Passat W8
Engine Management,
Motronic ME 7.1.1

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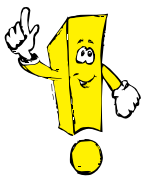
Always check Technical Bulletins and the Volkswagen Worldwide Repair Information System for information that may supersede any information included in this booklet.

Table of Contents

New!



Important/Note!

The Self-Study Program provides you with information regarding designs and functions.

The Self-Study Program is not a Repair Manual!

For maintenance and repair work, always refer to the current technical literature.

The Passat W8 Motronic ME 7.1.1 Engine Management System

The Motronic ME 7.1.1 engine management system used on the Passat W8 engine enables high power output with minimal fuel consumption through adaptation to all operating modes. The heart of the Motronic system is the Motronic Engine Control Module J220. It processes incoming signals and transmits adjustment commands for controlling the subsystems. The Motronic Engine Control Module J220 also provides information for the diagnosis of subsystems and components.

For more information on the mechanical aspects of the W8 engine, please refer to *The W Engine Concept*, Self-Study Program Course Number 821203.

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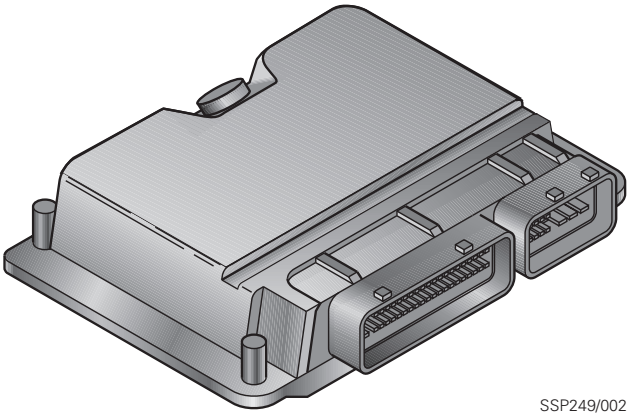
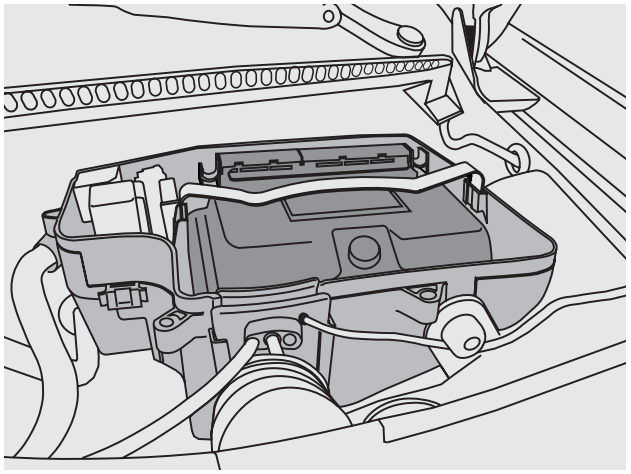


SSP249/002

Engine Management Functions

The regulation of the W8 engine in the Passat is performed by the Motronic ME 7.1.1 engine management system. In many respects this engine management system for the W8 engine is the same as that used for the 24 valve VR6 engine. These are the tasks of the engine management system:

- Optimization of the fuel-air mixture for all operating modes.
- Reduction of fuel consumption.
- Regulation of combustion.
- Monitoring and regulation of exhaust emissions.



SSP249/003

The Motronic Engine Control Module J220 is located in the electronics box in the engine compartment.

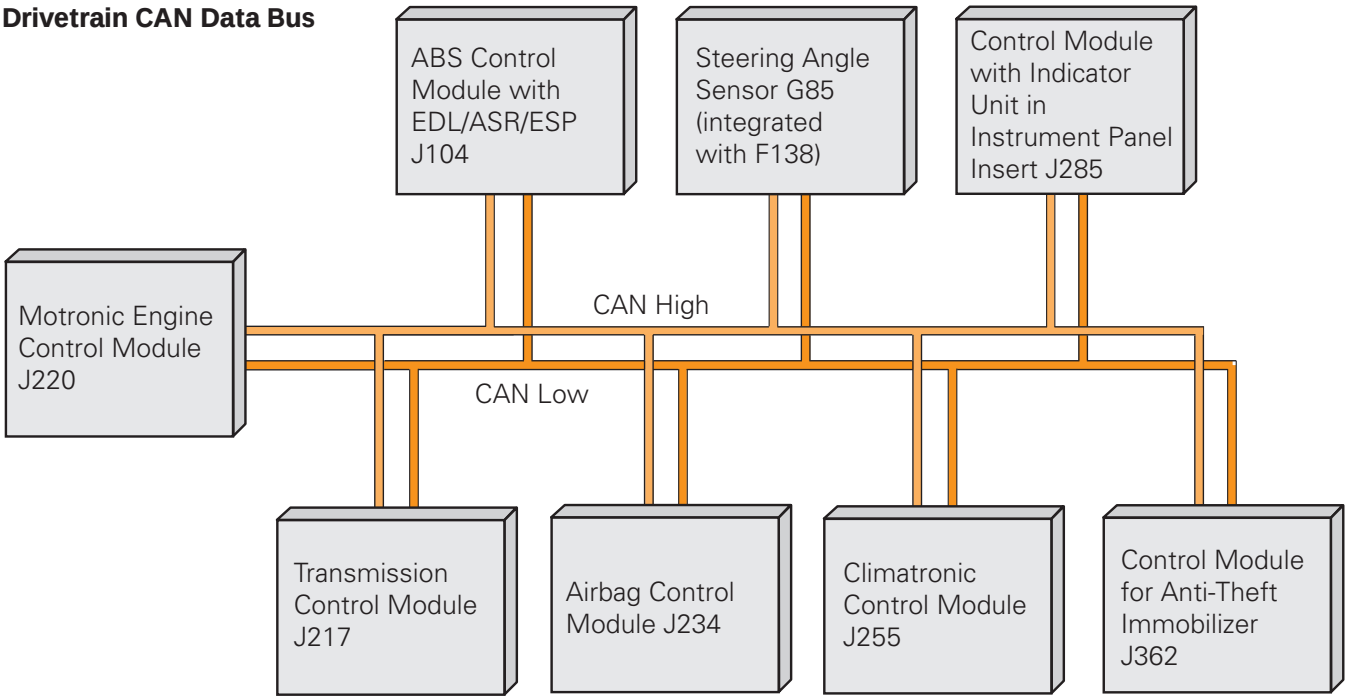
The Motronic Engine Control Module J220 performs the following functions:

- Regulation of injection.
- Regulation of ignition (ignition system with single-spark ignition coils).
- Regulation of idling speed.
- Oxygen sensor control.
- Fuel tank ventilation system.
- Electronic power control.
- Cruise control system.
- Secondary air system.
- Knock control.
- Continuously variable intake valve timing, two-position exhaust valve timing.
- Control of engine mount damping.
- Regulation of coolant temperature.
- Regulation of Brake System Vacuum Pump V192.
- Self-diagnosis.

Drivetrain CAN Data Bus

The Motronic Engine Control Module J220 communicates with the control modules for other vehicle systems. Data is exchanged through the drivetrain CAN data bus, which connects the individual control modules into a single system.

