltage (VG) < -0.10 V Or Pump current driver stage internal value Or Measurement O2S front label resistor n.a. Ohm 	<ul style="list-style-type: none"> O2S front (linear) ready O2S ceramic temperature $> 785^{\circ}$ C For time ≥ 10.0 s 	<ul style="list-style-type: none"> 2.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2243 O2 Sensor Reference Voltage Circuit/ Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Nernst Voltage (VN)	<ul style="list-style-type: none"> Diff. pump voltage (VIP) vs. virtual ground voltage (VG) ≤ 1.20 V Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.20 V And Choice of: <ul style="list-style-type: none"> Nernst voltage (VN) > 4.40 V Or Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 2.35 V Diff. pump voltage (VIP) vs. virtual ground voltage (VG) < -2.35 V Or Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.60 V Diff. nernst voltage (VN) vs. virtual ground voltage (VG) < -0.10 V Or Pump current driver stage internal value Or Measurement O2S front label resistor n.a. Ohm 	<ul style="list-style-type: none"> O2S front (linear) ready O2S ceramic temperature $> 785^{\circ}$ C For time ≥ 10.0 s 	<ul style="list-style-type: none"> 2.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2251 O2 Sensor Negative Current Control Circuit/ Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Virtual Ground (VG)	<ul style="list-style-type: none"> Nernst voltage (VN) > 4.40 V Or Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 2.35 V Diff. pump voltage (VIP) vs. virtual ground voltage (VG) < -2.35 V Or Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.60 V Diff. nernst voltage (VN) vs. virtual ground voltage (VG) < -0.10 V Or Pump current driver stage internal value Or Measurement O2S front label resistor > n.a. Ohm And Choice of: <ul style="list-style-type: none"> Diff. pump voltage (VIP) vs. virtual ground voltage (VG) <= 1.20 V Diff. nernst voltage (VN) vs. virtual ground voltage (VG) <= 1.20 V Or Diff. pump voltage (VIP) vs. virtual ground voltage (VG) > 1.20 V 	<ul style="list-style-type: none"> O2S front (linear) ready O2S ceramic temperature > 785° C For time >= 10.0 s 	<ul style="list-style-type: none"> 2.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to "3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Diff. nernst voltage (VN) vs. virtual ground voltage (VG) > 1.20 V 				
P2257 AIR System Control "A" Circuit Low	Secondary Air Injection Pump Relay Short To Ground	<ul style="list-style-type: none"> Output voltage (hardware values) 1.92 – 2.21 V 	<ul style="list-style-type: none"> Engine running Actuator commanded off 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Pump Motor - V101- / Secondary Air Injection Pump Relay - J299- . Refer to ⇒ "3.6.29 Secondary Air Injection Pump Motor V101 / Secondary Air Injection Pump Relay J299 , Checking", page 433 .
P2258 AIR System Control "A" Circuit High	Secondary Air Injection Pump Relay Short To Battery Plus	<ul style="list-style-type: none"> Actuator temperature > 160 – 200° C Or Output current (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Engine running Actuator commanded on 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Pump Motor - V101- / Secondary Air Injection Pump Relay - J299- . Refer to ⇒ "3.6.29 Secondary Air Injection Pump Motor V101 / Secondary Air Injection Pump Relay J299 , Checking", page 433 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2270 O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 2	Oxygen Sensors Rear Signal Range Check	<ul style="list-style-type: none"> O2S rear voltage < 0.87 V Intrusive lambda ramp lean < 0.85 [-] 	<ul style="list-style-type: none"> General conditions: Catalyst monitor lambda modulation request active Vehicle speed >= 19 mph Barometric pressure >= 0.00 kPa Catalyst overheating protection not active Turbine overheating protection not active O2S rear ready O2S front ready ECT @ cylinder head > 60° C IAT @ manifold > -48° C Modeled catalyst temperature @ start of diagnosis > 510° C Modeled catalyst temperature @ during diagnosis 470 – 830° C Diff. between dynamic and stationary catalyst temperature -150 – 150° C Integrated air mass, catalyst temp. conditions fulfilled >= 0.0 g Modeled EGT @ O2S rear <= 900° C MAF per cylinder 22.50 – 150.00 kg/h Air mass , lower range >= 0.00 mg/rev Air mass , upper range <= 650.00 – 1389.00 mg/rev And 	<ul style="list-style-type: none"> 0 (FTP75: 50) s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7, Checking", page 427 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • Engine load n.a. % • Air mass setpoint n.a. mg/rev • Accelerator pedal value n.a. % • For time n.a. s • And • Low dynamic conditions • Dynamic engine speed < 50 rpm • Dynamic air mass < 50.00 mg/rev • Dynamic lambda controller output < 20.00 % • And • Integrated air mass after dynamic conditions are fulfilled > 20.0 g • Time after a catalyst purge phase >= 1.0 s • O2S rear voltage @ diagnosis start >= 0.55 V • Integrated air mass >= 0.0 g • Integrated heat energy >= kJ • Engine speed 1,088 – 3,008 rpm • Deviation of lambda controller output < 50.00 % • Proportional part of secondary fuel control loop not calibrated % • Coasting function not active • O2S heater rear active • Lambda adaptation not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Valve lift not active And Depending on Lambda control: Sum of integral and proportional part of secondary fuel control loop before diagnosis < 0.10 [-] Or Sum of integral and proportional part of secondary fuel control loop during diagnosis < 0.25 [-] Depending on canister purge: Canister load n.a. [-] Evap purge flow n.a. Or Canister load calculation n.a. Evap purge flow n.a. Or Evap purge valve n.a. Or Evap purge valve n.a. Or Evap purge n.a. Or Depending on canister purge closing: Canister purge (conditions) n.a. Canister purge valve (closing time) n.a. [s] And Choice of: evap purge valve n.a. 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">• Or• Evap purge valve n.a.• And• Modeled air mass integral > 50.0 g• Integrated air mass per cylinder >= 1.40 – 1.80 kg			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2271 O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 2	Oxygen Sensors Rear Signal Range Check	<ul style="list-style-type: none"> O2S rear voltage > 0.25 V Intrusive lambda ramp lean > 1.12 [-] 	<ul style="list-style-type: none"> General conditions: Catalyst monitor lambda modulation request active Intrusive lambda ramp request active Vehicle speed >= 19 mph Barometric pressure >= 0.00 kPa Catalyst overheating protection not active Turbine overheating protection not active O2S rear ready O2S front ready ECT @ cylinder head > 60° C IAT @ manifold > -48° C Modeled catalyst temperature @ start of diagnosis > 510° C Modeled catalyst temperature @ during diagnosis 470 – 830° C Diff. between dynamic and stationary catalyst temperature -150 – 150° C Integrated air mass, catalyst temp. conditions fulfilled >= 0.0 g Modeled EGT @ O2S rear <= 900° C MAF per cylinder 22.50 – 150.00 kg/h Air mass, lower range >= 0.00 mg/rev 	<ul style="list-style-type: none"> 0 (FTP75: 50) s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Oxygen Sensor 1 After Catalytic Converter - GX7-. Refer to "3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7-, Checking", page 427.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Air mass upper range $\leq 650.00 - 1,389.00$ mg/rev And Engine load n.a. % Air mass setpoint n.a. g/rev Accelerator pedal value n.a. % For time n.a. s And Low dynamic conditions Dynamic engine speed < 50 rpm Dynamic air mass < 50.00 mg/rev Dynamic lambda controller output < 20.00 % And Integrated air mass after dynamic conditions are fulfilled > 20.0 g Time after a catalyst purge phase ≥ 1.0 s O2S rear voltage ≥ 0.55 V Integrated air mass ≥ 0.0 g Integrated heat energy \geq kJ Engine speed 1,088 – 3,008 rpm Deviation of lambda controller output < 50.00 % Proportional part of secondary fuel control loop not calibrated % Coasting function not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • O2S heater rear active • Lambda adaptation not active • Valve lift not active • And • Depending on Lambda control: • Sum of integral and proportional part of secondary fuel control loop before diagnosis < 0.10 [-] • Or • Sum of integral and proportional part of secondary fuel control loop during diagnosis < 0.25 [-] • Depending on canister purge: • Canister load n.a. [-] • Evap purge flow n.a. • Or • Canister load calculation n.a. • Evap purge flow n.a. • Or • Evap purge valve n.a. • Or • Evap purge valve n.a. • Or • Evap purge n.a. • Or • Depending on canister purge closing: • Canister purge (conditions) n.a. 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">• Canister purge valve (closing time) n.a. [s]• And• Choice of:<ul style="list-style-type: none">• Evap purge valve n.a.• Or• Evap purge valve n.a.• And• Modeled air mass integral > 50.0 g• Integrated air mass per cylinder >= 1.40 – 1.80 kg			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2279 MAP/ MAF - Throttle Position Correlation	Intake Air System Rationality Check	<ul style="list-style-type: none"> Filtered lambda controller included correction and adaptation -30.0 – 30.0 % Lambda control active And Deviation throttle area controller > 60.0 % 	<ul style="list-style-type: none"> Throttle position > 0.0° TPS Throttle position < 100.003° TPS Engine speed > 576; < 3,008 RPM Modeled pressure quotient > 0.27; < 0.57 [-] Engine running Throttle actuator commanded on Time after engine start > 5.0 s Throttle position sensor failure not detected Fuel cut off not active Fast throttle adaptation finished Gradient intake manifold pressure -199.90 – 199.90 kPa/s BARO plausibility diagnosis finished Intake manifold modeled adaptation active And Choice of: MAF sensor active Or Manifold pressure sensor active And Choice of: Pressure upstream throttle < 135.0 kPa Or 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check visually for air leaks between intake and throttle body, oil fill cap not tight or oil dipstick not seated in tube. Also visually inspect any engine gaskets that can cause additional air to enter the crankcase can set this fault as the PCV system is not metered. If a vacuum leak or crankcase gasket sealing is at cause, the idle may be rough or unstable. Check the Intake Manifold Sensor -GX9-. Refer to "3.6.23 Intake Manifold Sensor GX9, Checking", page 417



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none">• Pressure upstream throttle not active• And• Choice of:<ul style="list-style-type: none">• Barometric pressure > 73.00; < 107.50 kPa• Or• Barometric pressure sensor not active			





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Filtered lambda controller correction > 35.0 % Filtered lambda controller correction -50.0 – 50.0 % Lambda control active 	<ul style="list-style-type: none"> Throttle position > 4.500° TPS Engine speed > 1216; < 6000 rpm Modeled pressure quotient > 0.60; < 0.90 [-] Intake manifold modeled adaptation active Engine running Throttle actuator commanded on Time after engine start > 5.0 s Throttle position sensor failure not detected Fuel cut off not active Fast throttle adaptation finished MAP gradient -199.90 – 199.90 kPa/s BARO plausibility diagnosis finished And Choice of: MAF sensor active Or MAP sensor active And Choice of: Pressure upstream throttle < 135.00 kPa Or Pressure upstream throttle not active And Choice of: 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> BARO > 73.00; < 107.50 kPa Or Barometric pressure sensor not active 			
P2300 Ignition Coil "A" Primary Control Circuit Low	Ignition Coils Short To Ground	<ul style="list-style-type: none"> Output current in ON state (hardware values) > 50 – 100 mA 	<ul style="list-style-type: none"> Engine speed > 512 RPM ECT @ cylinder head > -30° C Engine stop not active 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .
P2301 Ignition Coil "A" Primary Control Circuit High	Ignition Coils Short To Battery Plus	<ul style="list-style-type: none"> Diagnosis by inactive low side: switch in ATIC: Output voltage in OFF state (hardware values) > 4.95 – 5.285 V 	<ul style="list-style-type: none"> Engine speed > 512 RPM Engine stop not active Actuator commanded off 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .
		<ul style="list-style-type: none"> Diagnosis by inactive low side: switch in ATIC: Output temperature from AT-IC in ON state > 160.0 – 200.0° C Or Output current in ON state (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Engine speed > 512 RPM Engine stop not active Actuator commanded on 			
P2302 Ignition Coil "A" Secondary Circuit	Ignition Coils open circuit	<ul style="list-style-type: none"> Output voltage in OFF state, lower range >= 1.92 – 2.21 V Output voltage in OFF state, upper range <= 2.85 – 3.25 V (hardware values) 	<ul style="list-style-type: none"> Engine speed > 512 RPM ECT @ cylinder head > -30° C Engine stop not active 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2303 Ignition Coil "B" Primary Control Circuit Low	Ignition Coils Short To Ground	<ul style="list-style-type: none"> Output current in ON state (hardware values) > 50 – 100 mA 	<ul style="list-style-type: none"> Engine speed > 512 RPM ECT @ cylinder head > -30° C Engine stop not active 	<ul style="list-style-type: none"> 1.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .
P2304 Ignition Coil "B" Primary Control Circuit High	Ignition Coils Short To Battery Plus	<ul style="list-style-type: none"> Diagnosis by inactive low side: switch in ATIC: Output voltage in OFF state (hardware values) > 4.95 – 5.285 V 	<ul style="list-style-type: none"> Engine speed > 512 RPM Engine stop not active Actuator commanded off 	<ul style="list-style-type: none"> 1.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .
P2305 Ignition Coil "B" Secondary Circuit	Ignition Coils open circuit	<ul style="list-style-type: none"> Diagnosis by inactive low side: switch in ATIC: Output temperature from AT-IC in ON state > 160.0 – 200.0° C Or Output current in ON state (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Engine speed > 512 RPM Engine stop not active Actuator commanded on 	<ul style="list-style-type: none"> 1.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .
P2306 Ignition Coil "C" Primary Control Circuit Low	Ignition Coils Short To Ground	<ul style="list-style-type: none"> Output voltage in OFF state, lower range >= 1.92 – 2.21 V Output voltage in OFF state, upper range <= 2.85 – 3.25 V (hardware values) 	<ul style="list-style-type: none"> Engine speed > 512 RPM ECT @ cylinder head > -30° C Engine stop not active 	<ul style="list-style-type: none"> 1.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2307 Ignition Coil "C" Primary Control Circuit High	Ignition Coils Short To Battery Plus	<ul style="list-style-type: none"> Diagnosis by inactive low side: switch in ATIC: Output voltage in OFF state (hardware values) > 4.95 – 5.285 V 	<ul style="list-style-type: none"> Engine speed > 512 RPM Engine stop not active Actuator commanded off 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .
P2308 Ignition Coil "C" Secondary Circuit	Ignition Coils open circuit	<ul style="list-style-type: none"> Diagnosis by inactive low side: switch in ATIC: Output temperature from AT-IC in ON state > 160.0 – 200.0° C Or Output current in ON state (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Engine speed > 512 RPM Engine stop not active Actuator commanded on 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .
P2309 Ignition Coil "D" Primary Control Circuit Low	Ignition Coils Short To Ground	<ul style="list-style-type: none"> Output voltage in OFF state, lower range >= 1.92 – 2.21 V Output voltage in OFF state, upper range <= 2.85 – 3.25 V (hardware values) 	<ul style="list-style-type: none"> Engine speed > 512 RPM ECT @ cylinder head > -30° C Engine stop not active 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .
P2310 Ignition Coil "D" Primary Control Circuit High	Ignition Coils Short To Battery Plus	<ul style="list-style-type: none"> Output current in ON state (hardware values) > 50 – 100 mA 	<ul style="list-style-type: none"> Engine speed > 512 RPM ECT @ cylinder head > -30° C Engine stop not active 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to ⇒ "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Diagnosis by inactive low side: switch in ATIC: Output temperature from AT-IC in ON state > 160.0 – 200.0° C Or Output current in ON state (hardware values) driver stage internal value 	<ul style="list-style-type: none"> Engine speed > 512 RPM Engine stop not active Actuator commanded on 			
P2311 Ignition Coil "D" Secondary Circuit	Ignition Coils open circuit	<ul style="list-style-type: none"> Output voltage in OFF state, lower range >= 1.92 – 2.21 V Output voltage in OFF state, upper range <= 2.85 – 3.25 V (hardware values) 	<ul style="list-style-type: none"> Engine speed > 512 RPM ECT @ cylinder head > -30° C Engine stop not active 	<ul style="list-style-type: none"> 1.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Ignition Coils with Power Output Stage . Refer to "3.6.20 Ignition Coils with Power Output Stage , Checking", page 409



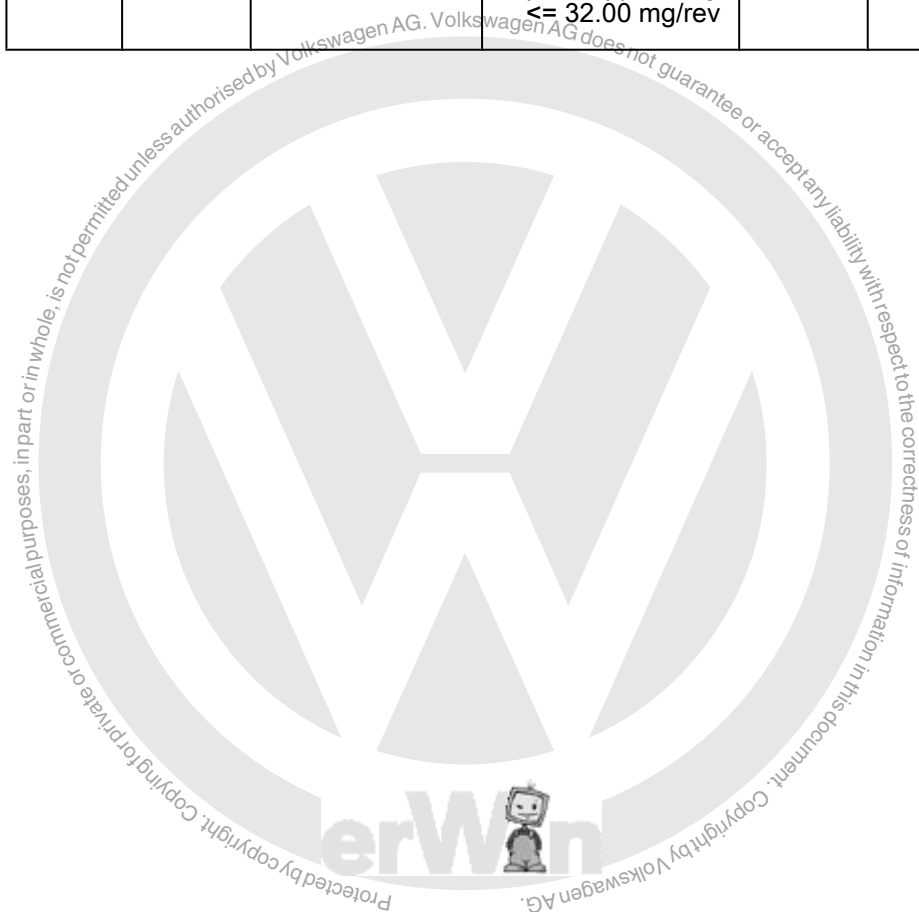
DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P230A Cylinder 1 Air-Fuel Ratio Imbalance - Adjustment At Limit During Balance	Fuel System A/F imbalance: rationality check	<ul style="list-style-type: none"> Cylinder misfire counter > 2.00 [-] 	<ul style="list-style-type: none"> Fuel pressure setpoint not calibrated kPa Modeled catalyst temperature @ start $\leq 850^{\circ}\text{C}$ Lambda set value 0.97 – 1.03 [-] Catalyst heating not active Engine roughness signal valid Fuel cut off not active AAT $\geq -48^{\circ}\text{C}$ Barometric pressure ≥ 73.00 kPa And Min. injection time not reached And Choice of: Catalyst diagnosis n.a. Or Catalyst diagnosis n.a. Depending on catalyst diagnosis: Canister purge (conditions) n.a. Or Evap purge valve n.a. Or Evap purge n.a. And O2S dynamic diagnosis n.a. O2S delay diagnosis n.a. Lambda control closed loop Catalyst purge not active 	<ul style="list-style-type: none"> 90 (does not run in FTP) s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6/15 Fuel Injectors Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Canister load ≤ 2.00 [-] Engine no full load Segment adaptation finished Catalyst damaging misfire not detected Emission threshold misfire not detected No gear switch for segments ≥ 90.00 [-] Segments after start > 0.00 [-] Time after engine start > 0.0 [s] Rough road not detected And Min. fuel mass ≥ 0.00 [mg/rev] Intake manifold runner flap position change not active Injection mode change (DFI/MFI) not equipped Valve lift position change not active And Depending on gear 1st gear not active 2nd gear not active 3rd gear not active 4th gear active 5th gear active 6th gear active 7th gear active 8th gear not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • And • Integrated air mass $\geq 1.00 - 12.00$ kg • Diff. engine speed vs. dynamic engine speed < 200 rpm • Diff. air mass vs. dynamic air mass < 29.99 mg/rev • ECT @ cylinder head $60 - 143^{\circ}$ C • Adaptation cycles ≤ 255.00 [-] • Engine speed $1,312 - 3,008$ rpm • And • Fuel mass set-point lower range ≥ 11.00 mg/rev • Fuel mass set-point upper range ≤ 32.00 mg/rev 			





DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P230B Cylinder 2 Air-Fuel Ratio Imbalance - Adjustment At Limit During Balance	Fuel System A/F imbalance: rationality check	<ul style="list-style-type: none"> Cylinder misfire counter > 2.00 [-] 	<ul style="list-style-type: none"> Fuel pressure setpoint not calibrated kPa Modeled catalyst temperature @ start ≤ 850° C Lambda set value 0.97 – 1.03 [-] Catalyst heating not active Engine roughness signal valid Fuel cut off not active AAT ≥ -48° C Barometric pressure ≥ 73.00 kPa And Min. injection time not reached And Choice of: Catalyst diagnosis n.a. Or Catalyst diagnosis n.a. Depending on catalyst diagnosis: Canister purge (conditions) n.a. Or Evap purge valve n.a. Or Evap purge n.a. And O2S dynamic diagnosis n.a. O2S delay diagnosis n.a. Lambda control closed loop Catalyst purge not active 	<ul style="list-style-type: none"> 90 (does not run in FTP) s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Canister load ≤ 2.00 [-] Engine no full load Segment adaptation finished Catalyst damaging misfire not detected Emission threshold misfire not detected No gear switch for segments ≥ 90.00 [-] Segments after start > 0.00 [-] Time after engine start > 0.0 s Rough road not detected And Min. fuel mass ≥ 0.00 mg/rev Intake manifold runner flap position change not active Injection mode change (DFI/MFI) not equipped Valve lift position change not active And Depending on gear 1st gear not active 2nd gear not active 3rd gear not active 4th gear active 5th gear active 6th gear active 7th gear active 8th gear not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • And • Integrated air mass $\geq 1.00 - 12.00$ kg • Diff. engine speed vs. dynamic engine speed < 200 rpm • Diff. air mass vs. dynamic air mass < 29.99 mg/rev • ECT @ cylinder head $60 - 143^{\circ}$ C • Adaptation cycles ≤ 255.00 [-] • Engine speed $1,312 - 3,008$ rpm • And • Fuel mass set-point lower range ≥ 11.00 mg/rev • Fuel mass set-point upper range ≤ 32.00 mg/rev 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P230C Cylinder 3 Air-Fuel Ratio Imbalance - Adjustment At Limit During Balance	Fuel System A/F imbalance: rationality check	<ul style="list-style-type: none"> Cylinder misfire counter > 2.00 [-] 	<ul style="list-style-type: none"> Fuel pressure set point not calibrated kPa Modeled catalyst temperature @ start ≤ 850° C Lambda set value 0.97 – 1.03 [-] Catalyst heating not active Engine roughness signal valid Fuel cut off not active AAT ≥ -48° C Barometric pressure ≥ 73.00 kPa And Min. injection time not reached And Choice of: <ul style="list-style-type: none"> Catalyst diagnosis n.a. Or Catalyst diagnosis n.a. Depending on catalyst diagnosis: <ul style="list-style-type: none"> Canister purge (conditions) n.a. Or Evap purge valve n.a. Or Evap purge n.a. And O2S dynamic diagnosis n.a. O2S delay diagnosis n.a. Lambda control closed loop Catalyst purge not active 	<ul style="list-style-type: none"> 90 (does not run in FTP) s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to ⇒ "3.6.15 Fuel Injectors, Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> Canister load ≤ 2.00 [-] Engine no full load Segment adaptation finished Catalyst damaging misfire not detected Emission threshold misfire not detected No gear switch for segments ≥ 90.00 [-] Segments after start > 0.00 [-] Time after engine start > 0.0 s Rough road not detected And Min. fuel mass ≥ 0.00 mg/rev Intake manifold runner flap position change not active Injection mode change (DFI/MFI) not equipped Valve lift position change not active And Depending on gear 1st gear not active 2nd gear not active 3rd gear not active 4th gear active 5th gear active 6th gear active 7th gear active 8th gear not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • And • Integrated air mass $\geq 1.00 - 12.00$ kg • Diff. engine speed vs. dynamic engine speed < 200 rpm • Diff. air mass vs. dynamic air mass < 29.99 mg/rev • ECT @ cylinder head $60 - 143^{\circ} \text{C}$ • Adaptation cycles ≤ 255.00 [-] • Engine speed $1,312 - 3,008$ rpm • And • Fuel mass set-point lower range ≥ 11.00 mg/rev • Fuel mass set-point upper range ≤ 32.00 mg/rev 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P230D Cylinder 4 Air-Fuel Ratio Imbalance - Adjustment At Limit During Balance	Fuel System A/F imbalance: rationality check	<ul style="list-style-type: none"> Cylinder misfire counter > 2.00 [-] 	<ul style="list-style-type: none"> Fuel pressure setpoint not calibrated kPa Modeled catalyst temperature @ start ≤ 850° C Lambda set value 0.97 – 1.03 [-] Catalyst heating not active Engine roughness signal valid Fuel cut off not active AAT ≥ -48° C Barometric pressure ≥ 73.00 kPa And Min. injection time not reached And Choice of: Catalyst diagnosis n.a. Or Catalyst diagnosis n.a. Depending on catalyst diagnosis: Canister purge (conditions) n.a. Or Evap purge valve n.a. Or Evap purge n.a. And O2S dynamic diagnosis n.a. O2S delay diagnosis n.a. Lambda control closed loop Catalyst purge not active 	<ul style="list-style-type: none"> 90 (does not run in FTP) s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Injectors . Refer to "3.6.15 Fuel Injectors Checking", page 396 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • Canister load ≤ 2.00 [-] • Engine no full load • Segment adaptation finished • Catalyst damaging misfire not detected • Emission threshold misfire not detected • No gear switch for segments ≥ 90.00 [-] • Segments after start > 0.00 [-] • Time after engine start > 0.0 s • Rough road not detected • And • Min. fuel mass ≥ 0.00 mg/rev • Intake manifold runner flap position change not active • Injection mode change (DFI/MFI) not equipped • Valve lift position change not active • And • Depending on gear • 1st gear not active • 2nd gear not active • 3rd gear not active • 4th gear active • 5th gear active • 6th gear active • 7th gear active • 8th gear not active 			



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			<ul style="list-style-type: none"> • And • Integrated air mass $\geq 1.00 - 12.00$ kg • Diff. engine speed vs. dynamic engine speed < 200 rpm • Diff. air mass vs. dynamic air mass < 29.99 mg/rev • ECT @ cylinder head $60 - 143^{\circ}$ C • Adaptation cycles ≤ 255.00 [-] • Engine speed $1,312 - 3,008$ rpm • And • Fuel mass set-point lower range ≥ 11.00 mg/rev • Fuel mass set-point upper range ≤ 32.00 mg/rev 			
P2414 O2 Sensor Exhaust Sample Error Bank 1 Sensor 1	Oxygen Sensors Front Rationality Check	<ul style="list-style-type: none"> • Pump current correction (nernst-cell) > 1.2 mA 	<ul style="list-style-type: none"> • O2S front ready • Fuel cut off not active • injection mode change (DFI/MFI) off not active • Depending on engine state: • Engine part load • Or • Engine full load • Or • Engine idle for time ≥ 3.0 s 	<ul style="list-style-type: none"> • 10.0 s • Continuous 	<ul style="list-style-type: none"> • 2 DCY 	<ul style="list-style-type: none"> – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to 3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking, page 430 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2431 AIR System Air Flow/ Pressure Sensor Circuit Range/ Performance Bank 1	Secondary Air System Pressure Sensor Rationality Check	<ul style="list-style-type: none"> Difference between AIR pressure and barometric pressure > 6.0 kPa And Difference between AIR pressure and intake manifold pressure > 6.0 kPa 	<ul style="list-style-type: none"> Engine stop For time > 0.0 s 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ "3.6.30 Secondary Air Injection Sensor 1 G609 / Secondary Air Injection Solenoid Valve N112 , Checking", page 436 .
P2432 AIR System Air Flow/ Pressure Sensor Circuit Low Bank 1	Secondary Air System Pressure Sensor Out Of Range Low	<ul style="list-style-type: none"> Sensor voltage < 0.50 V 		<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ "3.6.30 Secondary Air Injection Sensor 1 G609 / Secondary Air Injection Solenoid Valve N112 , Checking", page 436 .
P2433 AIR System Air Flow/ Pressure Sensor Circuit High Bank 1	Secondary Air System Pressure Sensor Out Of Range High	<ul style="list-style-type: none"> Sensor voltage > 4.50 V 		<ul style="list-style-type: none"> 0.1 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ "3.6.30 Secondary Air Injection Sensor 1 G609 / Secondary Air Injection Solenoid Valve N112 , Checking", page 436 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2440 AIR System Switching Valve Stuck Open Bank 1	Secondary Air Valve Functional Check	<ul style="list-style-type: none"> Ratio relative pressure phase 1 and relative pressure phase 2 > 1.34 [-] 	<ul style="list-style-type: none"> General: Secondary air pump active Catalyst heating active Secondary air injection active MAF <= 140.0 kg/h ECT @ cylinder head >= -10; < 115° C IAT @ manifold >= -10; < 100° C Modeled catalyst temperature < 900° C Relative barometric pressure > 0.73 [-] And Diff. barometric pressure vs. manifold pressure > n.a. kPa Or Engine n.a. 	<ul style="list-style-type: none"> 0.1 s Once / DCY 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ "3.6.30 Secondary Air Injection Sensor 1 G609 / Secondary Air Injection Solenoid Valve N112 , Checking", page 436 .
P2556 Engine Coolant Level Sensor/ Switch Circuit	Engine Cooling System: Bypass Valve Communication Check	<ul style="list-style-type: none"> Communication signal failure 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Temperature Control Actuator - N493- . Refer to ⇒ "3.6.12 Engine Temperature Control Actuator N493 , Checking", page 388 .
	Engine Cooling System: Bypass Valve Signal Check	<ul style="list-style-type: none"> Sensor signal failure 				
P2557 Engine Coolant Level Sensor/ Switch Circuit Range/ Performance	Engine Cooling System: Bypass Valve Checksum Verification	<ul style="list-style-type: none"> Checksum signal failure 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Temperature Control Actuator - N493- . Refer to ⇒ "3.6.12 Engine Temperature Control Actuator N493 , Checking", page 388 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2564 Turbocharger Boost Control Position Sensor "A" Circuit Low	Turbocharger Position Sensor Short To Ground / Open Circuit	<ul style="list-style-type: none"> Turbocharger boost control position sensor voltage < 0.20 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- . Refer to ⇒ "3.6.7 Charge Pressure Actuator V465 / Charge Pressure Actuator Position Sensor G581 , Checking", page 374 .
P2565 Turbocharger Boost Control Position Sensor "A" Circuit High	Turbocharger Boost Control Position Sensor Short To Battery Voltage	<ul style="list-style-type: none"> Turbocharger boost control position sensor voltage > 4.80 V 		<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- . Refer to ⇒ "3.6.7 Charge Pressure Actuator V465 / Charge Pressure Actuator Position Sensor G581 , Checking", page 374 .
P2610 ECM/PCM Engine Off Timer Performance	Engine Off Time ECM Internal Timer Check	<ul style="list-style-type: none"> ECM internal timer failure Or ECM internal timer signal not calibrated ECM internal timer not calibrated Time after last engine stop not calibrated 	<ul style="list-style-type: none"> SPI initialization finished 	<ul style="list-style-type: none"> 1.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Control Module - J623- . Refer to appropriate repair manual.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Engine Off Time ECM Rationality Check	<ul style="list-style-type: none"> Difference between engine-off-time and ECM keep alive-time ≥ 12.0 s 	<ul style="list-style-type: none"> Monitor Entry Conditions: ECM keep alive-time active Delay time ≥ 1.0 s Last ECM activation time ≥ 2.0 s Time delay ≥ 1.0 s Time after last engine stop < 48 [h] Case 1: For time (after entry conditions fulfilled) ≥ 65 s Case 2: For time (after entry conditions fulfilled) < 65 s Ignition key transition off to on 	<ul style="list-style-type: none"> 10 ms Once / DCY 		
		<ul style="list-style-type: none"> Difference between ECM keep alive-time and engine-off-time ≥ 12.0 s 	<ul style="list-style-type: none"> Time after last ignition off < 24.00 [h] Time after ECM wake up < 2.0 [s] SPI initialization finished 			
P2635 Fuel Pump Control Module Performance	COM: Fuel Pump Control Module (FPCM) communication with FPCM	<ul style="list-style-type: none"> FP signal: overcurrent failure feedback ≥ 2.00 [-] FP signal: rotary failure feedback ≥ 2.00 [-] FP sensor: short to battery failure or rpm deviation feedback ≥ 2.00 [-] 	<ul style="list-style-type: none"> Engine on 	<ul style="list-style-type: none"> 1.6 s Continuous 1.8 s Continuous 2.4 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Fuel Delivery Unit - GX1- / Fuel Pump Control Module - J538- . Refer to "3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1, Checking", page 404 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2681 Engine Coolant Bypass Valve "A" Control Circuit/ Open	Engine Cooling System: Bypass Valve Open Circuit	<ul style="list-style-type: none"> Load resistance > 200.0 kOhm 	<ul style="list-style-type: none"> Rotary slide valve commanded off 	<ul style="list-style-type: none"> 1.3 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Temperature Control Actuator - N493- . Refer to ⇒ "3.6.12 Engine Temperature Control Actuator N493, Checking", page 388 .
P2682 Engine Coolant Bypass Valve "A" Control Circuit Low	Engine Cooling System: Bypass Valve Short To Ground Engine Cooling System: Bypass Valve Short To Ground	<ul style="list-style-type: none"> High side current output 1 driver stage internal value High side current output 2 driver stage internal value 	<ul style="list-style-type: none"> Rotary slide valve commanded on Rotary valve direction forward Rotary slide valve commanded on Rotary valve direction reversed 	<ul style="list-style-type: none"> 0.30 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Temperature Control Actuator - N493- . Refer to ⇒ "3.6.12 Engine Temperature Control Actuator N493, Checking", page 388 .
P2683 Engine Coolant Bypass Valve "A" Control Circuit High	Rotary Coolant Valve Short To Battery Plus Rotary Coolant Valve Short To Battery Plus	<ul style="list-style-type: none"> Low side current output 1 driver stage internal value Low side current output 2 driver stage internal value 	<ul style="list-style-type: none"> Rotary slide valve commanded off Rotary slide valve commanded off 	<ul style="list-style-type: none"> 0.30 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Engine Temperature Control Actuator - N493- . Refer to ⇒ "3.6.12 Engine Temperature Control Actuator N493, Checking", page 388 .
P334A Charge Pressure Actuator Electrical Error	Turbo-charger Boost Pressure Control Short Circuit	<ul style="list-style-type: none"> Bypass valve driver current driver stage internal value 	<ul style="list-style-type: none"> Boost pressure actuator controller active 	<ul style="list-style-type: none"> 0.4 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- . Refer to ⇒ "3.6.7 Charge Pressure Actuator V465 / Charge Pressure Actuator Position Sensor G581, Checking", page 374 .



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
U0001 High Speed CAN Communication Bus	CAN: Power-train BUS reading back sent message Power-train	<ul style="list-style-type: none"> Message no feedback 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U0002 High Speed CAN Communication Bus Performance	CAN: Power-train BUS communication check Power-train	<ul style="list-style-type: none"> Global time out receiving no message 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U0101 Lost Communication with TCM	CAN: Transmission Control Module (TCM) CAN Communication With TCM	<ul style="list-style-type: none"> Received message from TCM no message 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 1.0 s 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U0121 Lost Communication With Anti-Lock Brake System (ABS) Control Module	CAN: Brake System Control Module (BSCM) communication with BSCM	<ul style="list-style-type: none"> Received CAN message no message 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 0.5 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
U0140 Lost Communication With Body Control Module	CAN: Body Control Module (BCM) CAN Communication With Body Control Module	<ul style="list-style-type: none"> Received message no message 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U0146 Lost Communication With Gateway "A"	CAN: Gateway CAN Communication With Gateway	<ul style="list-style-type: none"> Message no message 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 1.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U0155 Lost Communication With Instrument Panel Cluster (IPC) Control Module	CAN: Instrument Cluster CAN Communication With Instrument Cluster Module	<ul style="list-style-type: none"> Message no message 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U0302 Software Incompatibility With Transmission Control Module	COM: Transmission Control Module (TCM) communication with TCM	<ul style="list-style-type: none"> Received AT vehicle data from TCM, TCM signal 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 5.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check for software updates and TSB's. Reprogram as necessary. If none are found, refer to appropriate repair manual.
U0322 Software Incompatibility With Body Control Module	CAN: Gateway CAN Communication With Gateway	<ul style="list-style-type: none"> Ambient temperature sensor coding monitoring failure 	<ul style="list-style-type: none"> Time after ignition on > 1.5 s 	<ul style="list-style-type: none"> 2.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
U0415 Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	Vehicle Speed Rationality Check High	<ul style="list-style-type: none"> Vehicle speed > 202 mph 		<ul style="list-style-type: none"> 2.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to appropriate repair manual for the ABS. Refer to the proper wiring schematic for terminal and component location.
	CAN: Vehicle Speed Sensor CAN communication with BSCM	<ul style="list-style-type: none"> Speed sensor signal: sensor error =655,35 km/h (no map, just bottom and top limit) 	<ul style="list-style-type: none"> Time since engine on > 0.5 s 	<ul style="list-style-type: none"> 0.5 s Continuous 		
		<ul style="list-style-type: none"> Speed sensor signal: initialization error =655,33 – 655,34 km/h (no map, just bottom and top limit) 	<ul style="list-style-type: none"> Time since engine running > 0.5 s Vehicle speed < 7 mph 	<ul style="list-style-type: none"> 2.0 s Continuous 		
		<ul style="list-style-type: none"> Speed sensor signal: low voltage error =655,33 – 655,34 km/h (no map, just bottom and top limit) 	<ul style="list-style-type: none"> Time since engine running > 0.5 s Vehicle speed > 7 mph 	<ul style="list-style-type: none"> 0.5 s Continuous 		
	CAN: Brake System Control Module (BSCM) CAN Communication With Brake Unit	<ul style="list-style-type: none"> Received data from TCS implausible message 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 0.5 s Continuous 		
U0422 Invalid Data Received From Body Control Module	CAN: Gateway CAN communication with BCM	<ul style="list-style-type: none"> Received data from BCM implausible message 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 1.0 s Continuous 	2 DCY	<ul style="list-style-type: none"> Check the Outside Air Temperature Sensor - G17- . Refer to "3.6.26 Outside Air Temperature Sensor G17, Checking", page 425 . Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		<ul style="list-style-type: none"> Ambient temperature value (initialization) failure 	<ul style="list-style-type: none"> Time after ignition on > 1.5 s Engine running 	<ul style="list-style-type: none"> 3.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	component location.
U0423 Invalid Data Received From Instrument Panel Cluster Control Module	CAN: Instrument Cluster CAN Communication With Instrument Cluster Module	<ul style="list-style-type: none"> Received data from Instrument Cluster implausible message 	<ul style="list-style-type: none"> Time after ignition on 0.5 s 	<ul style="list-style-type: none"> 3.0 s Continuous 	<ul style="list-style-type: none"> 2 DCY 	<ul style="list-style-type: none"> Check the CAN-Bus circuits. If there are any other DTC's present check them first. Refer to the proper wiring schematic for terminal and component location.
U1103 Production Mode Active	ECM: Production Mode Function Monitoring Mode Change	<ul style="list-style-type: none"> Production mode active 	<ul style="list-style-type: none"> Vehicle speed < 3 mph Max trip mileage since initial vehicle start-up < 62.15 miles During ECM keep alive-time after ignition off engine speed 0 rpm <p>For hybrid:</p> <ul style="list-style-type: none"> Drive motor off 	<ul style="list-style-type: none"> 0.01 s Continuous 	<ul style="list-style-type: none"> 1 DCY 	<ul style="list-style-type: none"> PERFORM: Preliminary Check to verify the concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . Perform readiness check. Refer to ⇒ "3.2 Readiness Code", page 19 .