Drivetrain CAN Data Bus



SSP249/004

Through the drivetrain CAN data bus, data are exchanged between the Motronic Engine Control Module J220 and:

- ABS Control Module with EDL/ASR/ESP J104
- Transmission Control Module J217
- Airbag Control Module J234
- Steering Angle Sensor G85 (integrated with F138)
- Climatronic Control Module J255
- Control Module with Indicator Unit in Instrument Panel Insert J285
- Control Module for Anti-Theft Immobilizer J362

System Overview

Motronic ME 7.1.1 System Overview

Sensors

Mass Air Flow (MAF) Sensor G70 (Combined with G42)
Intake Air Temperature (IAT) Sensor G42 (Combined with G70)
Engine Speed (RPM) Sensor G28

Engine Coolant Temperature (ECT) Sensor G62

Engine Coolant Temperature (ECT) Sensor
(On Radiator) G83

Heated Oxygen Sensor (HO2S) G39

Heated Oxygen Sensor (HO2S) 2 G108

Oxygen Sensor (O2S) Behind Three Way Catalytic
Converter (TWC) G130

Oxygen Sensor (O2S) 2 Behind Three Way Catalytic
Converter (TWC) G131

Camshaft Position (CMP) Sensor G40
Camshaft Position (CMP) Sensor 2 G163
Camshaft Position (CMP) Sensor 3 G300
Camshaft Position (CMP) Sensor 4 G301

Knock Sensor 1 G61
Knock Sensor 2 G66
Knock Sensor 3 G198
Knock Sensor 4 G199

Throttle Valve Control Module J338
Angle Sensor -1- for Throttle Drive G187
Angle Sensor -2- for Throttle Drive G188

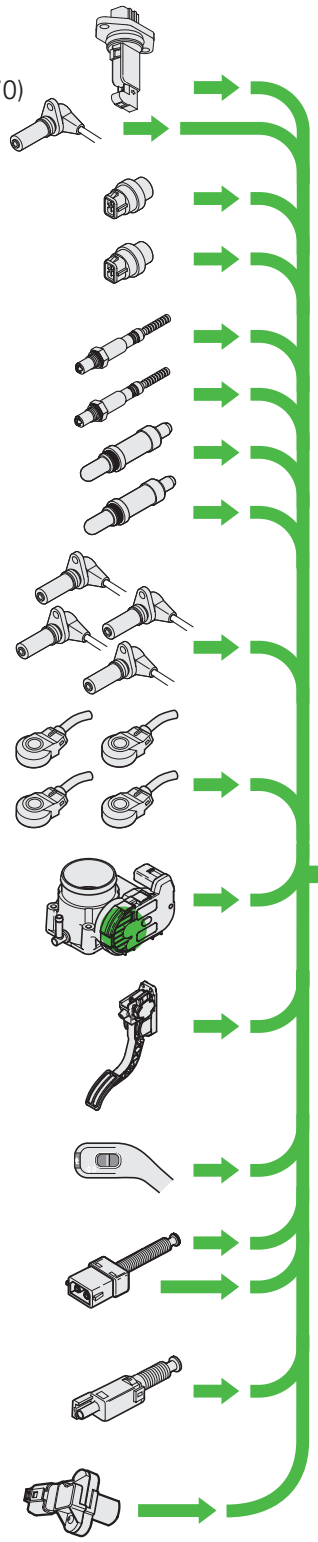
Accelerator Pedal Module with:
Throttle Position (TP) Sensor G79
Sender -2- for Accelerator Pedal Position G185

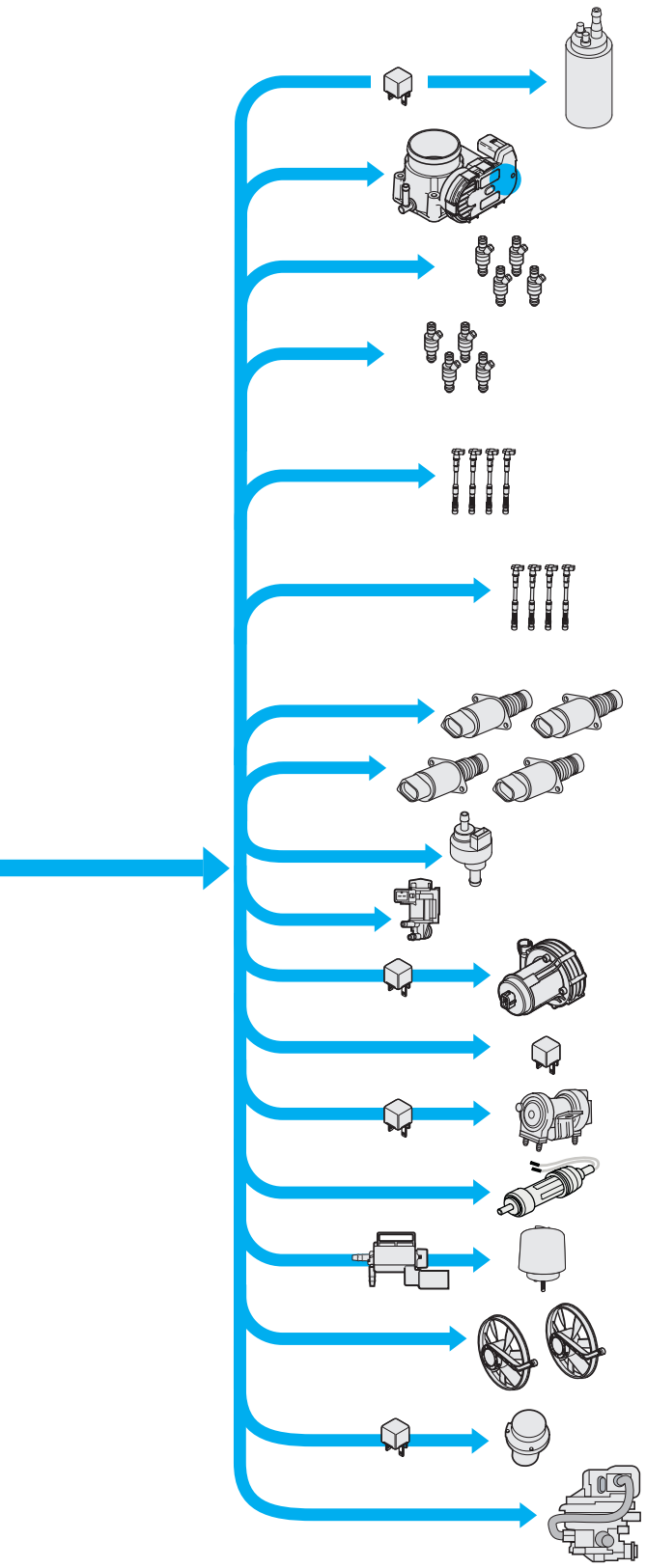
Cruise Control Switch E45 (On Column Switch)
Button for Cruise Control (Set) E227 (On Steering Wheel)

Brake Light Switch F
Vacuum Vent Valve, Brake F47

Clutch Vacuum Vent Valve Switch F36

Brake Booster Pressure Sensor G294
(Only with Automatic Transmissions)





SSP249/005

Actuators

Fuel Pump Relay J17

Fuel Pump G6

Throttle Valve Control Module J338 (Combined with G186)
Throttle Drive (Power Accelerator Actuation) G186 (Combined with J338)

Cylinder 1 Fuel Injector N30, Cylinder 2 Fuel Injector N31

Cylinder 3 Fuel Injector N32, Cylinder 4 Fuel Injector N33

Cylinder 5 Fuel Injector N83, Cylinder 6 Fuel Injector N84
Cylinder 7 Fuel Injector N85, Cylinder 8 Fuel Injector N86

Ignition Coil 1 with Power Output Stage N70
Ignition Coil 2 with Power Output Stage N127
Ignition Coil 3 with Power Output Stage N291
Ignition Coil 4 with Power Output Stage N292

Ignition Coil 5 with Power Output Stage N323
Ignition Coil 6 with Power Output Stage N324
Ignition Coil 7 with Power Output Stage N325
Ignition Coil 8 with Power Output Stage N326

Valve 1 for Camshaft Adjustment N205
Valve 2 for Camshaft Adjustment N208

Camshaft Adjustment Valve 1 (Exhaust) N318
Camshaft Adjustment Valve 2 (Exhaust) N319

Evaporative Emission (EVAP) Canister Purge Regulator Valve N80

Secondary Air Injection Solenoid Valve N112

Secondary Air Injection Pump Motor V101
Secondary Air Injection Pump Relay J299

Motronic Engine Control Module Power Supply Relay J271

Auxiliary Engine Coolant (EC) Pump Relay J496
Coolant Pump V36

Map Controlled Engine Cooling Thermostat F265

Left Electro-Hydraulic Engine Mount Solenoid Valve N144

Coolant Fan V7
Coolant Fan -2- V177

Brake Booster Relay J569
Brake System Vacuum Pump V192
(Only with Automatic Transmissions)

Leak Detection Pump V144

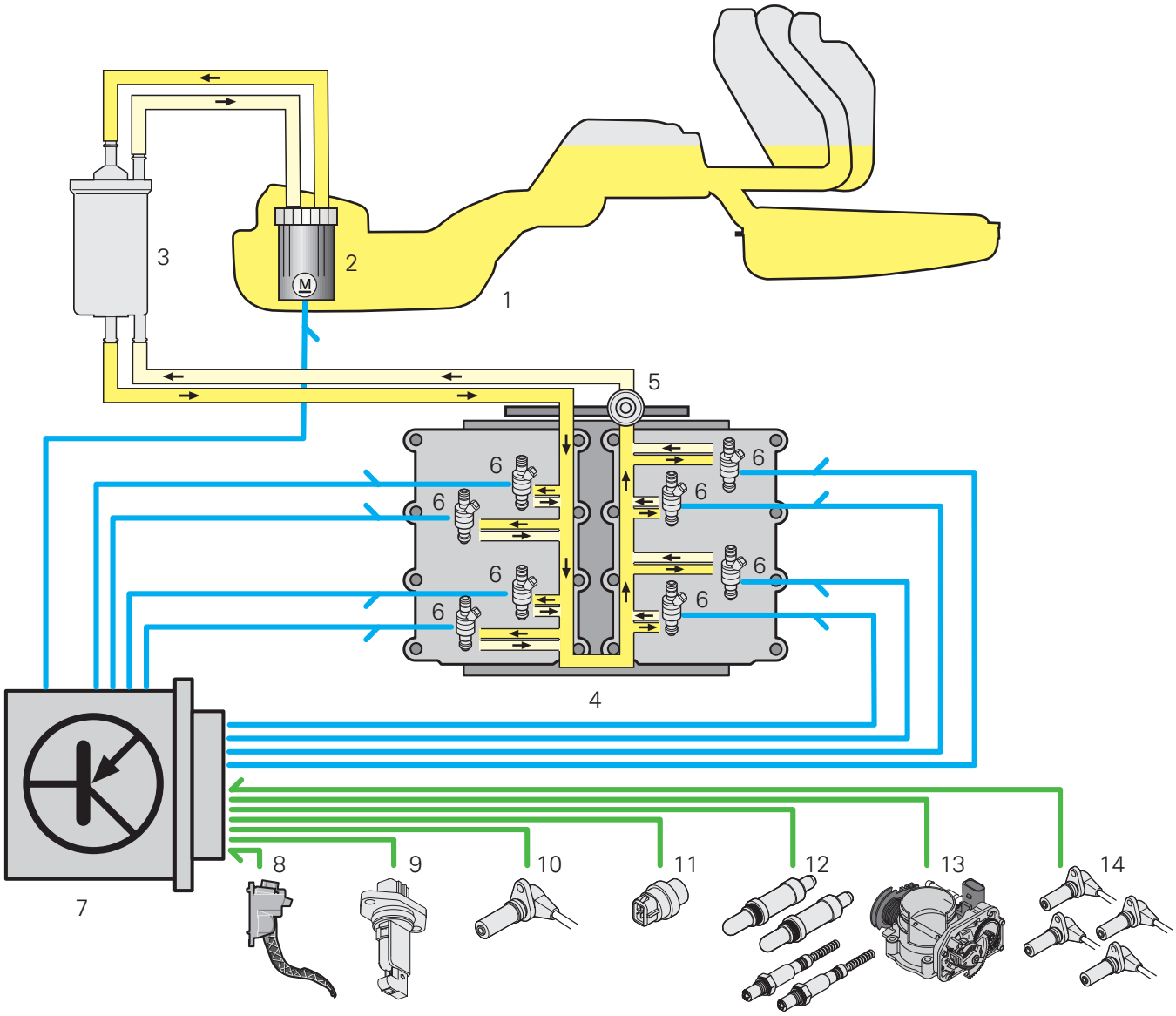
Fuel Injection System

Input Signals for Calculating Fuel Injection Periods:

- Engine load signal from Mass Air Flow (MAF) Sensor G70
- Intake air temperature from Intake Air Temperature (IAT) Sensor G42
- Signal from Throttle Valve Control Module J338
- Signal from Engine Speed (RPM) Sensor G28
- Coolant temperature from Engine Coolant Temperature (ECT) Sensor G62
- Signals from heated Oxygen Sensors G39, G108, G130, G131
- Signals from accelerator pedal module Throttle Position (TP) Sensor G79 and Sender -2- for Accelerator Pedal Position G185
- Signal from Camshaft Position Sensors G40, G163, G300, G301

The Fuel Pump G6, which is located in the fuel tank, pumps fuel through the fuel filter to the fuel injectors. The fuel injectors are connected to each other by the fuel rail. Fuel injection occurs sequentially. Using the input signals, the Motronic Engine Control Module J220 calculates the necessary fuel quantity and the required injection period.

The quantity of fuel injected is determined solely by the length of the period during which the injector is open. The fuel pressure regulator regulates the injection pressure in the fuel rail and the return flow of excess fuel to the fuel tank.



1 Fuel Tank
2 Fuel Pump G6
3 Fuel Filter
4 Fuel Rail
5 Fuel Pressure Regulator
6 Fuel Injectors N30, N31, N32, N33, N83, N84, N85, N86
7 Motronic Engine Control Module J220
8 Accelerator Pedal Module with Throttle Position (TP) Sensor G79 and Sender -2- for Accelerator Pedal Position G185
9 Mass Air Flow (MAF) Sensor G70 Combined with Intake Air Temperature (IAT) Sensor G42
10 Engine Speed (RPM) Sensor G28
11 Engine Coolant Temperature (ECT) Sensor G62
12 Oxygen Sensors G39, G108, G130, G131
13 Throttle Valve Control Module J338
14 Camshaft Position Sensors G40, G163, G300, G301

SSP249/006

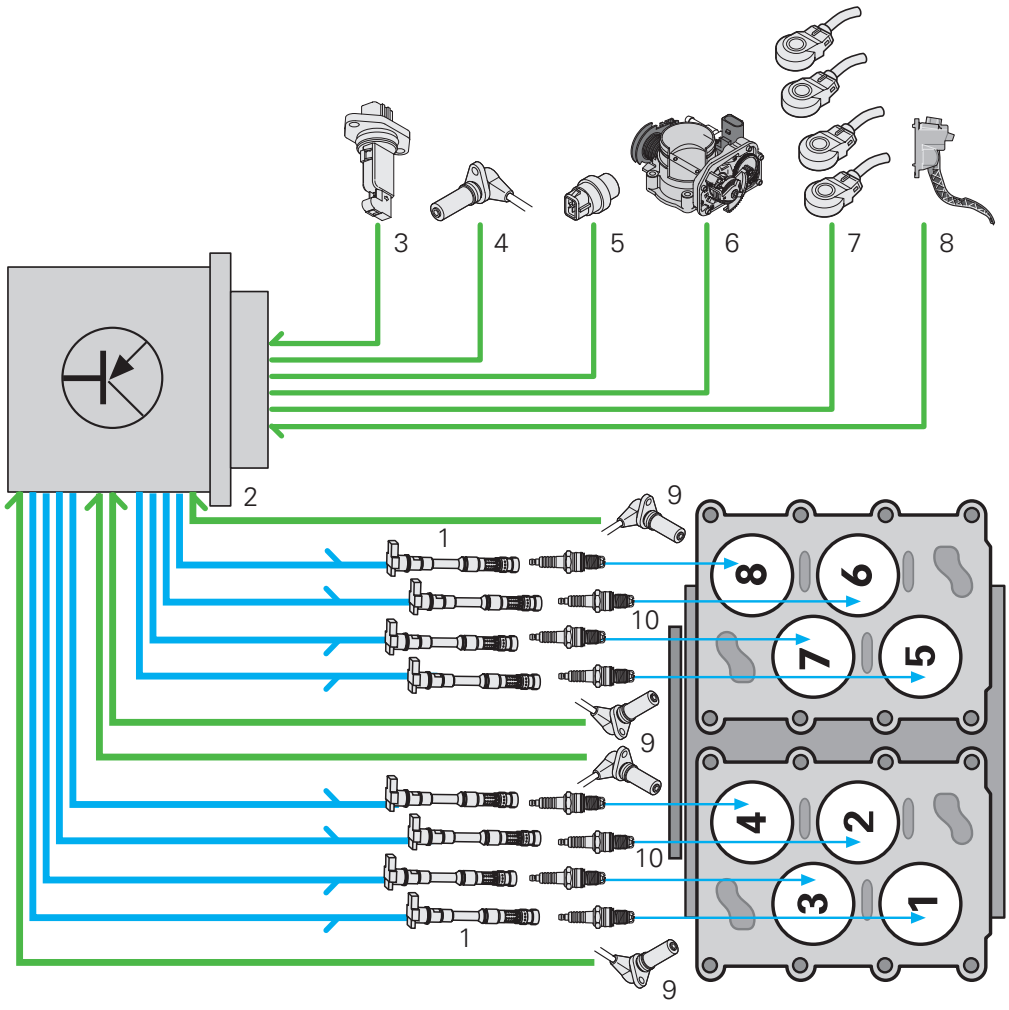
Ignition System

Input Signals for Calculating the Ignition Timing:

- Signal from Engine Speed (RPM) Sensor G28
- Engine load signal from Mass Air Flow (MAF) Sensor G70
- Signal from Throttle Valve Control Module J338
- Coolant temperature from Engine Coolant Temperature (ECT) Sensor G62
- Signals from Knock Sensors G61, G66, G198, G199
- Signals from Camshaft Position Sensors G40, G163, G300, G301
- Signals from accelerator pedal module Throttle Position (TP) Sensor G79 and Sender -2- for Accelerator Pedal Position G185

The ignition timing is calculated on the basis of the input signals according to a control map stored in the Motronic Engine Control Module J220.