3.5 Transmission DTC Tables

- ◆ ⇒ ["3.5.1 Transmission Mechatronic , DSG 6-spd 02E \(2015 MY\)", page 297](#)
- ◆ ⇒ ["3.5.2 Transmission Mechatronic , DSG 6-spd 02E \(2016 MY\)", page 327](#)



3.5.1 Transmission Mechatronic , DSG 6-spd 02E (2015 MY)

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0219	Engine Overspeed Condition	<ul style="list-style-type: none"> signal range check 	<ul style="list-style-type: none"> rotational speed of gearbox input shaft exceed a maximum value 	<ul style="list-style-type: none"> rotational speed > 12000 rpm 	<ul style="list-style-type: none"> terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 500 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0501	Vehicle Speed Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> plausibility check 	<ul style="list-style-type: none"> calculate the speed of input shaft with the gear ratio of engaged gear on input shaft and the output shaft speed. compare the calculated speed with measured speed of input shaft 	<ul style="list-style-type: none"> speed difference magnitude > 330 rpm (output speed = 500rpm)... 100 rpm (output speed >= 2000 rpm) 	<ul style="list-style-type: none"> gear on input shaft engaged no valid CAN output speed information output speed > 25 rpm OR speed of input shaft > 1000 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0701	Transmission Control System Range/Performance	<ul style="list-style-type: none"> signal range check 	<ul style="list-style-type: none"> travel sensor voltage gearshift fork 1/3 out of plausibility range travel sensor voltage gearshift fork 2/4 out of plausibility range travel sensor voltage gearshift fork 5/N out of plausibility range 	<ul style="list-style-type: none"> voltage < 100 mV OR voltage > 4900mV 		<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			<ul style="list-style-type: none"> travel sensor voltage gearshift fork 6/R out of plausibility range 				
P0702	Transmission Control System Electrical	<ul style="list-style-type: none"> plausibility check 	<ul style="list-style-type: none"> In spite of cut off Common High-side Switch 1 a measurable current. In spite of turned on Common High-side Switch 1 no current measurable. 	<ul style="list-style-type: none"> CHS1 cut off and CHS1-Current > 40 mA CHS1 turned on and CHS1-Current < 200 mA 	<ul style="list-style-type: none"> one time after reset terminal 15 voltage < 18 V no short-circuit current check failure of CHS1 common high-side switch 1 voltage > 9.2V gearbox subsystem 1 active common high-side switches not deactivated by module 2 	300 ms	<ul style="list-style-type: none"> 2 driving cycles
			<ul style="list-style-type: none"> In spite of cut off Common High-side Switch 2 a measurable current. In spite of turned on Common High-side Switch 2 no current measurable. 	<ul style="list-style-type: none"> CHS2 cut off and CHS2-Current > 40 mA CHS2 turned on and CHS2-Current < 200 mA 	<ul style="list-style-type: none"> one time after reset terminal 15 voltage < 18 V no short-circuit current check failure of CHS2 common high-side switch 2 voltage > 9.2V gearbox subsystem 2 active common high-side switches not deactivated by module 2 		



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			<ul style="list-style-type: none"> In spite of cut off Common High-side Switch 3 a measurable current. In spite of turned on Common High-side Switch 3 no current measurable. 	<ul style="list-style-type: none"> CHS3 cut off and CHS3-Current > 40 mA CHS3 turned on and CHS3-Current < 200 mA 	<ul style="list-style-type: none"> one time after reset terminal 15 voltage < 18 V no short-circuit current check failure of CHS3 and main pressure solenoid valve common high-side switch 1 and 2 voltage > 9.2V common high-side switches not deactivated by module 2 		
P0717	Input/Turbine Shaft Speed Sensor "A" Circuit No Signal	<ul style="list-style-type: none"> plausibility check 	<ul style="list-style-type: none"> calculate the speed of input shaft 1 with the gear ratio of engaged gear on input shaft 1 and the output shaft speed. compare the calculated speed with measured speed of input shaft 1 	<ul style="list-style-type: none"> speed difference magnitude > 330 rpm (output speed = 500rpm)... 100 rpm (output speed >= 2000 rpm) 	<ul style="list-style-type: none"> gear engaged on input shaft 1 valid CAN output speed information speed of input shaft 1 < 25 rpm output speed > 25 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	900 ms	2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			<ul style="list-style-type: none"> calculate the speed of input shaft 2 with the gear ratio of engaged gear on input shaft 2 and the output shaft speed. compare the calculated speed with measured speed of input shaft 2 		<ul style="list-style-type: none"> gear engaged on input shaft 2 valid CAN output speed information speed of input shaft 2 < 25 rpm output speed > 25 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 		
P0729	Gear 6 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage sixth gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 2 multiplexer position = 0 control gear-shift fork valve 3 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 2 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0731	Gear 1 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage first gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 1 multiplexer position = 0 control gear-shift fork valve 1 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 1 	<ul style="list-style-type: none"> 2 driving cycles
P0732	Gear 2 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage second gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 2 multiplexer position = 1 control gear-shift fork valve 3 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 2 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0733	Gear 3 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage third gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 1 multiplexer position = 0 control gear-shift fork valve 2 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 1 	<ul style="list-style-type: none"> 2 driving cycles
P0734	Gear 4 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage fourth gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 2 multiplexer position = 1 control gear-shift fork valve 4 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 2 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0735	Gear 5 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gearshift fork was controlled to engage fifth gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 1 multiplexer position = 1 control gearshift fork valve 1 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 1 	<ul style="list-style-type: none"> 2 driving cycles
P0736	Reverse Incorrect Ratio	<ul style="list-style-type: none"> unable to disengage the reverse gear 	<ul style="list-style-type: none"> gearshift fork of reverse gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position < synchronizing point reverse gear - 10% synchronizing point measured by a basic adjustment (reverse gear stays in shifted position) control gearshift fork 	<ul style="list-style-type: none"> control safety valve 2 (ON) >= 20% multiplexer position = 0 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 6000 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage reverse gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch multiplexer position = 0 control gear-shift fork valve 4 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 		
P0746	Pressure Control Solenoid "A" Performance/Stuck Off	<ul style="list-style-type: none"> pressure integral monitoring 	<ul style="list-style-type: none"> integral of actual pressure minus desired pressure minus drain exceeds a maximum value 	<ul style="list-style-type: none"> pressure integral >= 0,1 bars 	<ul style="list-style-type: none"> desired pressure <= adapted clutch slipping point + 1 bar standing vehicle with accelerator pedal < 0.1% battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> desired valve current of clutch 1 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold 	<ul style="list-style-type: none"> desired current > 350 mA actual current < 50 mA 	<ul style="list-style-type: none"> common high-side switch 1 on, not defect and voltage > 9.2 V gearbox sub-system 1 active common high-side switches not deactivated by module 2 terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 		
P0747	Pressure Control Solenoid "A" Stuck On	<ul style="list-style-type: none"> pressure buildup monitoring 	<ul style="list-style-type: none"> the number of successive pressure buildup failure of clutch 1 reaches a maximum value 	<ul style="list-style-type: none"> counter > 2 	<ul style="list-style-type: none"> engaged gear on input shaft 1 desired pressure > adapted clutch slipping point – 0.2 bar output speed < 200 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 0 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none">short-circuit current check	<ul style="list-style-type: none">comparison of actual valve current with desired valve current of clutch 1	<ul style="list-style-type: none">actual current > desired current and (actual current - desired current) > 200 mA for more than 200 ms	<ul style="list-style-type: none">common high-side switch 1 on, not defect and voltage > 9.2 Vgearbox sub-system 1 activecommon high-side switches not deactivated by module 2terminal 15 voltage > 9 V for more than 500 msengine speed > 500 rpm	<ul style="list-style-type: none">200 ms	



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0751	Shift Solenoid "A" Performance/Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 – actual current of clutch 1) at switching point of control gearshift fork valve 1 with residual current at permanent control of control gearshift fork valve 1 	<ul style="list-style-type: none"> difference of residual current ≤ 200 mA (supply voltage at common high-side 1 = 7 V) .. 450 mA (supply voltage at common high-side 1 = 13 V) 	<ul style="list-style-type: none"> common high-side switch 1 on, not defect and voltage > 9.2 V gearbox subsystem 1 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor change of safety valve 1 (control of safety valve 1 is stable) $\leq 5\%$ duty factor change of gearshift fork valve 2 (control of gearshift fork valve 2 is stable) $\leq 5\%$ duty factor change of safety valve 2 $> 70\%$ control of safety valve 2 is stable ≥ 50 ms duty factor change of gearshift > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0756	Shift Solenoid "B" Performance/Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 – actual current of clutch 1) at switching point of control gearshift fork valve 2 with residual current at permanent control of control gearshift fork valve 2 	<ul style="list-style-type: none"> difference of residual current ≤ 200 mA (supply voltage at common high-side 1=7 V) .. 450 mA (supply voltage at common high-side 1=13 V) 	<ul style="list-style-type: none"> common high-side switch 1 on, not defect and voltage > 9.2 V gearbox subsystem 1 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor change of safety valve 1 (control of safety valve 1 is stable) $\leq 5\%$ duty factor change of gearshift fork valve 1 (control of gearshift fork valve 1 is stable) $\leq 5\%$ duty factor of control gearshift fork valve 2 $> 70\%$ and steady state time ≥ 50ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0761	Shift Solenoid "C" Performance/Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 – actual current of clutch 2) at switching point of control gearshift fork valve 3 with residual current at permanent control of control gearshift fork valve 3 	<ul style="list-style-type: none"> difference of residual current ≤ 200 mA (supply voltage at common high-side 2 = 7 V) .. 450 mA (supply voltage at common high-side 2 = 13 V) 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage > 9.2 V gearbox subsystem 2 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor change of safety valve 2 $\leq 5\%$ (control of safety valve 2 is stable) duty factor change of gearshift fork valve 4 $\leq 5\%$ (control of gearshift fork valve 4 is stable) duty factor of control gearshift fork valve 3 $> 70\%$ and steady state time ≥ 50 ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0766	Shift Solenoid "D" Performance/Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 – actual current of clutch 2) at switching point of control gearshift fork valve 4 with residual current at permanent control of control gearshift fork valve 4 	<ul style="list-style-type: none"> difference of residual current ≤ 200 mA (supply voltage at common high-side 2=7 V) .. 450 mA (supply voltage at common high-side 2=13 V) 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage > 9.2 V gearbox subsystem 2 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor change of safety valve 2 $\leq 5\%$ (control of safety valve 2 is stable) duty factor change of gearshift fork valve 3 $\leq 5\%$ (control of gearshift fork valve 3 is stable) duty factor of control gearshift fork valve 4 $> 70\%$ and steady state time ≥ 50 ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0771	Shift Solenoid "E" Performance/Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of central control (total current at common high-side switch 3 – actual current of main pressure valve and cooling oil valve) at switching point of multiplexer valve with residual current at permanent control of multiplexer valve 	<ul style="list-style-type: none"> difference of residual current ≤ 150 mA (maximum of supply voltage at common high-side 1,2 and terminal 15 $= 7$ V) .. 300 mA (maximum of supply voltage at common high-side 1,2 and terminal 15 $= 13$ V) 	<ul style="list-style-type: none"> common high-side switch 3 on and not defect no short-circuit current check failure of main pressure solenoid valve common high-side switch 1 and 2 voltage > 9.2 V common high-side switches not deactivated by module 2 change of supply voltage < 1 V multiplexer valve is controlled and steady state time ≥ 50 ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 		



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0776	Pressure Control Solenoid "B" Performance/Stuck Off	<ul style="list-style-type: none"> pressure integral monitoring 	<ul style="list-style-type: none"> integral of actual pressure minus desired pressure minus drain exceeds a maximum value 	<ul style="list-style-type: none"> pressure integral $\geq 0,1$ bars 	<ul style="list-style-type: none"> desired pressure \leq adapted clutch slipping point + 1 bar standing vehicle with accelerator pedal $< 0.1\%$ battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	300 ms	2 driving cycles
		<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> desired valve current of clutch 2 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold 	<ul style="list-style-type: none"> desired current > 350 mA actual current < 50 mA 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage > 9.2 V gearbox subsystem 2 active common high-side switches not deactivated by module 2 terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 		



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0777	Pressure Control Solenoid "B" Stuck On	<ul style="list-style-type: none"> pressure buildup monitoring 	<ul style="list-style-type: none"> the number of successive pressure buildup failure of clutch 2 reaches a maximum value 	<ul style="list-style-type: none"> counter > 2 	<ul style="list-style-type: none"> engaged gear on input shaft 2 desired pressure > adapted clutch slipping point - 0.2 bar output speed < 200 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 0 ms 	<ul style="list-style-type: none"> 2 driving cycles
		<ul style="list-style-type: none"> short-circuit current check 	<ul style="list-style-type: none"> comparison of actual valve current with desired valve current of clutch 2 	<ul style="list-style-type: none"> actual current > desired current and (actual current - desired current) > 200 mA for more than 200 ms 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage > 9.2 V gearbox subsystem 2 active common high-side switches not deactivated by module 2 terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 200 ms 	



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0781	1-2 Shift	<ul style="list-style-type: none"> unable to disengage the first gear 	<ul style="list-style-type: none"> gearshift fork of first gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position > synchronizing point first gear + 10% synchronizing point measured by a basic adjustment (first gear stays in shifted position) control gearshift fork valve 2 >= 5% 	<ul style="list-style-type: none"> control safety valve 1 (ON) >= 20% multiplexer position = 0 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	6000 ms	2 driving cycles
P0782	2-3 Shift	<ul style="list-style-type: none"> unable to disengage the second gear 	<ul style="list-style-type: none"> gearshift fork of second gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position < synchronizing point second gear - 10% synchronizing point measured by a basic adjustment (second gear stays in shifted position) control gearshift fork valve 4 >= 5% 	<ul style="list-style-type: none"> control safety valve 1 (ON) >= 20% multiplexer position = 1 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	6000 ms	2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0783	3-4 Shift	<ul style="list-style-type: none"> unable to disengage the third gear 	<ul style="list-style-type: none"> gearshift fork of third gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position < synchronizing point third gear - 10% synchronizing point measured by a basic adjustment (third gear stays in shifted position) control gearshift fork valve 1 >= 5% 	<ul style="list-style-type: none"> control safety valve 1 (ON) >= 20% multiplexer position = 0 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	6000 ms	<ul style="list-style-type: none"> 2 driving cycles
P0784	4-5 Shift	<ul style="list-style-type: none"> unable to disengage the fourth gear 	<ul style="list-style-type: none"> gearshift fork of fourth gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position > synchronizing point fourth gear + 10% synchronizing point measured by a basic adjustment (fourth gear stays in shifted position) control gearshift fork valve 3 >= 5% 	<ul style="list-style-type: none"> control safety valve 2 (ON) >= 20% multiplexer position = 1 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	6000 ms	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0791	Intermediate Shaft Speed Sensor "A" Circuit	<ul style="list-style-type: none"> signal range check 	<ul style="list-style-type: none"> rotational speed of input shaft 1 exceed a maximum value rotational speed of input shaft 2 exceed a maximum value 	<ul style="list-style-type: none"> rotational speed > 12000 rpm 	<ul style="list-style-type: none"> terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 100 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0797	Pressure Control Solenoid "C" Stuck On	<ul style="list-style-type: none"> short-circuit current check 	<ul style="list-style-type: none"> comparison of actual valve current with desired valve current of main pressure solenoid valve 	<ul style="list-style-type: none"> actual current > desired current and (actual current - desired current) > 200 mA for more than 300 ms 	<ul style="list-style-type: none"> common high-side switch 3 on and not defect common high-side switch 1 and 2 voltage > 9.2 V common high-side switches not deactivated by module 2 terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0829	5-6 Shift	<ul style="list-style-type: none"> unable to disengage the fifth gear 	<ul style="list-style-type: none"> gearshift fork of fifth gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position > synchronizing point fifth gear + 10% synchronizing point measured by a basic adjustment (fifth gear stays in shifted position) control gearshift fork valve 2 >= 5% 	<ul style="list-style-type: none"> control safety valve 1 (ON) >= 20% multiplexer position = 1 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	6000 ms	<ul style="list-style-type: none"> 2 driving cycles
		<ul style="list-style-type: none"> unable to disengage the sixth gear 	<ul style="list-style-type: none"> gearshift fork of sixth gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position > synchronizing point sixth gear + 10% synchronizing point measured by a basic adjustment (sixth gear stays in shifted position) control gearshift fork valve 4 >= 5% 	<ul style="list-style-type: none"> control safety valve 2 (ON) >= 20% multiplexer position = 0 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 		



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0840	Transmission Fluid Pressure Sensor/ Switch "A" Circuit	<ul style="list-style-type: none"> signal range check 	<ul style="list-style-type: none"> pressure sensor voltage clutch 1 out of plausibility range 	<ul style="list-style-type: none"> voltage < 100 mV OR voltage > 4900 mV 		<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0841	Transmission Fluid Pressure Sensor/ Switch "A" Circuit Range/Performance	<ul style="list-style-type: none"> overpressure monitoring 	<ul style="list-style-type: none"> hydraulic pressure of clutch 1 exceeds a maximum value 	<ul style="list-style-type: none"> pressure >= 15.5 bar 	<ul style="list-style-type: none"> signal range check is correct terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 1000 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0845	Transmission Fluid Pressure Sensor/ Switch "B" Circuit	<ul style="list-style-type: none"> pressure sensor voltage clutch 2 out of plausibility range 	<ul style="list-style-type: none"> pressure sensor voltage clutch 1 out of plausibility range 	<ul style="list-style-type: none"> voltage < 100 mV OR voltage > 4900 mV 		<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0846	Transmission Fluid Pressure Sensor/ Switch "B" Circuit Range/Performance	<ul style="list-style-type: none"> overpressure monitoring 	<ul style="list-style-type: none"> hydraulic pressure of clutch 2 exceeds a maximum value 	<ul style="list-style-type: none"> pressure >= 15.5 bar 	<ul style="list-style-type: none"> signal range check is correct terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 80 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0864	TCM Communication Circuit Range/Performance	<ul style="list-style-type: none"> buss off detection of the micro-controller 			<ul style="list-style-type: none"> terminal 15 voltage > 9 V for more than 500 ms > 500 ms after reset 	<ul style="list-style-type: none"> 1000 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0890	TCM Power Relay Sense Circuit Low	<ul style="list-style-type: none"> short-circuit current check 	<ul style="list-style-type: none"> Detection by hardware circuit 	<ul style="list-style-type: none"> current > 8.5 A 	<ul style="list-style-type: none"> terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 200 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0914	Gear Shift Position Circuit	<ul style="list-style-type: none"> time out detection of the question and answer diagnosis 	<ul style="list-style-type: none"> if time out of the question and answer diagnosis is detected increment an event counter 	<ul style="list-style-type: none"> time out threshold > 100 ms 	<ul style="list-style-type: none"> gear message for selector lever is transmittable and selector lever message is receivable no failure of selector lever CAN messages time after Reset > 100 ms terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> plausibility check of selector lever 	<ul style="list-style-type: none"> selector lever position is not equal to negation of the inverse selector lever position OR <ul style="list-style-type: none"> selector lever position equals initialization value OR <ul style="list-style-type: none"> selector lever position equals error value OR <ul style="list-style-type: none"> selector lever position is equal to negation of the inverse selector lever position but no valid position 	<ul style="list-style-type: none"> selector lever position = Position 1 or Position 2 or Position 3 or Position 4 or Position L 	<ul style="list-style-type: none"> no bus off error no error failure of all CAN messages no failure of selector lever CAN messages time after Reset > 1100 ms terminal 15 voltage > 9 V for more than 1100 ms 	<ul style="list-style-type: none"> 1000 ms 	
		<ul style="list-style-type: none"> question and answer diagnosis 	<ul style="list-style-type: none"> failure of question and answer diagnosis 			<ul style="list-style-type: none"> 1500 ms 	
P0919	Gear Shift Position Control Error	<ul style="list-style-type: none"> evaluation the error signal of selector lever CAN message 	<ul style="list-style-type: none"> error flag of not determinable selector lever position is set 		<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 20 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> validity check of selector lever position 	<ul style="list-style-type: none"> if the selector lever position is equal to negation of the inverse selector lever position but is not valid (position == L, P4, P3, P2, or P1) <p>AND</p> <ul style="list-style-type: none"> is not in error state (position != error) <p>AND</p> <ul style="list-style-type: none"> initialization value with the initialization flag not set then increment an event counter 		<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms 		
		<ul style="list-style-type: none"> error detection of the question and answer diagnosis 	<ul style="list-style-type: none"> if the answer of the diagnosis is wrong an event counter is incremented 		<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 100 ms 	



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> plausibility check of selector lever position 	<ul style="list-style-type: none"> if the selector lever position is not equal to negation of the inverse selector lever position <p>OR</p> <ul style="list-style-type: none"> selector lever position equals initialization value but the initialization flag is not set <p>OR</p> <ul style="list-style-type: none"> selector lever position equals error value then increment an event counter 		<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 400 ms 	
P0929	Gear Shift Lock Solenoid/Actuator Control Circuit "A" Range/Performance	<ul style="list-style-type: none"> validity check of shiftlock position signal 	<ul style="list-style-type: none"> if the shiftlock position signal is not valid (position != error, deactivate, active or init) increment an event counter 		<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 20 ms 	<ul style="list-style-type: none"> 2 driving cycles
P2711	Unexpected Mechanical Gear Disengagement	<ul style="list-style-type: none"> unable to engage a gear on shaft 1 	<ul style="list-style-type: none"> the number of successive engagements of the same gear on shaft 1 exceeds a maximum value 	<ul style="list-style-type: none"> counter >= 6 	<ul style="list-style-type: none"> battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 0 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> unable to engage a gear on shaft 2 	<ul style="list-style-type: none"> the number of successive engagements of the same gear on shaft 2 exceeds a maximum value 				
		<ul style="list-style-type: none"> detect disengagement of gears on shaft 1 without control 	<ul style="list-style-type: none"> In spite of a constant desired gear disengagement counter exceeds a maximum value 	<ul style="list-style-type: none"> counter >3 	<ul style="list-style-type: none"> battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms output speed >= 12 rpm 		
		<ul style="list-style-type: none"> detect disengagement of gears on shaft 2 without control 	<ul style="list-style-type: none"> In spite of a constant desired gear disengagement counter exceeds a maximum value 				



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2723	Pressure Control Solenoid "E" Performance/Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> residual current of gearbox subsystem 1 (total current at common high-side switch 1 – actual current of clutch 1) is smaller than a minimum value 	<ul style="list-style-type: none"> residual current ≤ 150 mA (supply voltage at common high-side 1=7 V), 300 mA (supply voltage at common high-side 1=13 V) 	<ul style="list-style-type: none"> common high-side switch 1 on, not defect and voltage > 9.2 V gearbox subsystem 1 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor of control gear-shift fork valve 1 and 2 ≤ 10 % duty factor of safety valve 1 ≥ 53 % and steady state time ≥ 50 ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2732	Pressure Control Solenoid "F" Performance/Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> residual current of gearbox subsystem 2 (total current at common high-side switch 2 – actual current of clutch 2) is smaller than a minimum value 	<ul style="list-style-type: none"> residual current \leq 150 mA (supply voltage at common high-side 2=7 V) .. 300 mA (supply voltage at common high-side 2=13 V) 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage $>$ 9.2 V gearbox subsystem 2 active common high-side switches not deactivated by module 2 change of supply voltage $<$ 1 V duty factor of control gear-shift fork valve 3 and \leq 10 % duty factor of safety valve 2 \geq 53% and steady state time \geq 50 ms terminal 15 voltage $>$ 9 V for more than 500 ms engine speed $>$ 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles
C0100	Lost Communication With ECM/PCM "A"	<ul style="list-style-type: none"> Timeout Check 	<ul style="list-style-type: none"> failure of all CAN engine messages 	<ul style="list-style-type: none"> time-out for more than 490 ms 	<ul style="list-style-type: none"> no bus off error no error failure of all CAN messages terminal 15 voltage $>$ 9 V for more than 500 ms $>$500 ms after reset 	<ul style="list-style-type: none"> 490 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			<ul style="list-style-type: none"> failure of one or more CAN engine messages (but not all CAN engine messages) 	<ul style="list-style-type: none"> time-out for more than 1010 ms 	<ul style="list-style-type: none"> no bus off error no error failure of all CAN messages no error failure of all CAN engine messages terminal 15 voltage > 9 V for more than 500 ms >500 ms after reset 	<ul style="list-style-type: none"> 1010 ms 	
			<ul style="list-style-type: none"> failure of all CAN messages but gear-box is still in position to send 	<ul style="list-style-type: none"> time-out for more than 2080 ms 	<ul style="list-style-type: none"> terminal 15 voltage > 9 V for more than 500 ms >500 ms after reset 	<ul style="list-style-type: none"> 2080 ms 	
U0103	Lost Communication With Gear Shift Control Module "A"	<ul style="list-style-type: none"> Timeout Check 	<ul style="list-style-type: none"> failure of selector lever CAN messages 	<ul style="list-style-type: none"> time-out for more than 490 ms 	<ul style="list-style-type: none"> kein Bus off Fehler no bus off error no error failure of all CAN messages terminal 15 voltage > 9 V for more than 500 ms, >500 ms after reset 	<ul style="list-style-type: none"> 490 ms 	<ul style="list-style-type: none"> 2 driving cycles
U0404	Invalid Data Received From Gear Shift Control Module "A"	<ul style="list-style-type: none"> evaluation of selector lever CAN message counter 	<ul style="list-style-type: none"> if the value of message counter is permanent constant or change exceeds a threshold increment an event counter 	<ul style="list-style-type: none"> maximum change of message counter > 5 	<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 50 ms 	<ul style="list-style-type: none"> 2 driving cycles