1 Ignition Coils with Power Output Stage N70, N127, N291, N292, N323, N324, N325, N326
2 Motronic Engine Control Module J220
3 Mass Air Flow (MAF) Sensor G70
4 Engine Speed (RPM) Sensor G28
5 Engine Coolant Temperature (ECT) Sensor G62
6 Throttle Valve Control Module J338
7 Knock Sensors G61, G66, G198, G199
8 Accelerator Pedal Module with Throttle Position (TP) Sensor G79 and Sender -2- for Accelerator Pedal Position G185
9 Camshaft Position Sensors G40, G163, G300, G301
10 Spark Plugs Q



SSP249/007

Knock Control

Unfavorable operating conditions can lead to detonation and pre-ignition. To prevent this, the ignition timing must be adjusted.

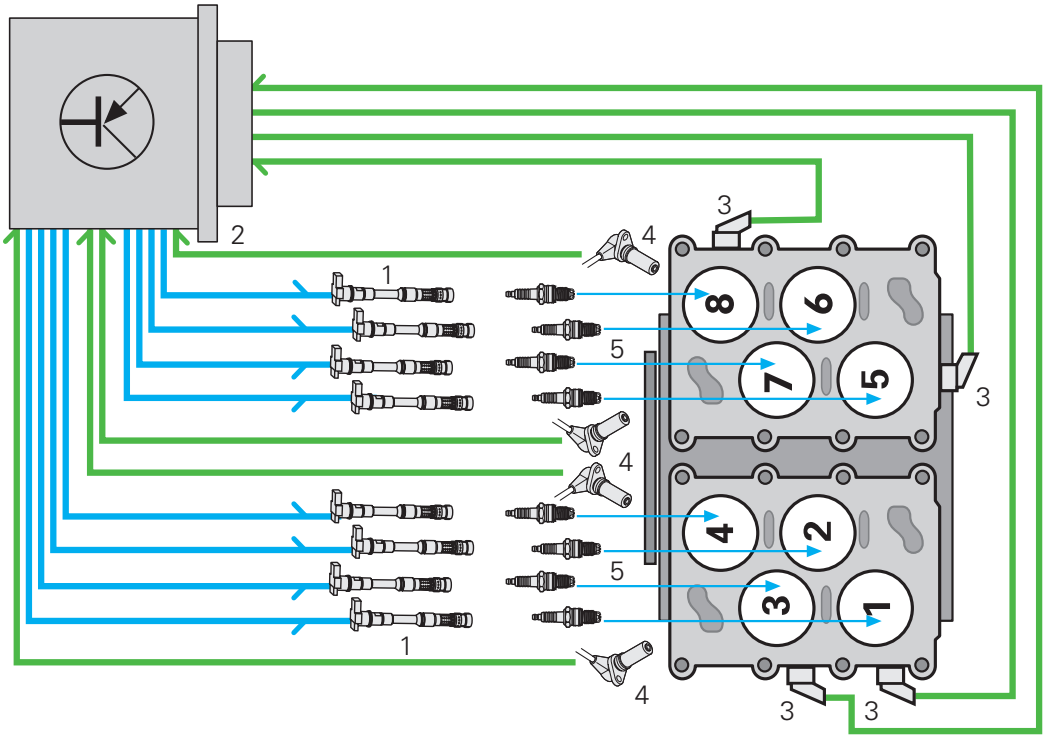
Input Signals:

- Signals from Knock Sensors G61, G66, G198, G199
- Signals from Camshaft Position Sensors G40, G163, G300, G301
- Engine coolant temperature from Engine Coolant Temperature (ECT) Sensor G62 through the Motronic Engine Control Module J220

Each bank of the W8 engine is equipped with two knock sensors mounted on the crankcase. To prevent the connectors in the wiring harness from being interchanged on the sensors, the connections are color coded. The knock signals can be related to individual cylinders with the aid of the camshaft position sensor signals.

When knocking is detected in a cylinder, the Motronic Engine Control Module J220 changes the ignition timing of the knocking cylinder by retarding the firing point until the knocking ceases.

When the affected cylinder no longer has the tendency to knock, the Motronic Engine Control Module J220 returns the ignition timing to its former setting by advancing the firing point.



1 Ignition Coils with Power Output Stage N70, N127, N291, N292, N323, N324, N325, N326
2 Motronic Engine Control Module J220
3 Knock Sensors G61, G66, G198, G199
4 Camshaft Position Sensors G40, G163, G300, G301
5 Spark Plugs Q

SSP249/008

Variable Valve Timing

The task of variable valve timing is to set the best valve timing for engine operation at idle, for maximum power, and for maximum torque. Variable valve timing optimizes the ratio between fresh air and exhaust gas. This is referred to as internal exhaust gas recirculation. The overlap angle, during which the intake valve is already opening while the exhaust valve is not yet closed, determines the quantity of recirculated exhaust gas in the cylinder.

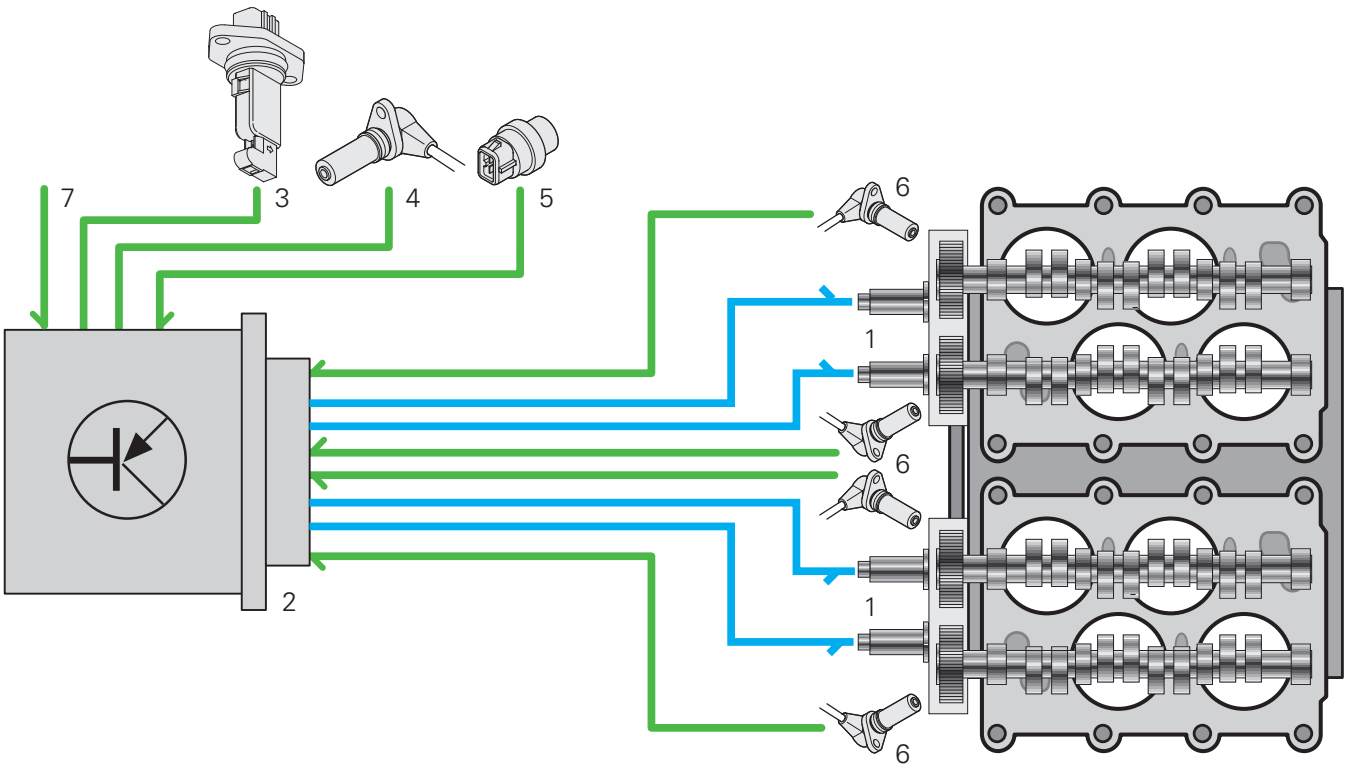
Input Signals:

- Signals from Camshaft Position Sensors G40, G163, G300, G301
- Signal from Engine Speed (RPM) Sensor G28
- Engine load signal from Mass Air Flow (MAF) Sensor G70
- Engine coolant temperature from Engine Coolant Temperature (ECT) Sensor G62
- Engine oil temperature from Engine Oil Temperature Sensor G8

To adjust the camshafts, the Motronic Engine Control Module J220 requires information on engine speed, engine load, engine coolant temperature, positions of the crankshaft and camshafts, and engine oil temperature from the instrument cluster via the CAN data bus. The Motronic Engine Control Module J220 actuates the Valve 1 for Camshaft Adjustment N205, Valve 2 for Camshaft Adjustment N208, Camshaft Adjustment Valve 1 (Exhaust) N318, and Camshaft Adjustment Valve 2 (Exhaust) N319 according to operating mode (idle, maximum power, maximum torque).

The camshafts are adjusted according to a map stored in the Motronic Engine Control Module J220. The intake camshafts can be continuously advanced or retarded relative to their neutral positions at any angle within a range of 52 degrees. The camshaft adjusters on the exhaust camshafts are restricted in movement across a range of 22 degrees to either the fully advanced or the fully retarded position.

For further information on variable valve timing, please refer to the Self-Study Program *The W Engine Concept*, Course Number 821203.



1 Valve 1 for Camshaft Adjustment N205, Valve 2 for Camshaft Adjustment N208, Camshaft Adjustment Valve 1 (Exhaust) N318, Camshaft Adjustment Valve 2 (Exhaust) N319

2 Motronic Engine Control Module J220

3 Mass Air Flow (MAF) Sensor G70

4 Engine Speed (RPM) Sensor G28

5 Engine Coolant Temperature (ECT) Sensor G62

6 Camshaft Position Sensors G40, G163, G300, G301

7 Engine Oil Temperature Sensor G8

SSP249/009

Oxygen Sensor Control

The Passat W8 engine management system employs heated oxygen sensor control. Its purpose is to maintain a lambda value of 1 during combustion so that the exhaust gases can be cleaned as completely as possible in the catalyst.

Lambda refers to the ratio between the actual measured air-fuel ratio and the theoretically ideal air-fuel mixture of 14.7 to 1 (the stoichiometric ratio at which complete combustion takes place).

Input Signals:

- Signal from Engine Speed (RPM) Sensor G28
- Engine load signal from Mass Air Flow (MAF) Sensor G70
- Signals from oxygen sensors:
  Heated Oxygen Sensor (HO2S) G39
  Heated Oxygen Sensor (HO2S) 2 G108
  Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
  Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131
- Engine coolant temperature from Engine Coolant Temperature (ECT) Sensor G62

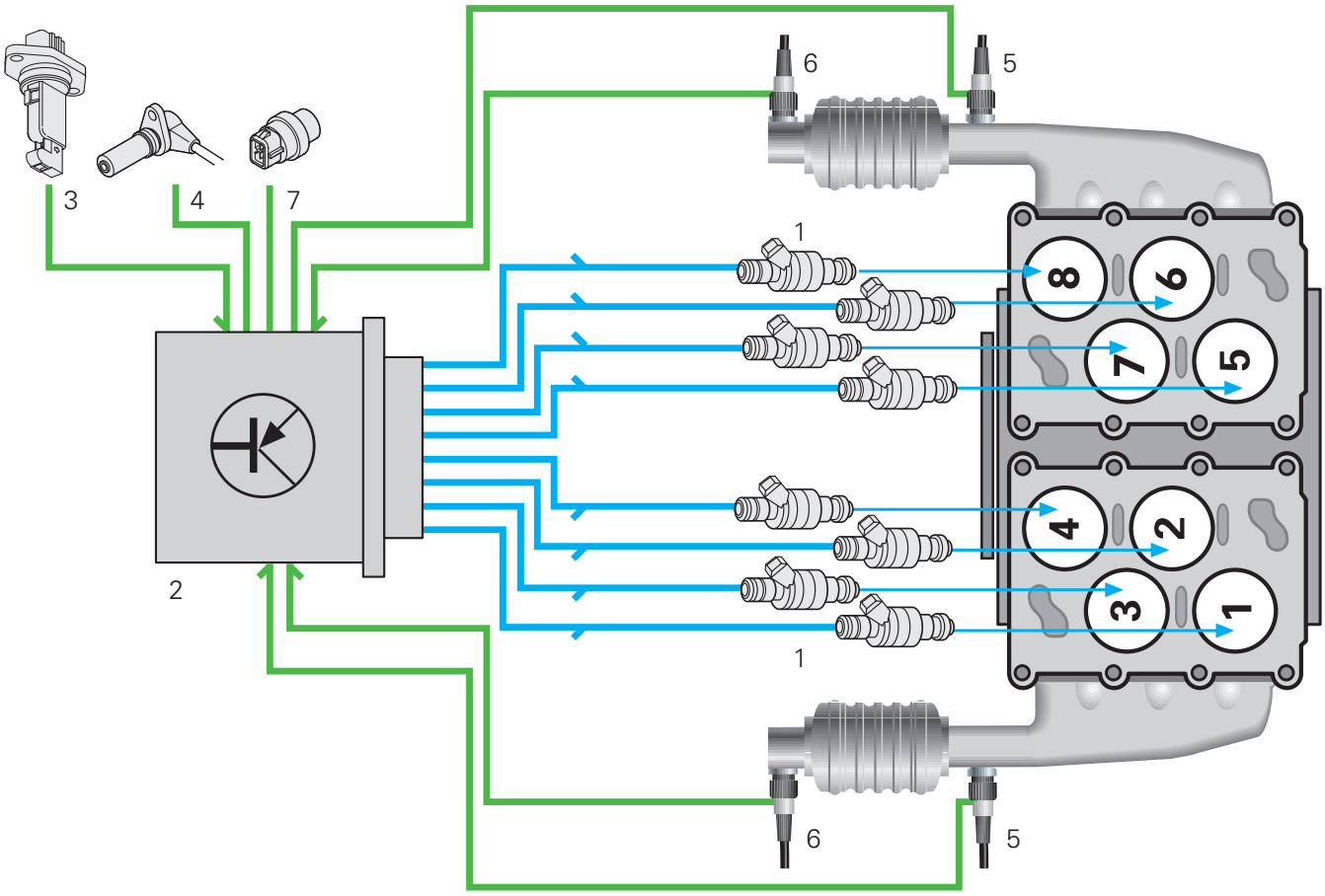
Heated oxygen sensor control uses separate regulation loops to determine the correct fuel-air mixture for each cylinder bank. Each regulation loop includes a pre-catalyst oxygen sensor, a catalyst, and post-catalyst oxygen sensor.

The pre-catalyst oxygen sensors and the post-catalyst oxygen sensors inform the Motronic Engine Control Module J220 of the residual oxygen content in the exhaust gas.

Using this signal, the Motronic Engine Control Module J220 calculates the momentary composition of the fuel-air mixture. When deviation from the specified value occurs, the fuel injection period is corrected.

In addition, the Motronic Engine Control Module J220 adapts to the operating conditions and stores the learned values (adaptive lambda regulation).

For further information, please refer to *Engine Management Systems,* Self-Study Program Course Number 841003.



1 Fuel Injectors N30, N31, N32, N33, N83, N84, N85, N86

2 Motronic Engine Control Module J220

3 Mass Air Flow (MAF) Sensor G70

4 Engine Speed (RPM) Sensor G28

5 Pre-Catalyst Oxygen Sensors:
Heated Oxygen Sensor (HO2S) G39
Heated Oxygen Sensor (HO2S) 2 G108

6 After-Catalyst Oxygen Sensors:
Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

7 Engine Coolant Temperature (ECT) Sensor G62

SSP249/010

Fuel Tank Ventilation System

Input Signals for Fuel Tank Ventilation Regulation:

- Signal from Engine Speed (RPM) Sensor G28
- Engine load signal from Mass Air Flow (MAF) Sensor G70
- Engine coolant temperature from Engine Coolant Temperature (ECT) Sensor G62
- Signals from Oxygen Sensors:
  Heated Oxygen Sensor (HO2S) G39
  Heated Oxygen Sensor (HO2S) 2 G108
  Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
  Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131
- Signal from Throttle Valve Control Module J338

The fuel tank ventilation system prevents fuel vapor that develops in the tank from escaping to the atmosphere. The fuel vapor is stored in the EVAP canister (activated charcoal filter).

When evaluation of the input signals determines that conditions are right for it to do so, the Motronic Engine Control Module J220 actuates the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 to release the stored fuel vapor.

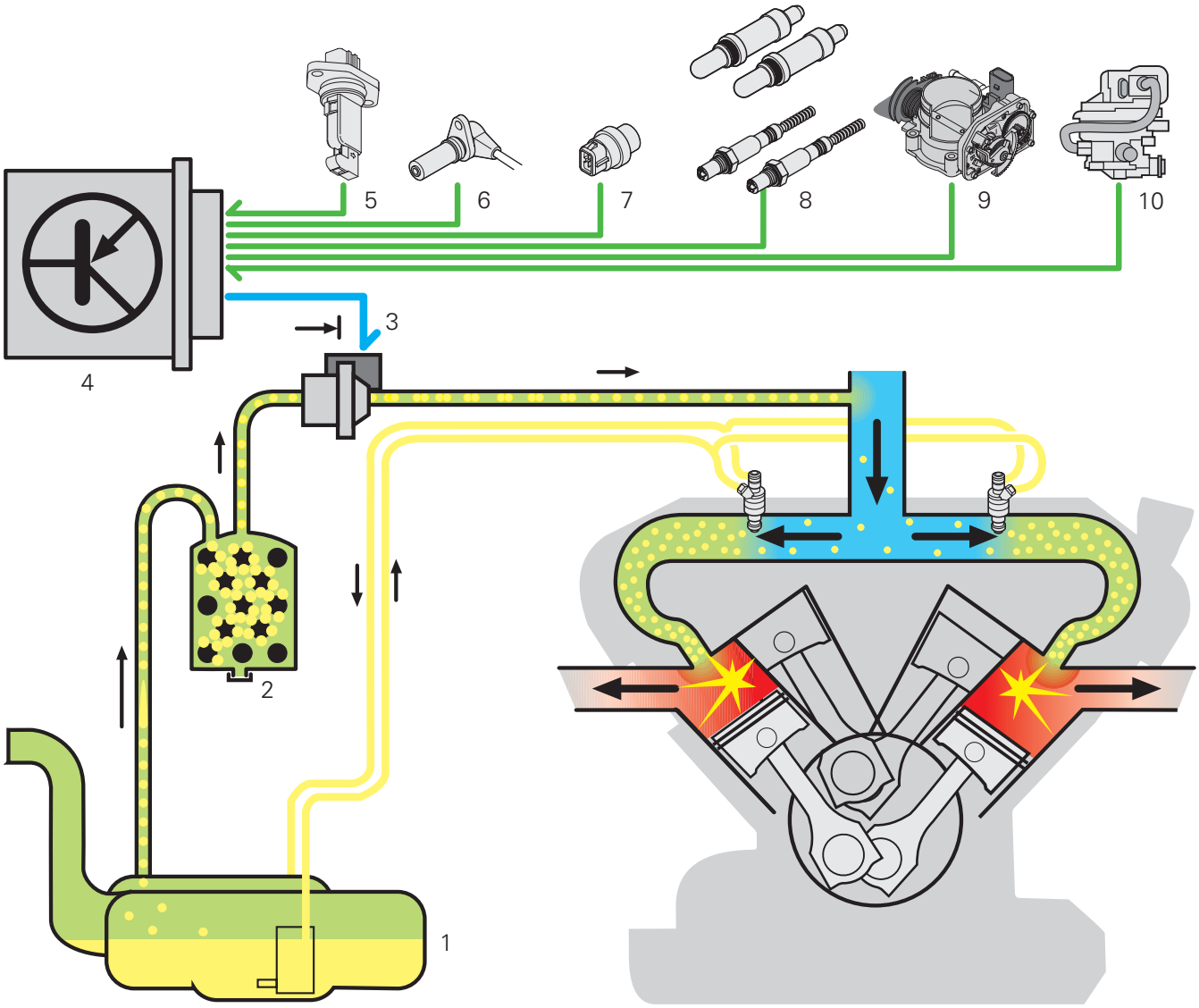
The fuel vapor released from the EVAP canister is routed through the intake manifold to the cylinders for combustion.

This briefly changes the fuel-to-air ratio. The change in the mixture is registered by the oxygen sensors. This causes oxygen sensor control to be activated by the Motronic Engine Control Module J220 and the mixture settles back to the stoichiometric ratio at which complete combustion takes place.

A Leak Detection Pump V144 is integrated into the fuel tank ventilation system and can have two functions. It can:

- Pressurize the fuel tank ventilation 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 separtate EVAP canister vent.

For further information, please refer to *EVAP Systems, Operation and Diagnosis,* Self-Study Program Course Number 841903.



1 Fuel Tank

2 Evaporative Emission (EVAP) Canister

3 Evaporative Emission (EVAP) Canister Purge Regulator Valve N80

4 Motronic Engine Control Module J220

5 Mass Air Flow (MAF) Sensor G70

6 Engine Speed (RPM) Sensor G28

7 Engine Coolant Temperature (ECT) Sensor G62

8 Oxygen Sensors:
Heated Oxygen Sensor (HO2S) G39
Heated Oxygen Sensor (HO2S) 2 G108
Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

9 Throttle Valve Control Module J338

10 Leak Detection Pump V144

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Cruise Control System (CCS)

With the aid of the cruise control system (CCS), a vehicle speed above 18.6 mph (30 km/h) can be specified. This speed will then be maintained without driver intervention.

Input Signals:

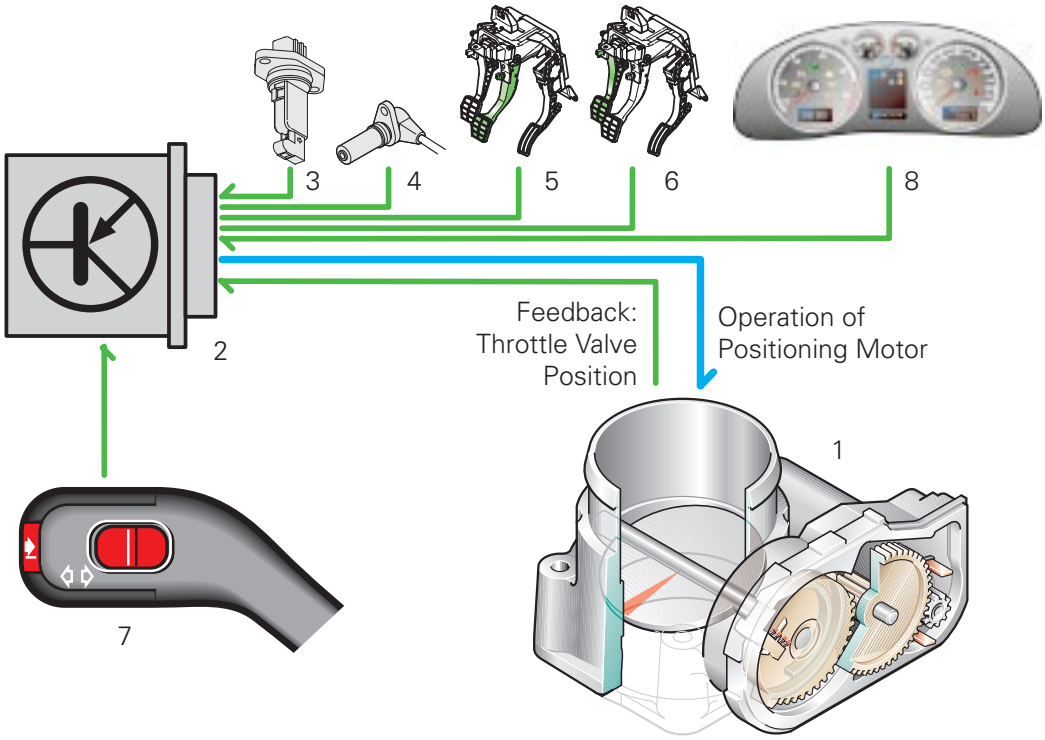
- Signal from Engine Speed (RPM) Sensor G28
- Engine load signal from Mass Air Flow (MAF) Sensor G70
- Vehicle speed signal from Control Module with Indicator Unit in Instrument Panel Insert J285
- Signal "brake operated" from Brake Light Switch F
- Signal "clutch operated" from Clutch Vacuum Vent Valve Switch F36
- "On" and "off" signals from Cruise Control Switch E45