3.5.2 Transmission Mechatronic , DSG 6-spd 02E (2016 MY)

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0219	Engine Over-speed Condition	<ul style="list-style-type: none"> signal range check 	<ul style="list-style-type: none"> rotational speed of gearbox input shaft exceed a maximum value 	<ul style="list-style-type: none"> rotational speed > 12000 rpm 	<ul style="list-style-type: none"> terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 500 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0501	Vehicle Speed Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> plausibility check 	<ul style="list-style-type: none"> calculate the speed of input shaft with the gear ratio of engaged gear on input shaft and the output shaft speed. compare the calculated speed with measured speed of input shaft 	<ul style="list-style-type: none"> speed difference magnitude > 330 rpm (output speed = 500rpm)... 100 rpm (output speed >= 2000 rpm) 	<ul style="list-style-type: none"> gear on input shaft engaged no valid CAN output speed information output speed > 25 rpm OR speed of input shaft > 1000 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0701	Transmission Control System Range/Performance	<ul style="list-style-type: none"> signal range check 	<ul style="list-style-type: none"> travel sensor voltage gearshift fork 1/3 out of plausibility range travel sensor voltage gearshift fork 2/4 out of plausibility range travel sensor voltage gearshift fork 5/N out of plausibility range 	<ul style="list-style-type: none"> voltage < 100 mV OR voltage > 4900mV 		<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			<ul style="list-style-type: none"> travel sensor voltage gearshift fork 6/R out of plausibility range 				
P0702	Transmission Control System Electrical	<ul style="list-style-type: none"> plausibility check 	<ul style="list-style-type: none"> In spite of cut off Common High-side Switch 1 a measurable current. In spite of turned on Common High-side Switch 1 no current measurable. In spite of cut off Common High-side Switch 2 a measurable current. In spite of turned on Common High-side Switch 2 no current measurable. 	<ul style="list-style-type: none"> CHS1 cut off and CHS1-Current > 40 mA CHS1 turned on and CHS1-Current < 200 mA CHS2 cut off and CHS2-Current > 40 mA CHS2 turned on and CHS2-Current < 200 mA 	<ul style="list-style-type: none"> one-time after reset terminal 15 voltage < 18 V no short-circuit current check failure of CHS1 common high-side switch 1 voltage > 9.2V gearbox subsystem 1 active common high-side switches not deactivated by module 2 one-time after reset terminal 15 voltage < 18 V no short-circuit current check failure of CHS2 common high-side switch 2 voltage > 9.2V gearbox subsystem 2 active common high-side switches not deactivated by module 2 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			<ul style="list-style-type: none"> In spite of cut off Common High-side Switch 3 a measurable current. In spite of turned on Common High-side Switch 3 no current measurable. 	<ul style="list-style-type: none"> CHS3 cut off and CHS3-Current > 40 mA CHS3 turned on and CHS3-Current < 200 mA 	<ul style="list-style-type: none"> one-time after reset terminal 15 voltage < 18 V no short-circuit current check failure of CHS3 and main pressure solenoid valve common high-side switch 1 and 2 voltage > 9.2V common high-side switches not deactivated by module 2 		
P0717	Input/Turbine Shaft Speed Sensor "A" Circuit No Signal	<ul style="list-style-type: none"> plausibility check 	<ul style="list-style-type: none"> calculate the speed of input shaft 1 with the gear ratio of engaged gear on input shaft 1 and the output shaft speed. compare the calculated speed with measured speed of input shaft 1 	<ul style="list-style-type: none"> speed difference magnitude > 330 rpm (output speed = 500rpm)... 100 rpm (output speed >= 2000 rpm) 	<ul style="list-style-type: none"> gear engaged on input shaft 1 valid CAN output speed information speed of input shaft 1 < 25 rpm output speed > 25 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 900 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			<ul style="list-style-type: none"> calculate the speed of input shaft 2 with the gear ratio of engaged gear on input shaft 2 and the output shaft speed, compare the calculated speed with measured speed of input shaft 2 		<ul style="list-style-type: none"> gear engaged on input shaft 2 valid CAN output speed information speed of input shaft 2 < 25 rpm output speed > 25 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 		
P0729	Gear 6 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detected while the gear-shift fork was controlled to engage sixth gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 2 multiplexer position = 0 control gear-shift fork valve 3 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 2 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0731	Gear 1 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage first gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 1 multiplexer position = 0 control gear-shift fork valve 1 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 1 	<ul style="list-style-type: none"> 2 driving cycles
P0732	Gear 2 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage second gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 2 multiplexer position = 1 control gear-shift fork valve 3 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 2 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0733	Gear 3 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage third gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 1 multiplexer position = 0 control gear-shift fork valve 2 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 1 	<ul style="list-style-type: none"> 2 driving cycles
P0734	Gear 4 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage fourth gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 2 multiplexer position = 1 control gear-shift fork valve 4 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 2 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0735	Gear 5 Incorrect Ratio	<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage fifth gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 1 multiplexer position = 1 control gear-shift fork valve 1 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> synchronizing slip, duty factor of safety valve 1 	<ul style="list-style-type: none"> 2 driving cycles
P0736	Reverse Incorrect Ratio	<ul style="list-style-type: none"> unable to disengage the reverse gear 	<ul style="list-style-type: none"> gearshift fork of reverse gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position < synchronizing point reverse gear - 10% synchronizing point measured by a basic adjustment (reverse gear stays in shifted position) control gear-shift fork 	<ul style="list-style-type: none"> control safety valve 2 (ON) >= 20% multiplexer position = 0 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 6000 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> synchronizing detection while the gear-shift fork was controlled to engage reverse gear 	<ul style="list-style-type: none"> integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2 	<ul style="list-style-type: none"> integral > 125 	<ul style="list-style-type: none"> no slipping point adaptation of clutch 1 multiplexer position = 0 control gear-shift fork valve 4 >= 5% no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 		
P0746	Pressure Control Solenoid "A" Performance/ Stuck Off	<ul style="list-style-type: none"> pressure integral monitoring 	<ul style="list-style-type: none"> integral of actual pressure minus desired pressure minus drain exceeds a maximum value 	<ul style="list-style-type: none"> pressure integral >= 0.1 bar*s 	<ul style="list-style-type: none"> desired pressure <= adapted clutch slipping point + 1 bar standing vehicle with accelerator pedal < 0.1% battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> desired valve current of clutch 1 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold 	<ul style="list-style-type: none"> desired current > 350 mA actual current < 50 mA 	<ul style="list-style-type: none"> common high-side switch 1 on, not defect and voltage > 9.2 V gearbox sub-system 1 active common high-side switches not deactivated by module 2 terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 		
P0747	Pressure Control Solenoid "A" Stuck On	<ul style="list-style-type: none"> pressure buildup monitoring 	<ul style="list-style-type: none"> the number of successive pressure buildup failure of clutch 1 reaches a maximum value 	<ul style="list-style-type: none"> counter > 2 	<ul style="list-style-type: none"> engaged gear on input shaft 1 desired pressure > adapted clutch slipping point - 0.2 bar output speed < 200 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 0 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none">short-circuit current check	<ul style="list-style-type: none">comparison of actual valve current with desired valve current of clutch 1	<ul style="list-style-type: none">actual current > desired current and (actual current - desired current) > 200 mA for more than 200 ms	<ul style="list-style-type: none">common high-side switch 1 on, not defect and voltage > 9.2 Vgearbox subsystem 1 activecommon high-side switches not deactivated by module 2terminal 15 voltage > 9 V for more than 500 msengine speed > 500 rpm	<ul style="list-style-type: none">200 ms	



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0751	Shift Solenoid "A" Performance/ Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 - actual current of clutch 1) at switching point of control gearshift fork valve 1 with residual current at permanent control of control gearshift fork valve 1 	<ul style="list-style-type: none"> difference of residual current ≤ 200 mA (supply voltage at common high-side 1=7 V) .. 450 mA (supply voltage at common high-side 1=13 V) 	<ul style="list-style-type: none"> common high-side switch 1 on, not defect and voltage > 9.2 V gearbox subsystem 1 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor change of safety valve 1 (control of safety valve 1 is stable) $\leq 5\%$ duty factor change of gearshift fork valve 2 (control of gearshift fork valve 2 is stable) $\leq 5\%$ y factor change of safety valve 2 $> 70\%$ control of safety valve 2 is stable ≥ 50 ms duty factor change of gearshift > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0756	Shift Solenoid "B" Performance/ Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 - actual current of clutch 1) at switching point of control gearshift fork valve 2 with residual current at permanent control of control gearshift fork valve 2 	<ul style="list-style-type: none"> difference of residual current ≤ 200 mA (supply voltage at common high-side 1=7 V) .. 450 mA (supply voltage at common high-side 1=13 V) 	<ul style="list-style-type: none"> common high-side switch 1 on, not defect and voltage > 9.2 V gearbox subsystem 1 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor change of safety valve 1 (control of safety valve 1 is stable) $\leq 5\%$ duty factor change of gearshift fork valve 1 (control of gearshift fork valve 1 is stable) $\leq 5\%$ duty factor of control gearshift fork valve 2 $> 70\%$ and steady state time ≥ 50ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0761	Shift Solenoid "C" Performance/ Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 - actual current of clutch 2) at switching point of control gearshift fork valve 3 with residual current at permanent control of control gearshift fork valve 3 	<ul style="list-style-type: none"> difference of residual current ≤ 200 mA (supply voltage at common high-side 2=7 V) .. 450 mA (supply voltage at common high-side 2=13 V) 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage > 9.2 V gearbox subsystem 2 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor change of safety valve 2 $\leq 5\%$ (control of safety valve 2 is stable) duty factor change of gearshift fork valve 4 $\leq 5\%$ (control of gearshift fork valve 4 is stable) duty factor of control gearshift fork valve 3 $> 70\%$ and steady state time ≥ 50 ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0766	Shift Solenoid "D" Performance/ Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 - actual current of clutch 2) at switching point of control gearshift fork valve 4 with residual current at permanent control of control gearshift fork valve 4 	<ul style="list-style-type: none"> difference of residual current ≤ 200 mA (supply voltage at common high-side 2=7 V) .. 450 mA (supply voltage at common high-side 2=13 V) 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage > 9.2 V gearbox subsystem 2 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor change of safety valve 2 $\leq 5\%$ (control of safety valve 2 is stable) duty factor change of gearshift fork valve 3 $\leq 5\%$ (control of gearshift fork valve 3 is stable) duty factor of control gearshift fork valve 4 $> 70\%$ and steady state time ≥ 50 ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0771	Shift Solenoid "E" Performance/ Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> Comparison of residual current of central control (total current at common high-side switch 3 - actual current of main pressure valve and cooling oil valve) at switching point of multiplexer valve with residual current at permanent control of multiplexer valve 	<ul style="list-style-type: none"> difference of residual current ≤ 150 mA (maximum of supply voltage at common high-side 1.2 and terminal 15 = 7 V) .. 300 mA (maximum of supply voltage at common high-side 1.2 and terminal 15 = 13 V) 	<ul style="list-style-type: none"> common high-side switch 3 on and not defect no short-circuit current check failure of main pressure solenoid valve common high-side switch 1 and 2 voltage > 9.2 V common high-side switches not deactivated by module 2 change of supply voltage < 1 V multiplexer valve is controlled and steady state time ≥ 50 ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 		
P0776	Pressure Control Solenoid "B" Performance/ Stuck Off	<ul style="list-style-type: none"> pressure integral monitoring 	<ul style="list-style-type: none"> integral of actual pressure minus desired pressure minus drain exceeds a maximum value 	<ul style="list-style-type: none"> pressure integral ≥ 0.1 bar*s 	<ul style="list-style-type: none"> desired pressure \leq adapted clutch slipping point + 1 bar standing vehicle with accelerator pedal $< 0.1\%$ battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	300 ms	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> desired valve current of clutch 2 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold 	<ul style="list-style-type: none"> desired current > 350 mA actual current < 50 mA 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage > 9.2 V gearbox sub-system 2 active common high-side switches not deactivated by module 2 terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 		
P0777	Pressure Control Solenoid "B" Stuck On	<ul style="list-style-type: none"> pressure buildup monitoring 	<ul style="list-style-type: none"> the number of successive pressure buildup failure of clutch 2 reaches a maximum value 	<ul style="list-style-type: none"> counter > 2 	<ul style="list-style-type: none"> engaged gear on input shaft 2 desired pressure > adapted clutch slipping point - 0.2 bar output speed < 200 rpm terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 0 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> short-circuit current check 	<ul style="list-style-type: none"> comparison of actual valve current with desired valve current of clutch 2 	<ul style="list-style-type: none"> actual current > desired current and (actual current - desired current) > 200 mA for more than 200 ms 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage > 9.2 V gearbox sub-system 2 active common high-side switches not deactivated by module 2 terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 200 ms 	
P0781	1-2 Shift	<ul style="list-style-type: none"> unable to disengage the first gear 	<ul style="list-style-type: none"> gearshift fork of first gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position > synchronizing point first gear + 10% synchronizing point measured by a basic adjustment (first gear stays in shifted position) control gearshift fork valve 2 >= 5% 	<ul style="list-style-type: none"> control safety valve 1 (ON) >= 20% multiplexer position = 0 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 6000 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0782	2-3 Shift	<ul style="list-style-type: none"> unable to disengage the second gear 	<ul style="list-style-type: none"> gearshift fork of second gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position < synchronizing point second gear - 10% synchronizing point measured by a basic adjustment (second gear stays in shifted position) control gearshift fork valve 4 >= 5% 	<ul style="list-style-type: none"> control safety valve 1 (ON) >= 20% multiplexer position = 1 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	6000 ms	<ul style="list-style-type: none"> 2 driving cycles
P0783	3-4 Shift	<ul style="list-style-type: none"> unable to disengage the third gear 	<ul style="list-style-type: none"> gearshift fork of third gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position < synchronizing point third gear - 10% synchronizing point measured by a basic adjustment (third gear stays in shifted position) control gearshift fork valve 1 >= 5% 	<ul style="list-style-type: none"> control safety valve 1 (ON) >= 20% multiplexer position = 0 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	6000 ms	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0784	4-5 Shift	<ul style="list-style-type: none"> unable to disengage the fourth gear 	<ul style="list-style-type: none"> gearshift fork of fourth gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position > synchronizing point fourth gear + 10% synchronizing point measured by a basic adjustment (fourth gear stays in shifted position) control gearshift fork valve 3 >= 5% 	<ul style="list-style-type: none"> control safety valve 2 (ON) >= 20% multiplexer position = 1 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 6000 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0791	Intermediate Shaft Speed Sensor "A" Circuit	<ul style="list-style-type: none"> signal range check 	<ul style="list-style-type: none"> rotational speed of input shaft 1 exceed a maximum value <p>OR</p> <ul style="list-style-type: none"> rotational speed of input shaft 2 exceed a maximum value 	<ul style="list-style-type: none"> rotational speed > 12000 rpm 	<ul style="list-style-type: none"> terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 100 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0797	Pressure Control Solenoid "C" Stuck On	<ul style="list-style-type: none"> short-circuit current check 	<ul style="list-style-type: none"> comparison of actual valve current with desired valve current of main pressure solenoid valve 	<ul style="list-style-type: none"> actual current > desired current and (actual current - desired current) > 200 mA for more than 300 ms 	<ul style="list-style-type: none"> common high-side switch 3 on and not defect common high-side switch 1 and 2 voltage > 9.2 V common high-side switches not deactivated by module 2 terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0829	5-6 Shift	<ul style="list-style-type: none"> unable to disengage the fifth gear 	<ul style="list-style-type: none"> gearshift fork of fifth gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position > synchronizing point fifth gear + 10% synchronizing point measured by a basic adjustment (fifth gear stays in shifted position) control gearshift fork valve 2 >= 5% 	<ul style="list-style-type: none"> control safety valve 1 (ON) >= 20% multiplexer position = 1 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 6000 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> unable to disengage the sixth gear 	<ul style="list-style-type: none"> gearshift fork of sixth gear stays in shifted position in spite of control to disengage 	<ul style="list-style-type: none"> gearshift fork position > synchronizing point sixth gear + 10% synchronizing point measured by a basic adjustment (sixth gear stays in shifted position) control gearshift fork valve 4 >= 5% 	<ul style="list-style-type: none"> control safety valve 2 (ON) >= 20% multiplexer position = 0 desired main pressure > 2 bar no main pressure loss terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 		
P0840	Transmission Fluid Pressure Sensor/Switch "A" Circuit	<ul style="list-style-type: none"> signal range check 	<ul style="list-style-type: none"> pressure sensor voltage clutch 1 out of plausibility range 	<ul style="list-style-type: none"> voltage < 100 mV OR voltage > 4900 mV 		<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0841	Transmission Fluid Pressure Sensor/Switch "A" Circuit Range/Performance	<ul style="list-style-type: none"> overpressure monitoring 	<ul style="list-style-type: none"> hydraulic pressure of clutch 1 exceeds a maximum value 	<ul style="list-style-type: none"> pressure >= 15.5 bar 	<ul style="list-style-type: none"> signal range check is correct terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 1000 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0845	Transmission Fluid Pressure Sensor/Switch "B" Circuit	<ul style="list-style-type: none"> pressure sensor voltage clutch 2 out of plausibility range 	<ul style="list-style-type: none"> pressure sensor voltage clutch 1 out of plausibility range 	<ul style="list-style-type: none"> voltage < 100 mV OR voltage > 4900 mV 		<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0846	Transmission Fluid Pressure Sensor/Switch "B" Circuit Range/Performance	<ul style="list-style-type: none"> overpressure monitoring 	<ul style="list-style-type: none"> hydraulic pressure of clutch 2 exceeds a maximum value 	<ul style="list-style-type: none"> pressure ≥ 15.5 bar 	<ul style="list-style-type: none"> signal range check is correct terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 80 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0864	TCM Communication Circuit Range/Performance	<ul style="list-style-type: none"> buss off detection of the micro-controller 			<ul style="list-style-type: none"> terminal 15 voltage > 9 V for more than 500 ms > 500 ms after reset 	<ul style="list-style-type: none"> 1000 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0890	TCM Power Relay Sense Circuit Low	<ul style="list-style-type: none"> short-circuit current check 	<ul style="list-style-type: none"> Detection by hardware circuit 	<ul style="list-style-type: none"> current > 8.5 A 	<ul style="list-style-type: none"> terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 200 ms 	<ul style="list-style-type: none"> 2 driving cycles
P0914	Gear Shift Position Circuit	<ul style="list-style-type: none"> time out detection of the question and answer diagnosis 	<ul style="list-style-type: none"> if time out of the question and answer diagnosis is detected increment an event counter 	<ul style="list-style-type: none"> time out threshold > 100 ms 	<ul style="list-style-type: none"> gear message for selector lever is transmittable and selector lever message is receivable no failure of selector lever CAN messages time after Reset > 100 ms terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> plausibility check of selector lever 	<ul style="list-style-type: none"> selector lever position is not equal to negation of the inverse selector lever position <p>OR</p> <ul style="list-style-type: none"> selector lever position equals initialization value <p>OR</p> <ul style="list-style-type: none"> selector lever position equals error value <p>OR</p> <ul style="list-style-type: none"> selector lever position is equal to negation of the inverse selector lever position but no valid position 	<ul style="list-style-type: none"> selector lever position == Position 1 or Position 2 or Position 3 or Position 4 or Position L 	<ul style="list-style-type: none"> no bus off error no error failure of all CAN messages no failure of selector lever CAN messages time after Reset > 1100 ms terminal 15 voltage > 9 V for more than 1100 ms 	<ul style="list-style-type: none"> 1000 ms 	
		<ul style="list-style-type: none"> question and answer diagnosis 	<ul style="list-style-type: none"> failure of question and answer diagnosis 			<ul style="list-style-type: none"> 1500 ms 	
P0919	Gear Shift Position Control Error	<ul style="list-style-type: none"> evaluation the error signal of selector lever CAN message 	<ul style="list-style-type: none"> error flag of not determinable selector lever position is set 		<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 20 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none">• validity check of selector lever position	<ul style="list-style-type: none">• if the selector lever position is equal to negation of the inverse selector lever position but is not valid (position == L, P4, P3, P2, or P1) AND <ul style="list-style-type: none">• is not in error state (position != error) AND <ul style="list-style-type: none">• initialization value with the initialization flag not set then increment an event counter		<ul style="list-style-type: none">• no failure of selector lever CAN messages• terminal 15 voltage > 4 V for more than 500 ms		
		<ul style="list-style-type: none">• error detection of the question and answer diagnosis	<ul style="list-style-type: none">• if the answer of the diagnosis is wrong an event counter is incremented		<ul style="list-style-type: none">• no failure of selector lever CAN messages• terminal 15 voltage > 4 V for more than 500 ms	<ul style="list-style-type: none">• 100 ms	