The signal from the Cruise Control Switch E45 goes to the Motronic Engine Control Module J220 which in turn actuates the Throttle Valve Control Module J338.

The Throttle Valve Control Module J338 opens the throttle valve according to the set speed.

If the vehicle is equipped with a multi-function steering wheel, an additional CCS switch is located on the steering wheel.

The signal "brake operated" or "clutch operated" causes the cruise control system to be turned off.



1 Throttle Valve Control Module J338
2 Motronic Engine Control Module J220
3 Mass Air Flow (MAF) Sensor G70
4 Engine Speed (RPM) Sensor G28
5 Brake Light Switch F
6 Clutch Vacuum Vent Valve Switch F36
7 Cruise Control Switch E45
8 Vehicle Speed Signal from Control Module with Indicator Unit in Instrument Panel Insert J285

SSP249/012

Electronic Power Control

Main Input Signals:

- Signals from Accelerator Pedal Module with Throttle Position (TP) Sensor G79 and Sender -2- for Accelerator Pedal Position G185

The driver's input is transmitted to the Motronic Engine Control Module J220 as input signals from the accelerator pedal module with Throttle Position (TP) Sensor G79 and Sender -2- for Accelerator Pedal Position G185. The Motronic Engine Control Module J220, uses these signals and the additional input signals to calculate the best fuel mixture, ignition timing, and camshaft timing, all to achieve the required torque.

The results of these calculations initiate signals from the Motronic Engine Control Module J220 to make adjustments to the throttle valve position (which is adjusted by an electric motor), and in the ignition timing, camshaft timing, and the fuel injection systems.

In the event of a fault in the electronic power control system, the Electronic Power Control (EPC) Warning Lamp K132 lights up to inform the driver.

For further information, please refer to *Motronic ME 7 Engine Management System*, Self-Study Program Course Number 842003.

1 Throttle Valve Control Module J338

2 Motronic Engine Control Module J220

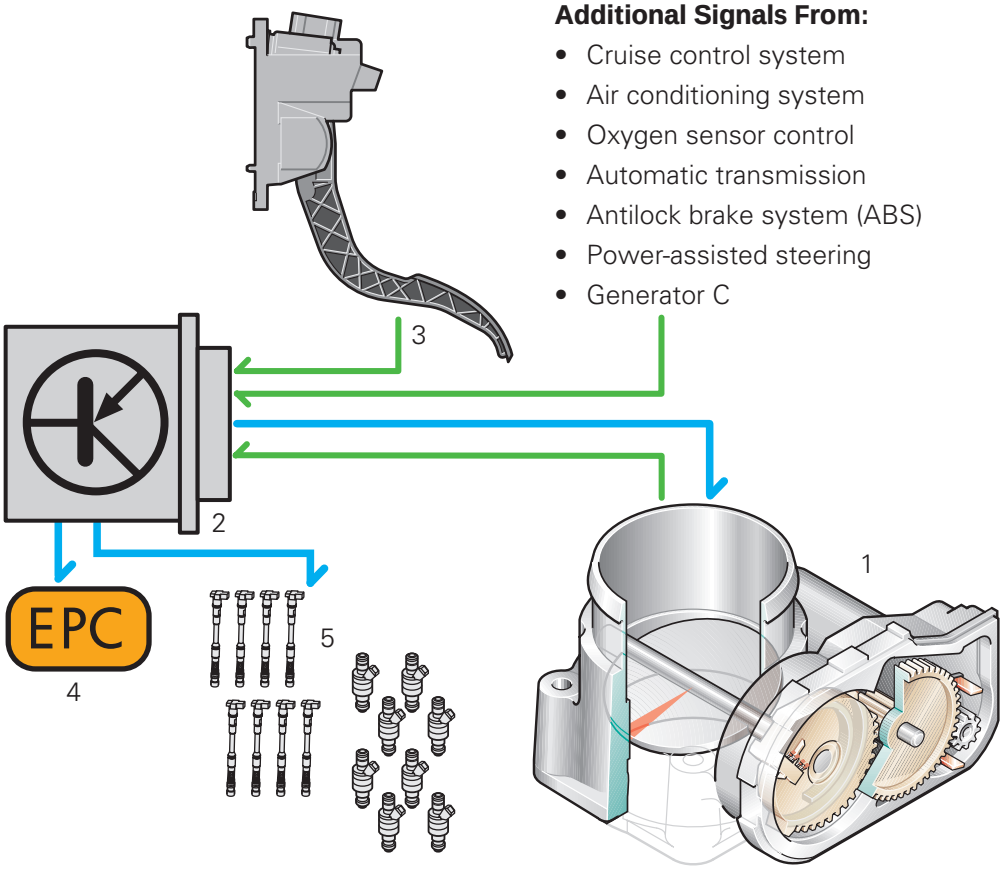
3 Accelerator Pedal Module with Throttle Position (TP) Sensor G79 and Sender -2- for Accelerator Pedal Position G185

4 Electronic Power Control (EPC) Warning Lamp K132

5 Ignition Coils with Power Output Stage (N70, N127, N291, N292, N323, N324, N325, N326) and Fuel Injectors (N30, N31, N32, N33, N83, N84, N85, N86)

Additional Signals From:

- Cruise control system
- Air conditioning system
- Oxygen sensor control
- Automatic transmission
- Antilock brake system (ABS)
- Power-assisted steering
- Generator C



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Secondary Air System

Input Signals:

- Signals from Oxygen Sensors:
  Heated Oxygen Sensor (HO2S) G39
  Heated Oxygen Sensor (HO2S) 2 G108
  Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
  Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131
- Coolant temperature from Engine Coolant Temperature (ECT) Sensor G62
- Engine load signal from Mass Air Flow (MAF) Sensor G70
- Signal from Engine Speed (RPM) Sensor G28

The secondary air system reduces exhaust emissions following a cold start.

During the warm-up period, the level of unburned hydrocarbons is elevated. The catalytic converters cannot process this amount because they have not yet attained their operating temperature. However, a stoichiometric mixture at which complete combustion takes place must be attained.