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> plausibility check of selector lever position 	<ul style="list-style-type: none"> if the selector lever position is not equal to negation of the inverse selector lever position <p>OR</p> <ul style="list-style-type: none"> selector lever position equals initialization value but the initialization flag is not set <p>OR</p> <ul style="list-style-type: none"> selector lever position equals error value then increment an event counter 		<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms battery voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 400 ms 	
P0929	Gear Shift Lock Solenoid/ Actuator Control Circuit "A" Range/ Performance	<ul style="list-style-type: none"> validity check of shiftlock position signal 	<ul style="list-style-type: none"> if the shiftlock position signal is not valid (position != error, de-active, active or init) increment an event counter 		<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 20 ms 	<ul style="list-style-type: none"> 2 driving cycles
P2711	Unexpected Mechanical Gear Disengagement	<ul style="list-style-type: none"> unable to engage a gear on shaft 1 	<ul style="list-style-type: none"> the number of successive engagements of the same gear on shaft 1 exceeds a maximum value 	<ul style="list-style-type: none"> counter >= 6 	<ul style="list-style-type: none"> battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms 	<ul style="list-style-type: none"> 0 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> unable to engage a gear on shaft 2 	<ul style="list-style-type: none"> the number of successive engagements of the same gear on shaft 2 exceeds a maximum value 				
		<ul style="list-style-type: none"> detect disengagement of gears on shaft 1 without control 	<ul style="list-style-type: none"> In spite of a constant desired gear disengagement counter exceeds a maximum value 	<ul style="list-style-type: none"> counter > 3 	<ul style="list-style-type: none"> battery voltage > 9 V for more than 500 ms engine speed > 600 rpm for more than 500 ms output speed >= 12 rpm 		
		<ul style="list-style-type: none"> detect disengagement of gears on shaft 2 without control 	<ul style="list-style-type: none"> In spite of a constant desired gear disengagement counter exceeds a maximum value 				



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2723	Pressure Control Solenoid "E" Performance/ Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> residual current of gearbox subsystem 1 (total current at common high-side switch 1 - actual current of clutch 1) is smaller than a minimum value 	<ul style="list-style-type: none"> residual current ≤ 150 mA (supply voltage at common high-side 1=7 V) .. 300 mA (supply voltage at common high-side 1=13 V) 	<ul style="list-style-type: none"> common high-side switch 1 on, not defect and voltage > 9.2 V gearbox subsystem 1 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor of control gear-shift fork valve 1 and 2 ≤ 10 % duty factor of safety valve 1 ≥ 53 % and steady state time ≥ 50 ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2732	Pressure Control Solenoid "F" Performance/ Stuck Off	<ul style="list-style-type: none"> open-circuit check 	<ul style="list-style-type: none"> residual current of gearbox subsystem 2 (total current at common high-side switch 2 - actual current of clutch 2) is smaller than a minimum value 	<ul style="list-style-type: none"> residual current ≤ 150 mA (supply voltage at common high-side 2=7 V) .. 300 mA (supply voltage at common high-side 2=13 V) 	<ul style="list-style-type: none"> common high-side switch 2 on, not defect and voltage > 9.2 V gearbox subsystem 2 active common high-side switches not deactivated by module 2 change of supply voltage < 1 V duty factor of control gear-shift fork valve 3 and ≤ 10 % duty factor of safety valve 2 ≥ 53 % and steady state time ≥ 50 ms terminal 15 voltage > 9 V for more than 500 ms engine speed > 500 rpm 	<ul style="list-style-type: none"> 300 ms 	<ul style="list-style-type: none"> 2 driving cycles
U0100	Lost Communication With ECM/ PCM "A"	<ul style="list-style-type: none"> Timeout Check 	<ul style="list-style-type: none"> failure of all CAN engine messages 	<ul style="list-style-type: none"> time-out for more than 490 ms 	<ul style="list-style-type: none"> no bus off error no error failure of all CAN messages terminal 15 voltage > 9 V for more than 500 ms > 500 ms after reset 	<ul style="list-style-type: none"> 490 ms 	<ul style="list-style-type: none"> 2 driving cycles



DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			<ul style="list-style-type: none"> failure of one or more CAN engine messages (but not all CAN engine messages) 	<ul style="list-style-type: none"> time-out for more than 1010 ms 	<ul style="list-style-type: none"> no bus off error no error failure of all CAN messages no error failure of all CAN engine messages terminal 15 voltage > 9 V for more than 500 ms >500 ms after reset 	<ul style="list-style-type: none"> 1010 ms 	
			<ul style="list-style-type: none"> failure of all CAN messages but gear-box is still in position to send 	<ul style="list-style-type: none"> time-out for more than 2080 ms 	<ul style="list-style-type: none"> terminal 15 voltage > 9 V for more than 500 ms >500 ms after reset 	<ul style="list-style-type: none"> 2080 ms 	
U0103	Lost Communication With Gear Shift Control Module "A"	<ul style="list-style-type: none"> Timeout Check 	<ul style="list-style-type: none"> failure of selector lever CAN messages 	<ul style="list-style-type: none"> time-out for more than 490 ms 	<ul style="list-style-type: none"> kein Bus off Fehler no bus off error no error failure of all CAN messages terminal 15 voltage > 9 V for more than 500 ms, >500 ms after reset 	<ul style="list-style-type: none"> 490 ms 	<ul style="list-style-type: none"> 2 driving cycles
U0404	Invalid Data Received From Gear Shift Control Module "A"	<ul style="list-style-type: none"> evaluation of selector lever CAN message counter 	<ul style="list-style-type: none"> if the value of message counter is permanent constant or change exceeds a threshold increment an event counter 	<ul style="list-style-type: none"> maximum change of message counter > 5 	<ul style="list-style-type: none"> no failure of selector lever CAN messages terminal 15 voltage > 4 V for more than 500 ms 	<ul style="list-style-type: none"> 50 ms 	<ul style="list-style-type: none"> 2 driving cycles



3.6 Diagnostic Procedures

- ◆ ⇒ ["3.6.1 Accelerator Pedal Module GX2 , Checking", page 357](#)
- ◆ ⇒ ["3.6.2 Cam Adjustment Actuators , Checking", page 359](#)
- ◆ ⇒ ["3.6.3 Camshaft Adjustment Valve 1 N205 , Checking", page 362](#)
- ◆ ⇒ ["3.6.4 Camshaft Position Sensor 3 G300 , Checking", page 364](#)
- ◆ ⇒ ["3.6.5 Camshaft Position Sensor G40 , Checking", page 368](#)
- ◆ ⇒ ["3.6.6 Charge Air Pressure Sensor G31 , Checking", page 372](#)
- ◆ ⇒ ["3.6.7 Charge Pressure Actuator V465 / Charge Pressure Actuator Position Sensor G581 , Checking", page 374](#)
- ◆ ⇒ ["3.6.8 Engine Component Power Supply Relay J757 , Checking", page 378](#)
- ◆ ⇒ ["3.6.9 Engine Coolant Temperature Sensor G62 , Checking", page 380](#)
- ◆ ⇒ ["3.6.10 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking", page 382](#)
- ◆ ⇒ ["3.6.11 Engine Speed Sensor G28 , Checking", page 384](#)
- ◆ ⇒ ["3.6.12 Engine Temperature Control Actuator N493 , Checking", page 388](#)
- ◆ ⇒ ["3.6.13 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 392](#)
- ◆ ⇒ ["3.6.14 Exhaust Camshaft Adjustment Valve 1 N318 , Checking", page 394](#)
- ◆ ⇒ ["3.6.15 Fuel Injectors , Checking", page 396](#)
- ◆ ⇒ ["3.6.16 Fuel Pressure Regulator Valve N276 , Checking", page 398](#)
- ◆ ⇒ ["3.6.17 Fuel Pressure Sensor G247 , Checking", page 400](#)
- ◆ ⇒ ["3.6.18 Fuel Pump Control Module J538 / Fuel Delivery Unit GX1 , Checking", page 404](#)
- ◆ ⇒ ["3.6.19 Fuel Tank Leak Detection Control Module J909 / Fuel Tank Pressure Sensor G400 , Checking", page 406](#)
- ◆ ⇒ ["3.6.20 Ignition Coils with Power Output Stage , Checking", page 409](#)
- ◆ ⇒ ["3.6.21 Intake Manifold Runner Control Valve N316 , Checking", page 411](#)
- ◆ ⇒ ["3.6.22 Intake Manifold Runner Position Sensor G336 , Checking", page 413](#)
- ◆ ⇒ ["3.6.23 Intake Manifold Sensor GX9 , Checking", page 417](#)
- ◆ ⇒ ["3.6.24 Knock Sensor 1 G61 , Checking", page 421](#)
- ◆ ⇒ ["3.6.25 Motronic Engine Control Module Power Supply Relay J271 , Checking", page 423](#)
- ◆ ⇒ ["3.6.26 Outside Air Temperature Sensor G17 , Checking", page 425](#)



- ◆ ⇒ ["3.6.27 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking", page 427](#)
- ◆ ⇒ ["3.6.28 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 430](#)
- ◆ ⇒ ["3.6.29 Secondary Air Injection Pump Motor V101 / Secondary Air Injection Pump Relay J299 , Checking", page 433](#)
- ◆ ⇒ ["3.6.30 Secondary Air Injection Sensor 1 G609 / Secondary Air Injection Solenoid Valve N112 , Checking", page 436](#)
- ◆ ⇒ ["3.6.31 Throttle Valve Control Module GX3 , Checking", page 439](#)
- ◆ ⇒ ["3.6.32 Turbocharger Recirculation Valve N249 , Checking", page 442](#)
- ◆ ⇒ ["3.6.33 Vehicle Speed Signal, Checking", page 444](#)

3.6.1 Accelerator Pedal Module - GX2- , Checking

General Description

The Accelerator Pedal Position Sensor - G79- and Accelerator Pedal Position Sensor 2 - G185- are combined in one component and integrated into the Accelerator Pedal Module - GX2- . They are used to detect the position of the accelerator pedal throughout the entire adjustment range. The Engine Control Module - J623- detects the driver's request from these signals and uses them to calculate the injection quantity and EPC Throttle valve operation.

The Accelerator Pedal Module - GX2- contains the following components:

- ◆ Accelerator Pedal Position Sensor - G79-
- ◆ Accelerator Pedal Position Sensor 2 - G185-

The Accelerator Pedal Module - GX2- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .



Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> PERFORM: Preliminary Check to verify the customers concern. Refer to "3.1 Preliminary Check", page 18. Was Complaint verified? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ GO TO: Step 2 ➤ page 358. NO: <ul style="list-style-type: none"> ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> CONNECT: Scan Tool. IGNITION: ON. CHECK: Throttle valve position closed. SPECIFIED VALUE: 3 – 25%. DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly. CHECK: Throttle valve position at WOT. SPECIFIED VALUE: 84 – 99%. IGNITION: OFF. Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ GO TO: Step 3 ➤ page 358. NO: <ul style="list-style-type: none"> ◆ GO TO: Step 4 ➤ page 358.
3	<ul style="list-style-type: none"> Condition may be intermittent. PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. 	<ul style="list-style-type: none"> ◆ GO TO: Step 7 ➤ page 359.
4	<ul style="list-style-type: none"> DISCONNECT: Accelerator Pedal Module - GX2- harness connector. IGNITION: ON. CHECK: Accelerator Pedal Module - GX2- harness connector terminals 2 to 3 and 1 to 5 for voltage. SPECIFIED VALUE: About 5.0 V. IGNITION: OFF. Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ GO TO: Step 5 ➤ page 358. NO: <ul style="list-style-type: none"> ◆ GO TO: Step 6 ➤ page 359.
5	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Accelerator Pedal Module - GX2- harness connector terminal 4 to the Engine Control Module - J623- harness connector T91 / 52 for resistance. CHECK: Accelerator Pedal Module - GX2- harness connector terminal 6 to the Engine Control Module - J623- harness connector T91 / 69 for resistance. SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ REPLACE: Accelerator Pedal Module - GX2- . Refer to appropriate repair manual. ◆ GO TO: Step 7 ➤ page 359. NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ➤ page 359.



Step	Procedure	Result / Action to Take
6	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Accelerator Pedal Module - GX2- harness connector terminal 1 to the Engine Control Module - J623- harness connector T91 / 16 for resistance. CHECK: Accelerator Pedal Module - GX2- harness connector terminal 2 to the Engine Control Module - J623- harness connector T91 / 33 for resistance. CHECK: Accelerator Pedal Module - GX2- harness connector terminal 3 to the Engine Control Module - J623- harness connector T91 / 34 for resistance. CHECK: Accelerator Pedal Module - GX2- harness connector terminal 5 to the Engine Control Module - J623- harness connector T91 / 51 for resistance. SPECIFIED VALUE: 0.5 Ω (±0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Accelerator Pedal Module - GX2- . Refer to appropriate repair manual. GO TO: Step 7 ⇒ page 359 . NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 7 ⇒ page 359 .
7	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 . Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19 . Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19 . Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

3.6.2 Cam Adjustment Actuators , Checking

- ◆ Includes:
- ◆ Cylinder 1 Exhaust Camshaft Adjuster A - N580-
- ◆ Cylinder 1 Exhaust Camshaft B - N581-



- ◆ Cylinder 2 Exhaust Camshaft Adjuster A - N588-
- ◆ Cylinder 2 Exhaust Camshaft B - N589-
- ◆ Cylinder 3 Exhaust Camshaft Adjuster A - N596-
- ◆ Cylinder 3 Exhaust Camshaft B - N597-
- ◆ Cylinder 4 Exhaust Camshaft Adjuster A - N604-
- ◆ Cylinder 4 Exhaust Camshaft B - N605-

General Description

The Cam Adjustment Actuators are electromagnetic solenoid-type actuators. Two actuators are used per cylinder. One actuator moves the cam element on the camshaft for large valve lift. The other actuator resets the cam element for small valve lift. Each actuator is attached externally to the cylinder head cover by a bolt. They are sealed with O rings. When the actuator is activated by the Engine Control Module - J623- , a metal pin engages the displacement groove in the cam element, thereby moving the other cam lobe into position.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 361 . – NO: ◆ GATHER more information from customer about the complaint.



Step	Procedure	Result / Action to Take
2	<ul style="list-style-type: none"> IGNITION: OFF. DISCONNECT: Suspected Cam Adjustment Actuator(s) harness connector. CHECK: Suspected Cam Adjustment Actuator(s) component connector terminals 1 to 2 for resistance. Refer to appropriate wiring diagram. SPECIFIED VALUE: 7 – 10 Ω (@ approx. 20° C). <p>– Was Value obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 3 ➤ page 361 . – NO: <ul style="list-style-type: none"> ◆ REPLACE: Cam Adjustment Actuator(s) . Refer to appropriate repair manual. ◆ GO TO: Step 5 ➤ page 362 .
3	<ul style="list-style-type: none"> IGNITION: ON. CHECK: Suspected Cam Adjustment Actuator(s) harness connector terminal 2 to ground for voltage. Refer to appropriate wiring diagram. IGNITION: OFF. SPECIFIED VALUE: Battery voltage. <p>– Was Value obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 4 ➤ page 361 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ➤ page 362 .
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Suspected Cam Adjustment Actuator(s) harness connector terminal 1 to the Engine Control Module - J623- harness connector for resistance. Refer to appropriate wiring diagram. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). <p>– Was Value obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REPLACE: Cam Adjustment Actuator(s) . Refer to appropriate repair manual. ◆ GO TO: Step 5 ➤ page 362 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ➤ page 362 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623. Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.3 Camshaft Adjustment Valve 1 - N205- , Checking

General Description

The camshaft's task is to operate the valves at the right time and in the right order to control the charge cycle. Camshaft adjustment using the Camshaft Adjustment Valve 1 - N205- varies the opening times of the valves to suit all operating conditions. This ensures ideal charge cycles within a wide range of engine speeds and loads. Fuel consumption and pollutant emissions are reduced, torque and smoothness increased. In engines with a double overhead camshaft the size and positioning of the valve opening overlap can be influenced, enhancing characteristics in full-load and part-load operation. In continuous camshaft adjustment, the adjustment is infinitely variable within specific parameters.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.



- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ "1.1 Safety Precautions", page 2
- View clean working conditions:
⇒ "1.2 Clean Working Conditions", page 3
- For Hybrid vehicles refer to:
⇒ "1.3 High Voltage System General Warnings", page 4

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 363 – NO: ◆ GATHER more information from customer about the complaint
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Camshaft Adjustment Valve 1 - N205- harness connector. • CHECK: Camshaft Adjustment Valve 1 - N205- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 5 to 20 Ω (at approx. 20$^{\circ}\text{C}$). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 363 – NO: ◆ REPLACE: Camshaft Adjustment Valve 1 - N205- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 364
3	<ul style="list-style-type: none"> • IGNITION: ON. • CHECK: Camshaft Adjustment Valve 1 - N205- harness connector terminal 1 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 363 – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 364
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Camshaft Adjustment Valve 1 - N205- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 105 for resistance. • SPECIFIED VALUE: 0.5 Ω ($\pm 0.3 \Omega$). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Camshaft Adjustment Valve 1 - N205- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 364 – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 364



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623. Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.4 Camshaft Position Sensor 3 - G300- , Checking

Early Production Prior to August 2015 ⇒ [page 365](#)

Late Production After August 2015 ⇒ [page 367](#)

General Description

Camshaft position sensors are located at each camshaft for control and monitoring of the camshaft adjusters. For exact determination of the camshaft adjustment, the basic settings (retard position) of the four camshafts are learned by the control modules (adaptation). During adaptation, the Camshaft solenoid valves are de-energized. The camshafts are moved to retard position (basic setting) both by the setting of the solenoid valves and the direction of pull exerted by the chain. The position of the camshaft position sensor signals relative to the engine speed sensor reference mark (actual values), is stored as basic position and compared to the specified values.

This provides the basic values for camshaft timing control. A distinction is made between basic and fine adaptation. Basic adaptation is always implemented after the ECM is de-energized (no Terminal 30) or erasing of DTCs. After starting the engine, the camshafts briefly remains in the basic position until the exact position of the camshafts with respect to the crankshaft has been established. If the camshafts are already in basic position (valves de-energized) and the coolant temperature is greater than 185° F (85° C), and assuming basic adaptation has been implemented, fine adaptation is always performed briefly several times (for approximately one second) after starting the engine. Adaptation of the inlet camshafts takes place at idle or in the near idle range.



Adaptation of the exhaust camshafts takes place in the engine speed range between 1,200 and 2,000 RPM and at low engine load. The camshaft timing control function is disabled if adaptation is not performed successfully.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure / Early Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 365 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Camshaft Position Sensor 3 - G300- harness connector. • IGNITION: ON. • CHECK: Camshaft Position Sensor 3 - G300- harness connector terminals 1 to 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 366 . – NO: ◆ GO TO: Step 4 ⇒ page 366 .





Step	Procedure	Result / Action to Take
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor 3 - G300- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 28 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REPLACE: Camshaft Position Sensor 3 - G300- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 366 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 366 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor 3 - G300- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 48 for resistance. • CHECK: Camshaft Position Sensor 3 - G300- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 29 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REPLACE: Camshaft Position Sensor 3 - G300- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 366 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 366 .
5	<ul style="list-style-type: none"> • Final Procedure • Perform a road test to verify repair. – Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.



Test Procedure / Late Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18. Was Complaint verified? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ GO TO: Step 2 ⇒ page 367. NO: <ul style="list-style-type: none"> ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> IGNITION: OFF. DISCONNECT: Camshaft Position Sensor 3 - G300- harness connector. IGNITION: ON. CHECK: Camshaft Position Sensor 3 - G300- harness connector terminals 1 to 3 for voltage. IGNITION: OFF. SPECIFIED VALUE: About 5.0 V. Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ GO TO: Step 3 ⇒ page 367. NO: <ul style="list-style-type: none"> ◆ GO TO: Step 4 ⇒ page 367.
3	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Camshaft Position Sensor 3 - G300- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 28 for resistance. SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ REPLACE: Camshaft Position Sensor 3 - G300- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 368. NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 368.
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Camshaft Position Sensor 3 - G300- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 38 for resistance. CHECK: Camshaft Position Sensor 3 - G300- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 29 for resistance. SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ REPLACE: Camshaft Position Sensor 3 - G300- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 368. NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 368.



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.5 Camshaft Position Sensor - G40- , Checking

Early Production Prior to August 2015 ⇒ [page 369](#)

Late Production After August 2015 ⇒ [page 370](#)

General Description

Using the signal from the Camshaft Position Sensor - G40- , the precise position of the camshaft relative to the crankshaft is determined very quickly when the engine is started. Used in combination with the signal from the Engine Speed Sensor - G28- , the signal from the Camshaft Position Sensor - G40- allows to detect which cylinder is at TDC. The fuel can be injected into the corresponding cylinder and ignited.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".



- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions:
⇒ "1.2 Clean Working Conditions", page 3 .
- For Hybrid vehicles refer to:
⇒ "1.3 High Voltage System General Warnings", page 4 .

Test Procedure / Early Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 369 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Camshaft Position Sensor - G40- harness connector. • IGNITION: ON. • CHECK: Camshaft Position Sensor - G40- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 369 . – NO: ◆ GO TO: Step 4 ⇒ page 369 .
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor - G40- harness connector terminal 2 to the Engine Control Module - J623- harness connector terminals T105 / 30 for resistance. • SPECIFIED VALUE: $0.5\ \Omega (\pm 0.3\ \Omega)$ – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Camshaft Position Sensor - G40- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 370 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 370 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor - G40- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. • CHECK: Camshaft Position Sensor - G40- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 47 for resistance. • SPECIFIED VALUE: $0.5\ \Omega (\pm 0.3\ \Omega)$. – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Camshaft Position Sensor - G40- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 370 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 370 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

Test Procedure / Late Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> PERFORM: Preliminary Check to verify the customers concern. Refer to "3.1 Preliminary Check", page 18. Was Complaint verified? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> GO TO: Step 2 ⇒ page 370. NO: <ul style="list-style-type: none"> GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> IGNITION: OFF. DISCONNECT: Camshaft Position Sensor - G40- harness connector. IGNITION: ON. CHECK: Camshaft Position Sensor - G40- harness connector terminals 1 to 3 for voltage. SPECIFIED VALUE: About 5.0 V. IGNITION: OFF. Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> GO TO: Step 3 ⇒ page 371. NO: <ul style="list-style-type: none"> GO TO: Step 4 ⇒ page 371.



Step	Procedure	Result / Action to Take
3	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Camshaft Position Sensor - G40- harness connector terminal 2 to the Engine Control Module - J623- harness connector terminals T105 / 30 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω) Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Camshaft Position Sensor - G40- . Refer to appropriate repair manual. GO TO: Step 5 ⇒ page 371 . NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 5 ⇒ page 371 .
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Camshaft Position Sensor - G40- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. CHECK: Camshaft Position Sensor - G40- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 44 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Camshaft Position Sensor - G40- . Refer to appropriate repair manual. GO TO: Step 5 ⇒ page 371 . NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 5 ⇒ page 371 .
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.



3.6.6 Charge Air Pressure Sensor - G31- , Checking

General Description

The Charge Air Pressure Sensor - G31- is located in the inlet to the intake manifold. The Engine Control Module - J623- uses the sensor signal to regulate the turbo boost. There is no substitute function in the event of signal failure. Charge air pressure regulation is shut off, leading to a significant reduction in engine output.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 372 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Charge Air Pressure Sensor - G31- harness connector. • IGNITION: ON. • CHECK: Charge Air Pressure Sensor - G31- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 373 . – NO: ◆ GO TO: Step 4 ⇒ page 373 .



Step	Procedure	Result / Action to Take
3	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Charge Air Pressure Sensor - G31- harness connector terminal 2 to the Engine Control Module - J623- harness connector T91 / 54 for resistance. CHECK: Charge Air Pressure Sensor - G31- harness connector terminal 4 to the Engine Control Module - J623- harness connector T91 / 55 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Charge Air Pressure Sensor - G31- . Refer to appropriate repair manual. GO TO: Step 5 ⇒ page 373 . NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 5 ⇒ page 373 .
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Charge Air Pressure Sensor - G31- harness connector terminal 1 to the Engine Control Module - J623- harness connector T91 / 35 for resistance. CHECK: Charge Air Pressure Sensor - G31- harness connector terminal 3 to the Engine Control Module - J623- harness connector T91 / 32 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Charge Air Pressure Sensor - G31- . Refer to appropriate repair manual. GO TO: Step 5 ⇒ page 373 . NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 5 ⇒ page 373 .
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 . Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.



3.6.7 Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sen- sor - G581- , Checking

Early Production Prior to August 2015 ⇒ [page 374](#)

Late Production After August 2015 ⇒ [page 376](#)

General Description

The Engine Control Module - J623- computes the nominal charge pressure from the requested torque. If the actual charge pressure deviates from the nominal charge pressure, the wastegate is opened further by the Charge Pressure Actuator - V465- (charge pressure decreases) or closed further (charge pressure increases). The rapid response of the Charge Pressure Actuator - V465- ensures that the wastegate opens quickly in overrun mode, thereby reducing the pumping effort of the turbocharger. The wastegate is closed in the start position. The Charge Pressure Actuator - V465- is activated by the PWM signal, and the Charge Pressure Actuator Position Sensor - G581- provides position feedback.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: ≥ 80° C.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#)
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure / Early Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check ", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 375 . – NO: ◆ GATHER more information from customer about the complaint.



Step	Procedure	Result / Action to Take
2	<ul style="list-style-type: none"> IGNITION: OFF. DISCONNECT: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector. CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- component connector terminals 2 to 6 for resistance. SPECIFIED VALUE: 2.4 – 4.6 Ω (@ approx. 20° C). <p>– Was Value obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 3 ➤ page 375 . – NO: <ul style="list-style-type: none"> ◆ REPLACE: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ➤ page 376 .
3	<ul style="list-style-type: none"> IGNITION: ON. CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminals 1 to 3 for voltage. SPECIFIED VALUE: About 5.0 V. IGNITION: OFF. <p>– Was Value obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 5 ➤ page 375 . – NO: <ul style="list-style-type: none"> ◆ GO TO: Step 4 ➤ page 375 .
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). <p>– Were Values obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 6 ➤ page 376 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ➤ page 376 .
5	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 88 for resistance. CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 5 to the Engine Control Module - J623- harness connector T105 / 41 for resistance. CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 6 to the Engine Control Module - J623- harness connector T105 / 89 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). <p>– Were Values obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REPLACE: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ➤ page 376 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ➤ page 376 .



Step	Procedure	Result / Action to Take
6	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

Test Procedure / Late Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> PERFORM: Preliminary Check to verify the customers concern. Refer to "3.1 Preliminary Check", page 18. Was Complaint verified? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> GO TO: Step 2 ⇒ page 376. NO: <ul style="list-style-type: none"> GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> IGNITION: OFF. DISCONNECT: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector. CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- component connector terminals 2 to 6 for resistance. SPECIFIED VALUE: 2.4 – 4.6 Ω (@ approx. 20° C). Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> GO TO: Step 3 ⇒ page 377. NO: <ul style="list-style-type: none"> REPLACE: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- . Refer to appropriate repair manual. GO TO: Step 6 ⇒ page 378.



Step	Procedure	Result / Action to Take
3	<ul style="list-style-type: none"> • IGNITION: ON. • CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF – Was Value obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 5 ➤ page 377 . – NO: <ul style="list-style-type: none"> ◆ GO TO: Step 4 ➤ page 377 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 61 for resistance. • CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 20 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 6 ➤ page 378 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ➤ page 378 .
5	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 88 for resistance. • CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 5 to the Engine Control Module - J623- harness connector T105 / 41 for resistance. • CHECK: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- harness connector terminal 6 to the Engine Control Module - J623- harness connector T105 / 89 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REPLACE: Charge Pressure Actuator - V465- / Charge Pressure Actuator Position Sensor - G581- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ➤ page 378 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ➤ page 378 .



Step	Procedure	Result / Action to Take
6	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.8 Engine Component Power Supply Relay - J757- , Checking

General Description

The following procedure is used to diagnose the Engine Component Power Supply Relay - J757- and the power supply voltage that is provided to the Ignition Coils .

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
[⇒ "1.1 Safety Precautions", page 2](#) .



- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 379 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Engine Component Power Supply Relay - J757- from the fuse box in the engine compartment. • CHECK: Engine Component Power Supply Relay - J757- harness connector terminal 111 (relay term 86) and 113 (relay term 30) to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 379 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 380 .
3	<ul style="list-style-type: none"> • CONNECT: Jumper wire, Engine Component Power Supply Relay - J757- socket terminals 113 (relay term 30) and 115 (relay term 87). • DISCONNECT: Ignition Coil 1, 2, 3, 4 With Power Output Stage - N70, N127, N291, N292- harness connectors. • CHECK: Ignition Coil 1, 2, 3, 4 With Power Output Stage - N70, N127, N291, N292- harness connector terminal 4 to ground for voltage. • SPECIFIED VALUE: Battery voltage. – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 379 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 380 .
4	<ul style="list-style-type: none"> • REMOVE: Jumper wire, Engine Component Power Supply Relay - J757- socket terminals 113 (relay term 30) and 115 (relay term 87). • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Component Power Supply Relay - J757- harness connector terminal 112 (relay term 85) to the Engine Control Module - J623- harness connector T91 / 8 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Engine Component Power Supply Relay - J757- . Refer to the appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 380 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 380 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> • Final Procedure • Perform a road test to verify repair. – Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.9 Engine Coolant Temperature Sensor - G62- , Checking

General Description

The Engine Coolant Temperature Sensor - G62- sends information about the current coolant temperature to the Engine Control Module - J623- . It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Gear Shift Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.



- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 381 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor - G62- harness connector. • CHECK: Engine Coolant Temperature Sensor - G62- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2,250 Ω (+/- 750 Ω @ approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 381 . – NO: ◆ REPLACE: Engine Coolant Temperature Sensor - G62- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 382 .
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Coolant Temperature Sensor - G62- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 47 for resistance. • CHECK: Engine Coolant Temperature Sensor - G62- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 40 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Engine Coolant Temperature Sensor - G62- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 382 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 382 .



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.10 Engine Coolant Temperature Sensor On Radiator Outlet - G83- , Checking

General Description

The Engine Coolant Temperature Sensor On Radiator Outlet - G83- sends information about the current coolant temperature to the Engine Control Module - J623- . It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.



- Observe all safety precautions:
⇒ [“1.1 Safety Precautions”, page 2](#) .
- View clean working conditions:
⇒ [“1.2 Clean Working Conditions”, page 3](#) .
- For Hybrid vehicles refer to:
⇒ [“1.3 High Voltage System General Warnings”, page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ “3.1 Preliminary Check”, page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 383 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet - G83- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2,250 Ω (+/- 750 Ω @ approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 383 . – NO: ◆ REPLACE: Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 384 .
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector terminal 1 to the Engine Control Module - J623- harness connector T91 / 49 for resistance. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector terminal 2 to the Engine Control Module - J623- harness connector T91 / 29 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 384 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 384 .



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.11 Engine Speed Sensor - G28- , Checking

Early Production Prior to August 2015 ➔ [page 385](#)

Late Production After August 2015 ➔ [page 386](#)

General Description

The Engine Speed Sensor - G28- detects rpm and reference marks from a toothed wheel on the crankshaft. Without an engine speed signal, the engine will not start. If the engine speed signal fails while the engine is running, the engine will stop immediately.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.



- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure / Early production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 385 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • CONNECT: Scan Tool. • START or CRANK: Engine. • CHECK: Engine rpm. • SPECIFIED VALUE: Cranking or Idle rpm. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 386 . – NO: ◆ GO TO: Step 3 ⇒ page 385 .
3	<ul style="list-style-type: none"> • DISCONNECT: Engine Speed Sensor - G28-harness connector. • IGNITION: ON. • CHECK: Engine Speed Sensor - G28- wiring connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 385 . – NO: ◆ GO TO: Step 5 ⇒ page 386 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Speed Sensor - G28- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 70 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REMOVE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ◆ CHECK: Engine Speed Sensor - G28- wheel for proper seating, damage and/or run - out. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 386 . ◆ Sensor wheel OK ◆ REPLACE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 386 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Speed Sensor - G28- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. • CHECK: Engine Speed Sensor - G28- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REPLACE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 386 . – NO: <ul style="list-style-type: none"> ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 386 .
6	<ul style="list-style-type: none"> • Final Procedure • Perform a road test to verify repair. – Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

Test Procedure / Late Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 2 ⇒ page 387 . – NO: <ul style="list-style-type: none"> ◆ GATHER more information from customer about the complaint.



Step	Procedure	Result / Action to Take
2	<ul style="list-style-type: none"> CONNECT: Scan Tool. START or CRANK: Engine. CHECK: Engine rpm. SPECIFIED VALUE: Cranking or Idle rpm. IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 388 . – NO: <ul style="list-style-type: none"> ◆ GO TO: Step 3 ⇒ page 387 .
3	<ul style="list-style-type: none"> DISCONNECT: Engine Speed Sensor - G28- harness connector. IGNITION: ON. CHECK: Engine Speed Sensor - G28- wiring connector terminals 1 to 3 for voltage. SPECIFIED VALUE: About 5.0 V. IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 4 ⇒ page 387 . – NO: <ul style="list-style-type: none"> ◆ GO TO: Step 5 ⇒ page 387 .
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Engine Speed Sensor - G28- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 70 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REMOVE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ◆ CHECK: Engine Speed Sensor - G28- wheel for proper seating, damage and/or run - out. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 388 . ◆ Sensor wheel OK. ◆ REPLACE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 388 . – NO: <ul style="list-style-type: none"> ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 388 .
5	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Engine Speed Sensor - G28- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. CHECK: Engine Speed Sensor - G28- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 77 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REPLACE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 388 . – NO: <ul style="list-style-type: none"> ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 388 .



Step	Procedure	Result / Action to Take
6	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.12 Engine Temperature Control Actuator - N493- Checking

Early Production Prior to August 2015 ➔ [page 389](#)

Late Production After August 2015 ➔ [page 390](#)

General Description

Coolant flow is regulated by means of two mechanically coupled rotary slide valves. The angular position of the rotary slide valves is regulated according to various engine maps stored in the engine control unit. Various switching positions can be implemented by configuring the rotary slide valves accordingly. This allows rapid heating of the engine, which, in turn, results in lower friction and higher fuel economy.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".



- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions:
⇒ "1.2 Clean Working Conditions", page 3 .
- For Hybrid vehicles refer to:
⇒ "1.3 High Voltage System General Warnings", page 4 .

Test Procedure / Early Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 389 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Engine Temperature Control Actuator - N493- harness connector. • CHECK: Engine Temperature Control Actuator - N493- component connector terminals 4 to 5 for resistance. • SPECIFIED VALUE: $2.4 - 4.6\ \Omega$ (@ approx. 20°C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 389 . – NO: ◆ REPLACE: Engine Temperature Control Actuator - N493- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 390 .
3	<ul style="list-style-type: none"> • IGNITION: ON. • CHECK: Engine Temperature Control Actuator - N493- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 5 ⇒ page 390 . – NO: ◆ GO TO: Step 4 ⇒ page 389 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. • CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. • SPECIFIED VALUE: $0.5\ \Omega$ ($\pm 0.3\ \Omega$). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 6 ⇒ page 390 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 390 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 80 for resistance. CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 4 to the Engine Control Module - J623- harness connector T105 / 86 for resistance. CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 5 to the Engine Control Module - J623- harness connector T105 / 87 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Engine Temperature Control Actuator - N493- . Refer to appropriate repair manual. GO TO: Step 6 ⇒ page 390 . NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 6 ⇒ page 390 .
6	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. If all electrical connections are OK: <ul style="list-style-type: none"> REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

Test Procedure / Late Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . Was Complaint verified? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> GO TO: Step 2 ⇒ page 391 . NO: <ul style="list-style-type: none"> GATHER more information from customer about the complaint.



Step	Procedure	Result / Action to Take
2	<ul style="list-style-type: none"> IGNITION: OFF. DISCONNECT: Engine Temperature Control Actuator - N493- harness connector. CHECK: Engine Temperature Control Actuator - N493- component connector terminals 4 to 5 for resistance. SPECIFIED VALUE: 2.4 – 4.6 Ω (@ approx. 20° C). <p>– Was Value obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 3 ⇒ page 391 . – NO: <ul style="list-style-type: none"> ◆ REPLACE: Engine Temperature Control Actuator - N493- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 392 .
3	<ul style="list-style-type: none"> IGNITION: ON. CHECK: Engine Temperature Control Actuator - N493- harness connector terminals 1 to 3 for voltage. SPECIFIED VALUE: About 5.0 V. IGNITION: OFF. <p>– Was Value obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 5 ⇒ page 391 . – NO: <ul style="list-style-type: none"> ◆ GO TO: Step 4 ⇒ page 391 .
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 78 for resistance. CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 26 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). <p>– Were Values obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 6 ⇒ page 392 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 392 .
5	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 80 for resistance. CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 4 to the Engine Control Module - J623- harness connector T105 / 86 for resistance. CHECK: Engine Temperature Control Actuator - N493- harness connector terminal 5 to the Engine Control Module - J623- harness connector T105 / 87 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). <p>– Were Values obtained?</p>	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REPLACE: Engine Temperature Control Actuator - N493- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 392 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 392 .



Step	Procedure	Result / Action to Take
6	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.13 EVAP Canister Purge Regulator Valve 1 - N80- , Checking

General Description

EVAP system is designed so that the admission of fuel vapors takes place only at idle and at light part-throttle. EVAP Canister Purge Regulator Valve 1 - N80- is map-activated by the Engine Control Module (ECM) - J623- to accomplish this task.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.



- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 393 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: EVAP Canister Purge Regulator Valve 1 - N80- harness connector. • CHECK: EVAP Canister Purge Regulator Valve 1 - N80- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 10 – 35 Ω (@ approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 393 . – NO: ◆ REPLACE: EVAP Canister Purge Regulator Valve 1 - N80- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 394 .
3	<ul style="list-style-type: none"> • IGNITION: ON. • CHECK: EVAP Canister Purge Regulator Valve 1 - N80- harness connector terminal 1 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 393 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 5 ⇒ page 394 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: EVAP Canister Purge Regulator Valve 1 - N80- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 3 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: EVAP Canister Purge Regulator Valve 1 - N80- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 394 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 394 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.14 Exhaust Camshaft Adjustment Valve 1 - N318- , Checking

General Description

By adjusting the camshafts, power and torque can be increased, fuel consumption can be improved and emissions reduced, depending on the load characteristics of the engine. To adjust the camshafts, the Engine Control Module (ECM) - J623- actuates Exhaust Camshaft Adjustment Valve 1 - N318- . Camshaft adjusters are adjusted by actuator solenoids with the assistance of the engine oil pressure. Adjusting both camshafts enables a maximum valve overlap of 42° CRK. The valve overlap allows for internal exhaust gas recirculation.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".



- Vehicles with Manual Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions:
⇒ "1.2 Clean Working Conditions", page 3 .
- For Hybrid vehicles refer to:
⇒ "1.3 High Voltage System General Warnings", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 395 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Exhaust Camshaft Adjustment Valve 1 - N318- harness connector. • CHECK: Exhaust Camshaft Adjustment Valve 1 - N318- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 5 – 30 Ω (@ approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 395 . – NO: ◆ REPLACE: Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 396 .
3	<ul style="list-style-type: none"> • IGNITION: ON. • CHECK: Exhaust Camshaft Adjustment Valve 1 - N318- harness connector terminal 1 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 395 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 5 ⇒ page 396 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Exhaust Camshaft Adjustment Valve 1 - N318- harness connector terminal 2 to the Engine Control Module - J623- harness connector terminals T105 / 104 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Exhaust Camshaft Adjustment Valve 1 - N318- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 396 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 396 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.15 Fuel Injectors , Checking

General Description

The Cylinder Fuel Injectors are controlled by the Engine Control Module - J623- and mounted normal in the cylinder head. The fuel injectors spray high-pressure atomized fuel directly into the combustion chamber.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ} \text{C}$.
- Observe all safety precautions:
[⇒ "1.1 Safety Precautions", page 2](#).
- View clean working conditions:
[⇒ "1.2 Clean Working Conditions", page 3](#).



- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ♦ GO TO: Step 2 ⇒ page 397 . – NO: ♦ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Suspect Fuel Injector from harness connector. • CHECK: Suspect Fuel Injector component connector terminals 1 to 2 for resistance (refer to the wiring diagram for proper terminal locations). • SPECIFIED VALUE: 0.5 – 15 Ω (@ approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ♦ GO TO: Step 3 ⇒ page 397 . – NO: ♦ REPLACE: Suspect Fuel Injector (s). Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 398 .
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Suspect Fuel Injector harness connector terminal 1 to the Engine Control Module - J623- harness connector for resistance (refer to the wiring diagram for proper terminal locations). • CHECK: Suspect Fuel Injector harness connector terminal 2 to the Engine Control Module - J623- harness connector for resistance (refer to the wiring diagram for proper terminal locations). • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ♦ REPLACE: Suspect Fuel Injector (s). Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 398 . – NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 398 .



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.16 Fuel Pressure Regulator Valve - N276- Checking

General Description

The Engine Control Module - J623- regulates the Fuel Pressure Regulator Valve - N276- directly at the High Pressure Fuel Pump to control the low pressure valve inside the High Pressure Fuel Pump.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ} \text{C}$.



- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 399 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Fuel Pressure Regulator Valve - N276- harness connector. • CHECK: Fuel Pressure Regulator Valve - N276- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 1.5 – 11 Ω (@ approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 399 . – NO: ◆ REPLACE: Fuel Pressure Regulator Valve - N276- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 400 .
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Pressure Regulator Valve - N276- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 93 for resistance. • CHECK: Fuel Pressure Regulator Valve - N276- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 92 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Fuel Pressure Regulator Valve - N276- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 400 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 400 .



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.17 Fuel Pressure Sensor - G247- , Checking

Early Production Prior to August 2015 [⇒ page 401](#)

Late Production After August 2015 [⇒ page 402](#)

General Description

The Fuel Pressure Sensor - G247- measures the fuel pressure in the high-pressure fuel system. The Engine Control Module - J623- analyzes the signal and regulates the fuel high pressure through the Fuel Metering Valve - N290- in the high-pressure pump.

Special tools and workshop equipment required

- ◆ Multimeter
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.



- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ [“1.1 Safety Precautions”, page 2](#).
- View clean working conditions:
⇒ [“1.2 Clean Working Conditions”, page 3](#).
- For Hybrid vehicles refer to:
⇒ [“1.3 High Voltage System General Warnings”, page 4](#).

Test Procedure / Early Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ “3.1 Preliminary Check”, page 18. – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 401. – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Fuel Pressure Sensor - G247- harness connector. • IGNITION: ON. • CHECK: Fuel Pressure Sensor - G247- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 401. – NO: ◆ GO TO: Step 4 ⇒ page 401.
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Pressure Sensor - G247- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 49 for resistance. • SPECIFIED VALUE: $0.5\ \Omega (\pm 0.3\ \Omega)$. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Fuel Pressure Sensor - G247- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 402. – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector ◆ GO TO: Step 5 ⇒ page 402.
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Pressure Sensor - G247- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. • CHECK: Fuel Pressure Sensor - G247- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. • SPECIFIED VALUE: $0.5\ \Omega (\pm 0.3\ \Omega)$. – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Fuel Pressure Sensor - G247- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 402. – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 402.



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. If all electrical connections are OK: <ul style="list-style-type: none"> REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

Test Procedure / Late Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> PERFORM: Preliminary Check to verify the customers concern. Refer to "3.1 Preliminary Check", page 18. Was Complaint verified? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> GO TO: Step 2 ⇒ page 402. NO: <ul style="list-style-type: none"> GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> IGNITION: OFF. DISCONNECT: Fuel Pressure Sensor - G247- harness connector. IGNITION: ON. CHECK: Fuel Pressure Sensor - G247- harness connector terminals 1 to 3 for voltage. SPECIFIED VALUE: About 5.0 V. IGNITION: OFF. Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> GO TO: Step 3 ⇒ page 403. NO: <ul style="list-style-type: none"> GO TO: Step 4 ⇒ page 403.



Step	Procedure	Result / Action to Take
3	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Fuel Pressure Sensor - G247- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 49 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Fuel Pressure Sensor - G247- . Refer to appropriate repair manual. GO TO: Step 5 ⇒ page 403 . NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 5 ⇒ page 403 .
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Fuel Pressure Sensor - G247- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 11 for resistance. CHECK: Fuel Pressure Sensor - G247- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 68 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Fuel Pressure Sensor - G247- . Refer to appropriate repair manual. GO TO: Step 5 ⇒ page 403 . NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 5 ⇒ page 403 .
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 . Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.



3.6.18 Fuel Pump Control Module - J538- / Fuel Delivery Unit - GX1- , Checking

General Description

The Engine Control Module - J623- tells the Fuel Pump Control Module - J538- the demand needed for fuel volume and pressure and activates the Fuel Delivery Unit - GX1- . The Fuel Delivery Unit - GX1- transfers fuel to the rest of the fuel system, where it is monitored by the Engine Control Module - J623- through sensors, and controlled through regulators and/or metering valves.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure



Note

When the door is opened or the Ignition is turned to the ON position the fuel pump is activated for 2 seconds to build up the pressure in the fuel system.

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 405 . – NO: ◆ GATHER more information from customer about the complaint.



Step	Procedure	Result / Action to Take
2	<ul style="list-style-type: none"> IGNITION: ON. LISTEN: Fuel Delivery Unit - GX1- should be heard running for 2 sec. SPECIFIED VALUE: Transfer Fuel Pump ON for 2 sec. IGNITION: OFF. Was Value obtained? 	<ul style="list-style-type: none"> YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 406 . NO: ◆ GO TO: Step 3 ⇒ page 405 .
3	<ul style="list-style-type: none"> DISCONNECT: Fuel Pump Control Module - J538- harness connector. IGNITION: ON. CHECK: Fuel Pump Control Module - J538- harness connector terminal 3 to 4 for voltage. SPECIFIED VALUE: Battery voltage. IGNITION: OFF. Was Value obtained? 	<ul style="list-style-type: none"> YES: ◆ GO TO: Step 4 ⇒ page 405 . NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 7 ⇒ page 406 .
4	<ul style="list-style-type: none"> RECONNECT: Fuel Pump Control Module - J538- harness connector. DISCONNECT: Fuel Delivery Unit - GX1- harness connector. CRANK: Engine. CHECK: Fuel Delivery Unit - GX1- harness connector terminals 1 to 5 for voltage while engine is cranking. SPECIFIED VALUE: 7 – 11 V. IGNITION: OFF. Was Value obtained? 	<ul style="list-style-type: none"> YES: ◆ REPLACE: Fuel Delivery Unit - GX1- , Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 406 . NO: ◆ GO TO: Step 5 ⇒ page 405 .
5	<ul style="list-style-type: none"> DISCONNECT: Fuel Pump Control Module - J538- harness connector. CHECK: Fuel Delivery Unit - GX1- harness connector terminal 1 to the Fuel Pump Control Module - J538- harness connector terminal 1 for resistance. CHECK: Fuel Delivery Unit - GX1- harness connector terminal 5 to the Fuel Pump Control Module - J538- harness connector terminal 2 for resistance. SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: ◆ GO TO: Step 6 ⇒ page 406 . NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 406 .



Step	Procedure	Result / Action to Take
6	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Fuel Pump Control Module - J538- harness connector terminal 5 to the Engine Control Module - J623- harness connector T91 / 9 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Fuel Pump Control Module - J538- . Refer to appropriate repair manual. GO TO: Step 7 ➔ page 406 . NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 7 ➔ page 406 .
7	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Do any DTC's return: 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to ➔ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 . Repair is complete. Generate Readiness Code. Refer to ➔ "3.2 Readiness Code", page 19 . Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to ➔ "3.2 Readiness Code", page 19 . Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

3.6.19 Fuel Tank Leak Detection Control Module - J909- / Fuel Tank Pressure Sensor - G400- , Checking

General Description

The system can test the evaporative system integrity by using natural vacuum after the engine is shut off. The Engine Control Module - J623- monitors the ability of the system to maintain vacuum through signals sent from the Fuel Tank Pressure Sensor - G400- / Fuel Tank Leak Detection Control Module - J909- . If the vacuum remains for a specified period of time, then there are no evaporative leaks, and a PASS is reported by the Engine Control Module - J623- . If there is a leak, the system either will not ach-



ieve a vacuum, or a vacuum cannot be maintained. Usually a fault can only be detected after a cold start.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#).
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#).
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#).

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 18. – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 407. – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • REMOVE: Evaporative Canister. Refer to appropriate repair manual. • Plug or Cap off the Fuel Tank Pressure Sensor - G400- hose going to the vent filter. • CONNECT: Hand vacuum pump to the Fuel Tank Pressure Sensor - G400- and apply 0.700 bar and see if the vacuum holds. – Did the vacuum hold? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 407. – NO: ◆ REPLACE: Fuel Tank Pressure Sensor - G400-. Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 409.
3	<ul style="list-style-type: none"> • DISCONNECT: Fuel Tank Pressure Sensor - G400- harness connector • CHECK: Fuel Tank Pressure Sensor - G400- component connector terminals 1 to 3 for resistance. • SPECIFIED VALUE: 18 – 30 Ω ($\pm 5.0 \Omega$ @ approx. 20°C) – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 408. – NO: ◆ REPLACE: Fuel Tank Pressure Sensor - G400-. Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 409.



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> • REMOVE: Fuel Tank Leak Detection Control Module - J909- . Refer to appropriate repair manual. • CHECK: Fuel Tank Pressure Sensor - G400- harness connector terminal 1 to Fuel Tank Leak Detection Control Module - J909- harness connector terminal 1 for resistance. • CHECK: Fuel Tank Pressure Sensor - G400- harness connector terminal 3 to Fuel Tank Leak Detection Control Module - J909- harness connector terminal 5 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 5 ⇒ page 408 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 409 .
5	<ul style="list-style-type: none"> • DISCONNECT: Fuel Tank Leak Detection Control Module - J909 - harness connector. • IGNITION: ON. • CHECK: Fuel Tank Leak Detection Control Module - J909 - harness connector terminal 4 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. <p>– Was Value obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 6 ⇒ page 408 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 409 .
6	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Tank Leak Detection Control Module - J909 - harness connector terminal 2 to the Engine Control Module - J623- harness connector T91 / 38 for resistance. • CHECK: Fuel Tank Leak Detection Control Module - J909 - harness connector terminal 3 to the Engine Control Module - J623- harness connector T91 / 78 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ REPLACE: Fuel Tank Leak Detection Control Module - J909- . Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 409 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 409 .



Step	Procedure	Result / Action to Take
7	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

3.6.20 Ignition Coils with Power Output Stage , Checking

General Description

The ignition coil must transform the relatively low 12 V on-board vehicle voltage to the high ignition voltage required and supply the energy stored in that voltage to the spark plug. The functional principle of the ignition coil is relatively simple. It has a primary winding (small number of turns) and a secondary winding (lots of turns). The turn ratio between the number of primary and secondary winding turns determines the level of the voltage generated at the output. Ignition Coils With Power Output Stage are plugged directly into the spark plug. This means that the ignition energy can be transferred directly to the spark plug with virtually zero power loss.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.
- ◆ LED Test Lamp.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.



- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 410 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Suspected Ignition Coil With Power Output Stage harness connector. • IGNITION: ON. • CHECK: Ignition Coil With Power Output Stage harness connector terminal 4 to 1 for voltage. • CHECK: Ignition Coil With Power Output Stage harness connector terminal 4 to 3 for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 410 . – NO: ◆ CHECK: Wiring for opens, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 5 ⇒ page 411 .
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Suspected Ignition Coil With Power Output Stage harness connector terminal 2 to the Engine Control Module - J623- harness connector terminals (refer to the wiring diagram for proper terminal locations). • SPECIFIED VALUE: $0.5\ \Omega (\pm 0.3\ \Omega)$. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 410 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 411 .
4	<ul style="list-style-type: none"> • DISABLE: Fuel Injectors . Refer to appropriate wiring diagram for in-line connector locations and/or fuses. • DISCONNECT: Cold Start Injector (if applicable). • CONNECT: LED Test Lamp to suspected Ignition Coil With Power Output Stage harness connector terminals 2 to 3. • CRANK: Engine. • SPECIFIED VALUE: LED Test Lamp should flicker ON & OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Suspected Ignition Coil With Power Output Stage . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 411 . – NO: ◆ GO TO: Step 5 ⇒ page 411 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.21 Intake Manifold Runner Control Valve - N316- , Checking

General Description

The intake manifold runner valve(s) are mounted on a common shaft and actuated by a vacuum cell. The partial vacuum required for actuation is supplied by the Intake Manifold Runner Control Valve - N316- . The Engine Control Module (ECM) - J623- activates the Intake Manifold Runner Control Valve - N316- on the basis of a characteristic map.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ} \text{C}$.



- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 412 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Intake Manifold Runner Control Valve - N316- harness connector. • CHECK: Intake Manifold Runner Control Valve - N316- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 5 – 35 Ω (@ approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 412 . – NO: ◆ REPLACE: Intake Manifold Runner Control Valve - N316- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 413 .
3	<ul style="list-style-type: none"> • IGNITION: ON. • CHECK: Intake Manifold Runner Control Valve - N316- harness connector terminal 1 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 412 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 5 ⇒ page 413 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Manifold Runner Control Valve - N316- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 53 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Intake Manifold Runner Control Valve - N316- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 413 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 5 ⇒ page 413 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.22 Intake Manifold Runner Position Sensor - G336- , Checking

Early Production Prior to August 2015 ⇒ [page 414](#)

Late Production After August 2015 ⇒ [page 415](#)

General Description

The Engine Control Module - J623- uses the Intake Manifold Runner Position Sensor - G336- signal to calculate a correction value for the charge air pressure. Evaluation of the signal gives consideration to the influence of temperature on the density of the charge air. Failure in the event of signal failure, the Engine Control Module - J623- employs a fixed, substitute value for calculation purposes. This may lead to reduced engine output.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".



- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#).
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#).
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#).

Test Procedure / Early Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18. – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 414. – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Intake Manifold Runner Position Sensor - G336- harness connector. • IGNITION: ON. • CHECK: Intake Manifold Runner Position Sensor - G336- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 414. – NO: ◆ GO TO: Step 4 ⇒ page 415.
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Manifold Runner Position Sensor - G336- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 36 for resistance. • SPECIFIED VALUE: $0.5\ \Omega (\pm 0.3\ \Omega)$. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Intake Manifold Runner Position Sensor - G336- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 415. – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 5 ⇒ page 415.



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Intake Manifold Runner Position Sensor - G336- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 48 for resistance. CHECK: Intake Manifold Runner Position Sensor - G336- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 47 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Intake Manifold Runner Position Sensor - G336- . Refer to appropriate repair manual. GO TO: Step 5 ⇒ page 415 . NO: <ul style="list-style-type: none"> CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. REPLACE: Any open fuses. GO TO: Step 5 ⇒ page 415 .
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 . Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

Test Procedure / Late Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . Was Complaint verified? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> GO TO: Step 2 ⇒ page 416 . NO: <ul style="list-style-type: none"> GATHER more information from customer about the complaint.



Step	Procedure	Result / Action to Take
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Intake Manifold Runner Position Sensor - G336- harness connector. • IGNITION: ON. • CHECK: Intake Manifold Runner Position Sensor - G336- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. <p>– Was Value obtained?</p>	<p>– YES: ◆ GO TO: Step 3 ⇒ page 416 .</p> <p>– NO: ◆ GO TO: Step 4 ⇒ page 416 .</p>
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Manifold Runner Position Sensor - G336- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 36 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). <p>– Was Value obtained?</p>	<p>– YES: ◆ REPLACE: Intake Manifold Runner Position Sensor - G336- . Refer to appropriate repair manual.</p> <p>◆ GO TO: Step 5 ⇒ page 417 .</p> <p>– NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals.</p> <p>◆ REPAIR: Faulty wiring or connector.</p> <p>◆ REPLACE: Any open fuses.</p> <p>◆ GO TO: Step 5 ⇒ page 417 .</p>
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Manifold Runner Position Sensor - G336- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 48 for resistance. • CHECK: Intake Manifold Runner Position Sensor - G336- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 27 for resistance. <p>SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω).</p> <p>– Were Values obtained?</p>	<p>– YES: ◆ REPLACE: Intake Manifold Runner Position Sensor - G336- . Refer to appropriate repair manual.</p> <p>◆ GO TO: Step 5 ⇒ page 417 .</p> <p>– NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals.</p> <p>◆ REPAIR: Faulty wiring or connector.</p> <p>◆ REPLACE: Any open fuses.</p> <p>◆ GO TO: Step 5 ⇒ page 417 .</p>



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.23 Intake Manifold Sensor - GX9- , Checking

Early Production Prior to August 2015 ⇒ [page 418](#)

Late Production After August 2015 ⇒ [page 419](#)

General Description

Air mass and charge pressure are two factors used for engine load management. For this purpose, there are several sensors with absolutely identical functions. They measure the intake air temperature and the intake manifold pressure. The first sender unit is located upstream of the Throttle Valve Control Module - J338- in the Intake Manifold Sensor - GX9- . They measure the pressure and temperature of the air in each individual cylinder bank. The values measured here correspond to the actual air mass in the cylinder bank(s).

Note the Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- are also known as the Intake Manifold Sensor - GX9- .

The Intake Manifold Sensor - GX9- contains the following components:

- ◆ Manifold Absolute Pressure Sensor - G71- .
- ◆ Intake Air Temperature Sensor - G42- .

The Intake Manifold Sensor - GX9- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required



- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#).
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#).
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#).

Test Procedure / Early Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18. – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 418. – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Intake Manifold Sensor - GX9- harness connector. • IGNITION: ON. • CHECK: Intake Manifold Sensor - GX9- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 418. – NO: ◆ GO TO: Step 4 ⇒ page 419.
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 51 for resistance. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 4 to the Engine Control Module - J623- harness connector T105 / 52 for resistance. • SPECIFIED VALUE: $0.5\ \Omega (\pm 0.3\ \Omega)$, – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Intake Manifold Sensor - GX9- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 419. – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 5 ⇒ page 419.



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Intake Manifold Sensor - GX9- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. CHECK: Intake Manifold Sensor - GX9- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Intake Manifold Sensor - GX9- . Refer to appropriate repair manual. GO TO: Step 5 ⇒ page 419 . NO: <ul style="list-style-type: none"> CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. REPLACE: Any open fuses. GO TO: Step 5 ⇒ page 419 .
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26 . Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. If all electrical connections are OK: <ul style="list-style-type: none"> REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19 . Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

Test Procedure / Late Production

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . Was Complaint verified? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> GO TO: Step 2 ⇒ page 420 . NO: <ul style="list-style-type: none"> GATHER more information from customer about the complaint.



Step	Procedure	Result / Action to Take
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Intake Manifold Sensor - GX9- harness connector. • IGNITION: ON. • CHECK: Intake Manifold Sensor - GX9- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. <p>– Was Value obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 3 ➤ page 420 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 4 ➤ page 420 .
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 51 for resistance. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 4 to the Engine Control Module - J623- harness connector T105 / 52 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω), <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ REPLACE: Intake Manifold Sensor - GX9- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ➤ page 421 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 5 ➤ page 421 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 42 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ REPLACE: Intake Manifold Sensor - GX9- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ➤ page 421 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 5 ➤ page 421 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. <p>– Does the original DTC return?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. <p>– NO:</p> <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.24 Knock Sensor 1 - G61- , Checking

General Description

The Knock Sensor 1 - G61- is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The Engine Control Module - J623- uses this signal to determine the presence of engine knock and to retard spark timing.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ} \text{C}$.
- Observe all safety precautions:
[⇒ "1.1 Safety Precautions", page 2](#).



- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 422 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Knock Sensor 1 - G61- harness connector. • CHECK: Knock Sensor 1 - G61- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2,250 Ω (+/- 750 Ω @ approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 422 . – NO: ◆ REPLACE: Knock Sensor 1 - G61- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 423 .
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Knock Sensor 1 - G61- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 98 for resistance. • CHECK: Knock Sensor 1 - G61- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 97 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Knock Sensor 1 - G61- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 423 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 4 ⇒ page 423 .



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.25 Motronic Engine Control Module Power Supply Relay - J271- , Checking

General Description

The following procedure is used to diagnose the Motronic Engine Control Module Power Supply Relay - J271- and the Engine Control Module - J623- power supply voltage that is provided by the Motronic Engine Control Module Power Supply Relay - J271- .

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.



- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 424 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Motronic Engine Control Module Power Supply Relay - J271- from the fuse box in the engine compartment. • IGNITION: ON. • CHECK: Motronic Engine Control Module Power Supply Relay - J271- socket terminals 87 and 86 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 424 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 425 .
3	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CONNECT: Jumper wire Motronic Engine Control Module Power Supply Relay - J271- socket terminals 87 and 30. • CHECK: Engine Control Module - J623- harness connector T91 / 5 and T91 / 6 to ground for voltage. • SPECIFIED VALUE: Battery voltage. – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 424 . – NO: ◆ GO TO: Step 5 ⇒ page 425 .
4	<ul style="list-style-type: none"> • REMOVE: Jumper wire Motronic Engine Control Module Power Supply Relay - J271- socket terminals 87 and 30. • CHECK: Motronic Engine Control Module Power Supply Relay - J271- socket terminal 85 to the Engine Control Module - J623- harness connector T91 / 7 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Motronic Engine Control Module Power Supply Relay - J271- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 425 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 425 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> REMOVE: Jumper wire Motronic Engine Control Module Power Supply Relay - J271- socket terminals 87 and 30. REMOVE: Fuse. Refer to appropriate wiring diagram for specific fuse. CHECK: Downstream (output) side of fuse to Engine Control Module - J623- harness connector T91 / 5 and T91 / 6 for resistance. SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> REPLACE: Fuse Panel B - SB- fuse box. Refer to appropriate repair manual. GO TO: Step 6 ⇒ page 425. NO: <ul style="list-style-type: none"> PERFORM: Visual Inspection of wiring and component. CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. REPAIR: Faulty wiring or connector. GO TO: Step 6 ⇒ page 425.
6	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

3.6.26 Outside Air Temperature Sensor - G17- , Checking

General Description

The ambient or Outside Air Temperature Sensor - G17- is a negative temperature coefficient (NTC) sensor that informs the semi-automatic / automatic temperature control system of outside air temperature. An NTC sensor's resistance decreases as the temperature increases. The computer uses this input along with different in-car temperature sensors to control temperature and blower speed. When there is a problem with this sensor, performance will suffer and the compressor's clutch may not engage.

Special tools and workshop equipment required



- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#).
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#).
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#).

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18. – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 426. – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Outside Air Temperature Sensor - G17- harness connector. • CHECK: Outside Air Temperature Sensor - G17- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: $1,300\ \Omega$ (+/- $500\ \Omega$ @ approx. 20°C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 426. – NO: ◆ REPLACE: Outside Air Temperature Sensor - G17-. Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 427.
3	<ul style="list-style-type: none"> • REMOVE: Vehicle Electrical System Control Module - J519-. Refer to appropriate repair manual. • CHECK: Outside Air Temperature Sensor - G17- harness connector terminal 1 to the Vehicle Electrical System Control Module - J519- harness connector T46b / 19 for resistance. • CHECK: Outside Air Temperature Sensor - G17- harness connector terminal 2 to the Vehicle Electrical System Control Module - J519- harness connector T46b / 27 for resistance. • SPECIFIED VALUE: $0.5\ \Omega$ ($\pm 0.3\ \Omega$). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Outside Air Temperature Sensor - G17-. Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 427. – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 427.



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623-. Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.27 Oxygen Sensor 1 After Catalytic Converter - GX7- , Checking

General Description

The Oxygen Sensor 1 After Catalytic Converter - GX7- downstream of the primary catalytic converter supplies the Engine Control Module - J623- with a voltage signal (nonlinear) indicating "rich" or "lean". If the primary catalytic converter is supersaturated with oxygen (lean mixture), Oxygen Sensor 1 After Catalytic Converter - GX7- will send the Engine Control Module - J623- a nonlinear signal indicating the lean mixture condition. The mixture is then enriched with fuel until the oxygen has been "displaced" from the catalytic converter. This condition, in turn, is registered by Oxygen Sensor 1 After Catalytic Converter - GX7- as a nonlinear signal indicating the rich mixture condition. The mixture is then leaned out by the Engine Control Module - J623-. If the nonlinear signal is received again, the mixture will again be enriched. The frequency, or period, during which the mixture is enriched or leaned out is variable, being dependent on the gas flow rate (engine load) at that moment.

Note the Oxygen Sensor 1 After Catalytic Converter - GX7- is also referred to as the Oxygen Sensor After Three Way Catalytic Converter - G130-.

The Oxygen Sensor 1 After Catalytic Converter - GX7- contains the following components:

- ◆ Oxygen Sensor After Three Way Catalytic Converter - G130-
- ◆ Heater For Oxygen Sensor 1 After Catalytic Converter - Z29-



The Oxygen Sensor 1 After Catalytic Converter - GX7- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 428 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: $1 - 5\ \Omega$ (@ 25°C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 428 . – NO: ◆ REPLACE: Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to appropriate repair manual. ◆ GO TO: Step 8 ⇒ page 430 .
3	<ul style="list-style-type: none"> • IGNITION: ON • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 429 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 8 ⇒ page 430 .



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> • RECONNECT: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in diagnostic mode 06. Refer to ➔ "3.3 Diagnostic Modes 01 - 09", page 21 . • IGNITION: OFF. • SPECIFIED VALUE: Mode 6 Pass. <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 5 ➔ page 429 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 6 ➔ page 429 .
5	<ul style="list-style-type: none"> • FAULT: Is intermittent. • PERFORM: Visual Inspection of wiring and component. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector. 	<ul style="list-style-type: none"> ◆ GO TO: Step 8 ➔ page 430 .
6	<ul style="list-style-type: none"> • DISCONNECT: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector. • IGNITION: ON. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- component connector terminals 3 to 4 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: 0.0 V to 1.0 V. <p>– Was Value obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 7 ➔ page 429 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 8 ➔ page 430 .
7	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 2 to the Engine Control Module - J623- harness connector T91 / 11 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 3 to the Engine Control Module - J623- harness connector T91 / 26 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 4 to the Engine Control Module - J623- harness connector T91 / 25 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ REPLACE: Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to appropriate repair manual. ◆ GO TO: Step 8 ➔ page 430 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 8 ➔ page 430 .



Step	Procedure	Result / Action to Take
8	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.28 Oxygen Sensor 1 Before Catalytic Converter - GX10-, Checking

General Description

The Oxygen Sensor 1 Before Catalytic Converter - GX10- does not actually measure oxygen concentration, but rather the difference between the amount of oxygen in the exhaust gas and the amount of oxygen in air. Rich mixture causes an oxygen demand. This demand causes a voltage to build up, due to transportation of oxygen ions through the Oxygen Sensor 1 Before Catalytic Converter - GX10- layer. Lean mixture causes low voltage, since there is an oxygen excess. The Oxygen Sensor 1 Before Catalytic Converter - GX10- and catalytic converters are used in order to reduce exhaust emissions. Information on oxygen concentration is sent to Engine Control Module - J623- , which adjusts the amount of fuel injected into the engine to compensate for excess air or excess fuel. The Engine Control Module - J623- attempts to maintain, on average, a certain air-fuel ratio by interpreting the information it gains from the Oxygen Sensor 1 Before Catalytic Converter - GX10- . The primary goal is a compromise between power, fuel economy, and emissions. The heater for Oxygen Sensor 1 Before Catalytic Converter - GX10- is designed to minimize the time-to-readiness for closed-loop operation by heating the Oxygen Sensor 1 Before Catalytic Converter - GX10- as quickly as possible.

Note the Oxygen Sensor 1 Before Catalytic Converter - GX10- is also referred to as the Heated Oxygen Sensor - G39- .

The Oxygen Sensor 1 Before Catalytic Converter - GX10- contains the following components:



- ◆ Oxygen Sensor Heater - Z19-
- ◆ Heated Oxygen Sensor - G39-

The Oxygen Sensor 1 Before Catalytic Converter - GX10- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ "1.1 Safety Precautions", page 2
- View clean working conditions:
⇒ "1.2 Clean Working Conditions", page 3
- For Hybrid vehicles refer to:
⇒ "1.3 High Voltage System General Warnings", page 4

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18. – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 431. – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF • DISCONNECT: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- component connector terminals 3 to 4 for resistance • SPECIFIED VALUE: 1 – 5 Ω (@ 25° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 432. – NO: ◆ REPLACE: Oxygen Sensor 1 Before Catalytic Converter - GX10-. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 433.



Step	Procedure	Result / Action to Take
3	<ul style="list-style-type: none"> • IGNITION: ON • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 4 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 4 ➤ page 432 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ➤ page 433 .
4	<ul style="list-style-type: none"> • RECONNECT: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in diagnostic mode 06. Refer to ➤ "3.3 Diagnostic Modes 01 - 09", page 21 . • IGNITION: OFF. • SPECIFIED VALUE: Mode 6 Pass. – Were Values obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ FAULT: Is intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ➤ page 433 . – NO: <ul style="list-style-type: none"> ◆ GO TO: Step 5 ➤ page 432 .
5	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to repair manual for removal / installation procedures. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 1 to the Engine Control Module - J623- harness connector T91 / 43 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 2 to the Engine Control Module - J623- harness connector T91 / 44 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 3 to the Engine Control Module - J623- harness connector T91 / 74 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 5 to the Engine Control Module - J623- harness connector T91 / 41 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Were Values obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ REPLACE: Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ➤ page 433 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ➤ page 433 .



Step	Procedure	Result / Action to Take
6	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

3.6.29 Secondary Air Injection Pump Motor - V101- / Secondary Air Injection Pump Relay - J299- , Checking

General Description

Injecting additional air into the exhaust pipe triggers an exothermic reaction. This leads to the combustion of HC and CO components that prevail mainly during the warm up phase. This oxidation process releases additional heat. Consequently, the exhaust gas becomes hotter, causing the catalytic converter to heat up at a faster rate. For spark-ignition engines, secondary-air injection is an effective means of reducing HC and CO emissions after starting the engine and to rapidly heat up the catalytic converter. This ensures that the conversion of NOx emissions commences earlier.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.



- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\leq 20\text{ }^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure



Note

The engine MUST be cold (room temperature) in order for the ECM to command the air pump relay ON. The pump runs for approximately 20 – 100 seconds. Once the engine has been started, the ECM may not command the pump to run again for approx 6-8 hrs of engine off time. Due to potential damage to the catalyst, the generic scan tool has no provision for SAI relay control.

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 2 ⇒ page 434 . – NO: <ul style="list-style-type: none"> ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF • DISCONNECT: Secondary Air Injection Pump Relay - J299- from the fuse panel. Refer to appropriate wiring diagram.. • CONNECT: Jumper wire, Secondary Air Injection Pump Relay - -J299-- socket terminals 5/87 and 3/30. • SPECIFIED VALUE: The Secondary Air Injection Pump Motor - V101- should be heard running. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 6 ⇒ page 435 . – NO: <ul style="list-style-type: none"> ◆ GO TO: Step 3 ⇒ page 434 .
3	<ul style="list-style-type: none"> • DISCONNECT: Jumper wire, Secondary Air Injection Pump Relay - -J299-- socket terminals 5/87 and 3/30. • IGNITION: ON. • CHECK: Secondary Air Injection Pump Relay - J299- socket terminals 5/87 and 1/86 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ GO TO: Step 4 ⇒ page 435 . – NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 7 ⇒ page 436 .



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> REINSTALL: Secondary Air Injection Pump Relay - J299- . DISCONNECT: Secondary Air Injection Pump Motor - V101- harness connector. IGNITION: ON. CHECK: Secondary Air Injection Pump Motor - V101- harness connector terminals 1 to 2 for voltage. IGNITION: OFF. SPECIFIED VALUE: Battery voltage. <p>– Was Value obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ REPLACE: Secondary Air Injection Pump Motor - V101- , Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 436 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 5 ⇒ page 435 .
5	<ul style="list-style-type: none"> REMOVE: Fuse from the fuse panel. Refer to appropriate wiring diagram.. CHECK: Secondary Air Injection Pump Motor - V101- harness connector terminal 1 to ground for resistance. CHECK: Secondary Air Injection Pump Motor - V101- harness connector terminal 2 to output cavity of fuse for resistance. SPECIFIED VALUE: $0.5 \Omega (\pm 0.3 \Omega)$. <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 6 ⇒ page 435 <p>– NO:</p> <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 7 ⇒ page 436 .
6	<ul style="list-style-type: none"> DISCONNECT: Jumper wire, Secondary Air Injection Pump Relay - -J299-- socket terminals 5/87 and 3/30. REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Secondary Air Injection Pump Relay - J299- harness connector terminal 2/85 to Engine Control Module - J623- harness connector T105 / 60 for resistance. SPECIFIED VALUE: $0.5 \Omega (\pm 0.3 \Omega)$. <p>– Was Value obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ REPLACE: Secondary Air Injection Pump Relay - -J299-- . Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 436 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 436 .



Step	Procedure	Result / Action to Take
7	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.30 Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112- , Checking

General Description

The secondary air injection system sends air into the exhaust on a cold-start of the engine for about 45 – 100 sec. and serves to quickly heat the catalytic converter(s) for improved emissions. A "pressure based secondary air diagnostics" function is used. In this system, the signal from Secondary Air Injection Sensor 1 - G609- is evaluated in the Engine Control Module - J623- . The injected air quantity is determined from the pressure level.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".



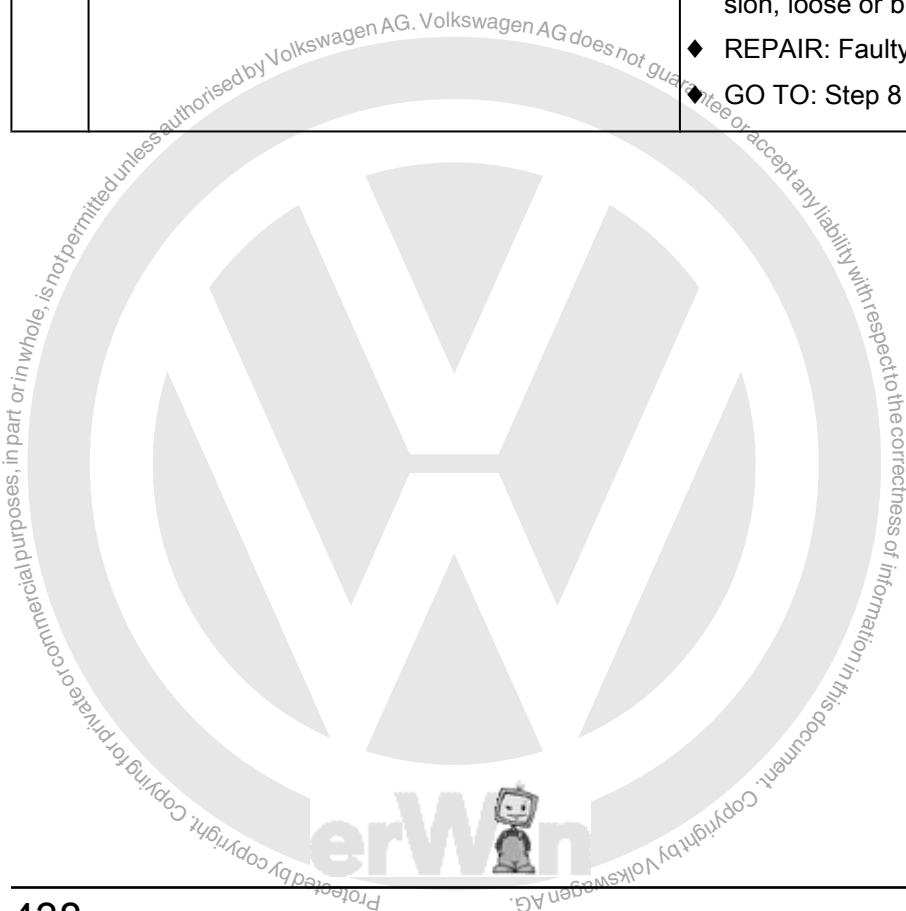
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
[⇒ "1.1 Safety Precautions", page 2](#).
- View clean working conditions:
[⇒ "1.2 Clean Working Conditions", page 3](#).
- For Hybrid vehicles refer to:
[⇒ "1.3 High Voltage System General Warnings", page 4](#).

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18. – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ♦ GO TO: Step 2 ⇒ page 437. – NO: ♦ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Secondary Air Injection Solenoid Valve - N112- harness connector. • CHECK: Secondary Air Injection Solenoid Valve - N112- component connector terminals 1 to 5 for resistance. • SPECIFIED VALUE: 5 – 35 Ω (at approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ♦ GO TO: Step 3 ⇒ page 437. – NO: ♦ REPLACE: Secondary Air Injection Sensor 1 - G609- / Secondary Air Injection Solenoid Valve - N112-. Refer to appropriate repair manual. ♦ GO TO: Step 8 ⇒ page 439.
3	<ul style="list-style-type: none"> • IGNITION: ON • CHECK: Secondary Air Injection Solenoid Valve - N112- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ♦ GO TO: Step 4 ⇒ page 437. – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 8 ⇒ page 439.
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623-. Refer to appropriate repair manual. • CHECK: Secondary Air Injection Solenoid Valve - N112- harness connector terminal 5 to the Engine Control Module - J623- harness connector T105 / 21 for resistance. • SPECIFIED VALUE: 0.5 Ω ($\pm 0.3 \Omega$). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ♦ GO TO: Step 5 ⇒ page 438. – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 8 ⇒ page 439.



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> IGNITION: ON. CHECK: Secondary Air Injection Sensor 1 - G609- harness connector terminals 1 to 3 for voltage. SPECIFIED VALUE: About 5.0 V. IGNITION: OFF. Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ GO TO: Step 7 ⇒ page 438 . NO: <ul style="list-style-type: none"> ◆ GO TO: Step 6 ⇒ page 438 .
6	<ul style="list-style-type: none"> CHECK: Secondary Air Injection Sensor 1 - G609- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 35 for resistance. CHECK: Secondary Air Injection Sensor 1 - G609- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 33 for resistance. SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). Were Values obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ GO TO: Step 8 ⇒ page 439 . NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 8 ⇒ page 439 .
7	<ul style="list-style-type: none"> CHECK: Secondary Air Injection Sensor 1 - G609- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 9 for resistance. SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). Was Value obtained? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> ◆ REPLACE: Secondary Air Injection Sensor 1 - G609- . Refer to appropriate repair manual. ◆ GO TO: Step 8 ⇒ page 439 . NO: <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 8 ⇒ page 439 .





Step	Procedure	Result / Action to Take
8	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> YES: <ul style="list-style-type: none"> CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. REPAIR: As necessary. Clear the DTC's. Refer to "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. If all electrical connections are OK: REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. Repair is complete. Generate Readiness Code. Refer to "3.2 Readiness Code", page 19. Return vehicle to Customer. NO: <ul style="list-style-type: none"> Perform the diagnostic procedure for any DTC's. If no DTC's return the repair is complete. Return vehicle to customer.

3.6.31 Throttle Valve Control Module - GX3- , Checking

General Description

Throttle valve operation occurs by an electric motor identified as EPC Throttle Drive - G186- located within the Throttle Valve Control Module - GX3- . It is controlled by the Engine Control Module - J623- with primary inputs from the Accelerator Pedal Module - GX2- as well as other peripheral inputs from EPC Throttle Drive Angle Sensor 1 - G187- and EPC Throttle Drive Angle Sensor 2 - G188- .

Note the Throttle Valve Control Module - GX3- was referred to as the Throttle Valve Control Module - J338- .

The Throttle Valve Control Module - GX3- contains the following components:

- ◆ EPC Throttle Drive - G186-
- ◆ EPC Throttle Drive Angle Sensor 1 - G187-
- ◆ EPC Throttle Drive Angle Sensor 2 - G188-

The Throttle Valve Control Module - GX3- components cannot be serviced separately, and must be serviced as a unit.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.



Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.
- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#).
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#).
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#).

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18. – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 440. – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • CONNECT: Scan Tool. • IGNITION: ON. • CHECK: Throttle valve position closed. • SPECIFIED VALUE: 3 - 25%. • DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly. • CHECK: Throttle valve position at WOT. • SPECIFIED VALUE: 84 - 97%. • IGNITION: OFF. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 440. – NO: ◆ GO TO: Step 4 ⇒ page 441.
3	<ul style="list-style-type: none"> • CONDITION: May be intermittent. • PERFORM: Visual Inspection of wiring and component. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector. 	<ul style="list-style-type: none"> ◆ GO TO: Step 7 ⇒ page 442.



Step	Procedure	Result / Action to Take
4	<ul style="list-style-type: none"> REMOVE: Throttle Valve Control Module - J338 - far enough so that the harness connector terminals are accessible. DISCONNECT: Throttle Valve Control Module - J338- harness connector. IGNITION: ON. CHECK: Throttle Valve Control Module - GX3- harness connector terminals 2 to 6 for voltage. CHECK: Throttle Valve Control Module - GX3- harness connector terminal 2 to ground for voltage. IGNITION: OFF. SPECIFIED VALUE: About 5.0 V. <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 5 ⇒ page 441 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ GO TO: Step 6 ⇒ page 441 .
5	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Throttle Valve Control Module - GX3- harness connector terminal 1 to the Engine Control Module - J623- harness connector T105 / 55 for resistance. CHECK: Throttle Valve Control Module - GX3- harness connector terminal 3 to the Engine Control Module - J623- harness connector T105 / 90 for resistance. CHECK: Throttle Valve Control Module - GX3- harness connector terminal 4 to the Engine Control Module - J623- harness connector T105 / 34 for resistance. CHECK: Throttle Valve Control Module - GX3- harness connector terminal 5 to the Engine Control Module - J623- harness connector T105 / 91 for resistance. SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ REPLACE: Throttle Valve Control Module - GX3- . Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 442 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 442 .
6	<ul style="list-style-type: none"> REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. CHECK: Throttle Valve Control Module - GX3- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 54 for resistance. CHECK: Throttle Valve Control Module - GX3- harness connector terminal 6 to the Engine Control Module - J623- harness connector T105 / 56 for resistance. SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). <p>– Were Values obtained?</p>	<p>– YES:</p> <ul style="list-style-type: none"> ◆ REPLACE: Throttle Valve Control Module - GX3- . Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 442 . <p>– NO:</p> <ul style="list-style-type: none"> ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 442 .



Step	Procedure	Result / Action to Take
7	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.32 Turbocharger Recirculation Valve - N249- , Checking

General Description

A Turbocharger Recirculation Valve - N249- keeps a portion of air running through the intake side of the turbocharger when the throttle valve is closed and boost pressure is still present. This keeps the turbocharger impeller from slowing down, reducing turbo lag when the throttle is applied again.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ} \text{C}$.



- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 443 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • DISCONNECT: Turbocharger Recirculation Valve - N249- harness connector. • CHECK: Turbocharger Recirculation Valve - N249- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 3 – 15 Ω (at approx. 20° C). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 3 ⇒ page 443 . – NO: ◆ REPLACE: Turbocharger Recirculation Valve - N249- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 444 .
3	<ul style="list-style-type: none"> • IGNITION: ON. • CHECK: Turbocharger Recirculation Valve - N249- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 4 ⇒ page 443 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 444 .
4	<ul style="list-style-type: none"> • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Turbocharger Recirculation Valve - N249- harness connector terminal 2 to the Engine Control Module - J623- harness connector T105 / 66 for resistance. • SPECIFIED VALUE: 0.5 Ω (\pm 0.3 Ω). – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ REPLACE: Turbocharger Recirculation Valve - N249- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 444 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 444 .



Step	Procedure	Result / Action to Take
5	<ul style="list-style-type: none"> Final Procedure Perform a road test to verify repair. Does the original DTC return? 	<ul style="list-style-type: none"> – YES: <ul style="list-style-type: none"> ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 26. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 19. ◆ Return vehicle to Customer. – NO: <ul style="list-style-type: none"> ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return the repair is complete. ◆ Return vehicle to customer.

3.6.33 Vehicle Speed Signal, Checking

General Description

The Vehicle Speed Signal or VSS measures Transmission / Transaxle output or Wheel Speed from the ABS System. The signal is broadcasted over the CAN Bus. The Engine Control Module - J623- uses this information to modify engine functions such as ignition timing, AF ratio, transmission shift points, and to initiate diagnostic routines.

Special tools and workshop equipment required

- ◆ Multimeter
- ◆ Wiring Diagram
- ◆ Scan Tool

Test requirements

- Fuses OK
- Battery voltage OK
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Coolant Temperature: $\geq 80^{\circ}\text{C}$.



- Observe all safety precautions:
⇒ ["1.1 Safety Precautions", page 2](#) .
- View clean working conditions:
⇒ ["1.2 Clean Working Conditions", page 3](#) .
- For Hybrid vehicles refer to:
⇒ ["1.3 High Voltage System General Warnings", page 4](#) .

Test Procedure

Step	Procedure	Result / Action to Take
1	<ul style="list-style-type: none"> • PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ "3.1 Preliminary Check", page 18 . – Was Complaint verified? 	<ul style="list-style-type: none"> – YES: ◆ GO TO: Step 2 ⇒ page 445 . – NO: ◆ GATHER more information from customer about the complaint.
2	<ul style="list-style-type: none"> • IGNITION: OFF. • CONNECT: Scan Tool. • ROAD TEST: Vehicle. • CHECK: Scan Tool to Speedometer for accuracy. • SPECIFIED VALUE: Difference ≤ 10%. – Was Value obtained? 	<ul style="list-style-type: none"> – YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 445 . – NO: ◆ GO TO: Step 3 ⇒ page 445 .
3	<ul style="list-style-type: none"> • CHECK: ABS system. • CHECK: ABS DTC's. – Was the ABS system OK? 	<ul style="list-style-type: none"> – YES: ◆ CHECK: CAN Bus wiring from Instrument Cluster Control Module - J285- to ABS Control Module - J104- . ◆ GO TO: Step 4 ⇒ page 445 . – NO: ◆ REPAIR: Any ABS concerns 1st. ◆ GO TO: Step 4 ⇒ page 445 .
4	<ul style="list-style-type: none"> • Final Procedure • Perform a road test to verify repair. • Do any DTC's return: 	<ul style="list-style-type: none"> – YES: ◆ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 24 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 19 . ◆ Return vehicle to Customer.

DFD 04/2015

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.
- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.
- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.
- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).
- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.
- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.
- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.
- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.
- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.
- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.
- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.
- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.
- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.
- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.
- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.
- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.
- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.
- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.
- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.
- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.
- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.
- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.
- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).
- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.



Cautions & Warnings

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.
- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.
- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.
- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.