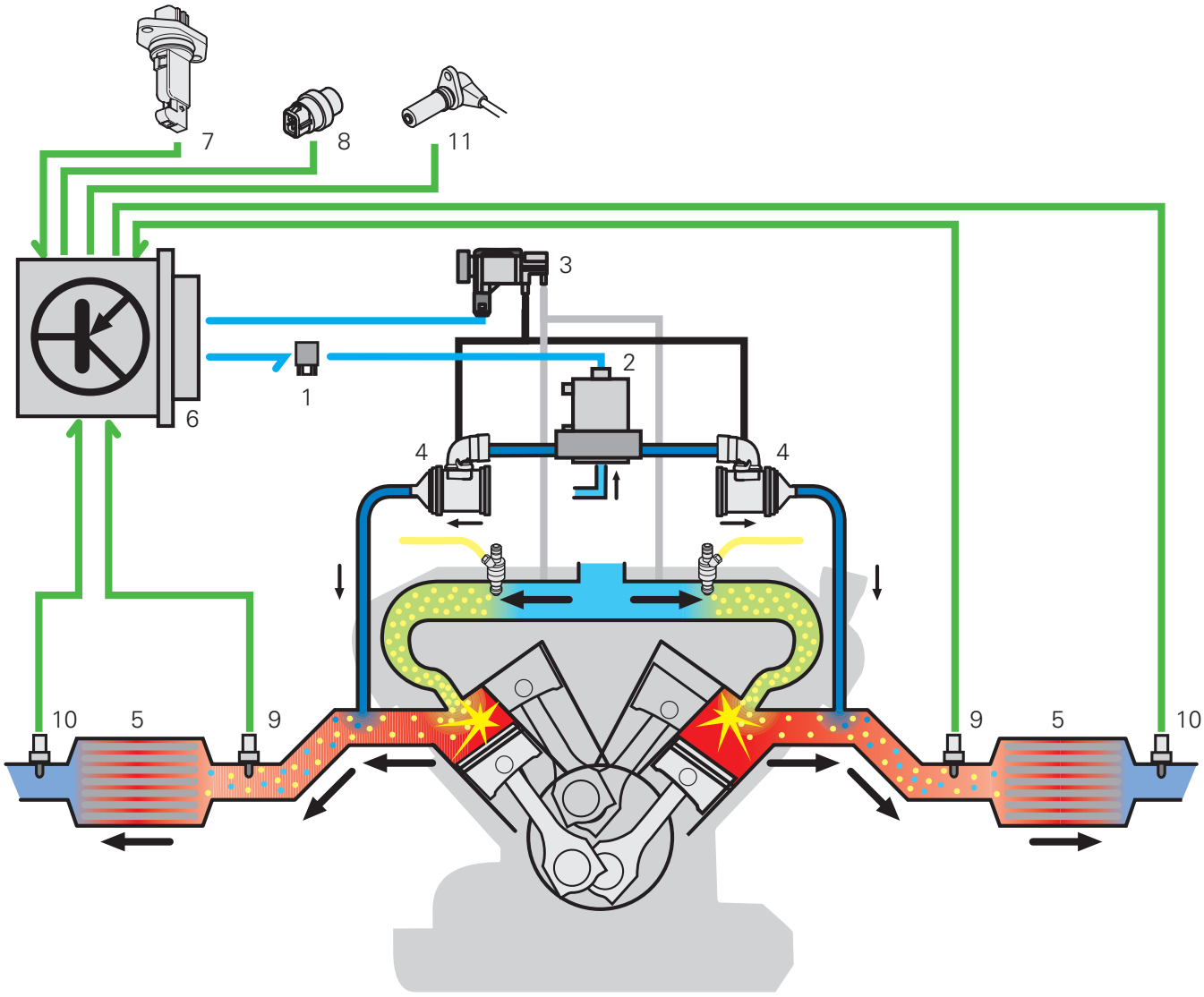
Blowing air in behind the exhaust valves enriches the exhaust gas with oxygen, and post-oxidation (afterburning) occurs. The resulting heat warms the catalytic converters to their operating temperature more quickly.

When the input signals indicate to the Motronic Engine Control Module J220 the need for secondary air injection, it actuates the Secondary Air Injection Solenoid Valve N112 and the Secondary Air Injection Pump Relay J299.

The Secondary Air Injection Pump Relay J299 energizes the Secondary Air Injection Pump Motor V101.

Vacuum from the Secondary Air Injection Solenoid Valve N112 opens the combination valves, and the Secondary Air Injection Pump Motor V101 forces air into the exhaust gas stream behind the exhaust valves.

Beginning at partial load, the secondary air system is turned off.



1 Secondary Air Injection Pump Relay J299

2 Secondary Air Injection Pump Motor V101

3 Secondary Air Injection Solenoid Valve N112

4 Combination Valve

5 Catalytic Converter

6 Motronic Engine Control Module J220

7 Mass Air Flow (MAF) Sensor G70

8 Engine Coolant Temperature (ECT) Sensor G62

9 Pre-Catalyst Oxygen Sensor:
Heated Oxygen Sensor (HO2S) G39
Heated Oxygen Sensor (HO2S) 2 G108

10 After-Catalyst Oxygen Sensor:
Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

11 Engine Speed (RPM) Sensor G28

SS249/014

Engine Mount Damping Control

Input Signals:

- Signal from Engine Speed (RPM) Sensor G28
- Vehicle Speed Signal from Control Module with Indicator Unit in Instrument Panel Insert J285

The hydraulically damped engine mounts with electro-pneumatic actuation reduce the transmission of engine vibration to the body over the entire engine speed range.

Depending on the engine speed and the vehicle speed, the Motronic Engine Control Module J220 actuates the Electro-Hydraulic Engine Mount Solenoid Valve N144 and it switches the mounts between the dynamically soft engine mount damping state in idling mode and the relatively hard engine mount damping state in driving mode.

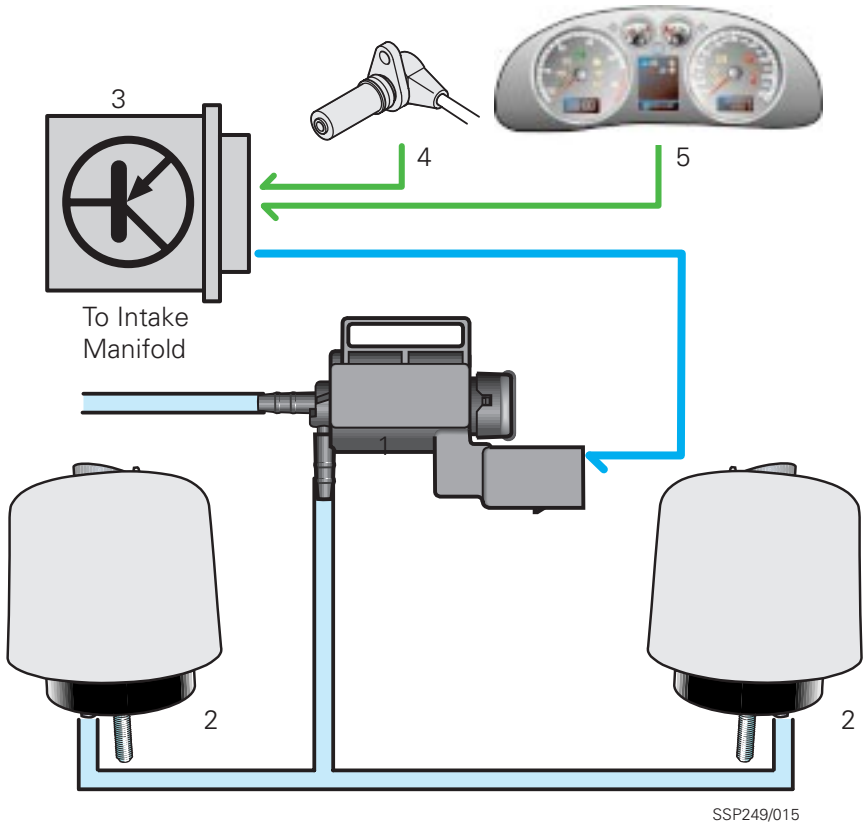
1 Electro-Hydraulic Engine Mount Solenoid Valve N144

2 Engine Mount

3 Motronic Engine Control Module J220

4 Engine Speed (RPM) Sensor G28

5 Vehicle Speed Signal from Control Module with Indicator Unit in Instrument Panel Insert J285



Electronically Controlled Engine Cooling

The aim of developing an electronically controlled cooling system was to be able to set the operating temperature of the engine to a specified value based on the load state.

An optimal operating temperature is set according to "maps" stored in the Motronic Engine Control Module J220 by heating the thermostat electrically and adjusting the radiator fan settings.

Cooling can thus be adapted to the engine's overall performance and load state.

As used here, **map** refers to an electronic database that sets up the relationship between incoming sensor information and outgoing control signals. Maps are also referred to as "look-up tables."

Advantages

The advantages of adapting the coolant temperature to the current operating state of the engine are:

- Lower fuel consumption in the part-throttle range.
- Reduced raw CO and HC emissions.

Changes to the conventional cooling circuit include:

- Integration in the cooling circuit through minimal design modifications.
- The coolant distributor housing and thermostat are combined to form a single module.
- There is no longer any need for a coolant thermostat on the cylinder head.
- Motronic Engine Control Module J220 contains the maps of the electronically controlled cooling system.

The Coolant Temperature Level

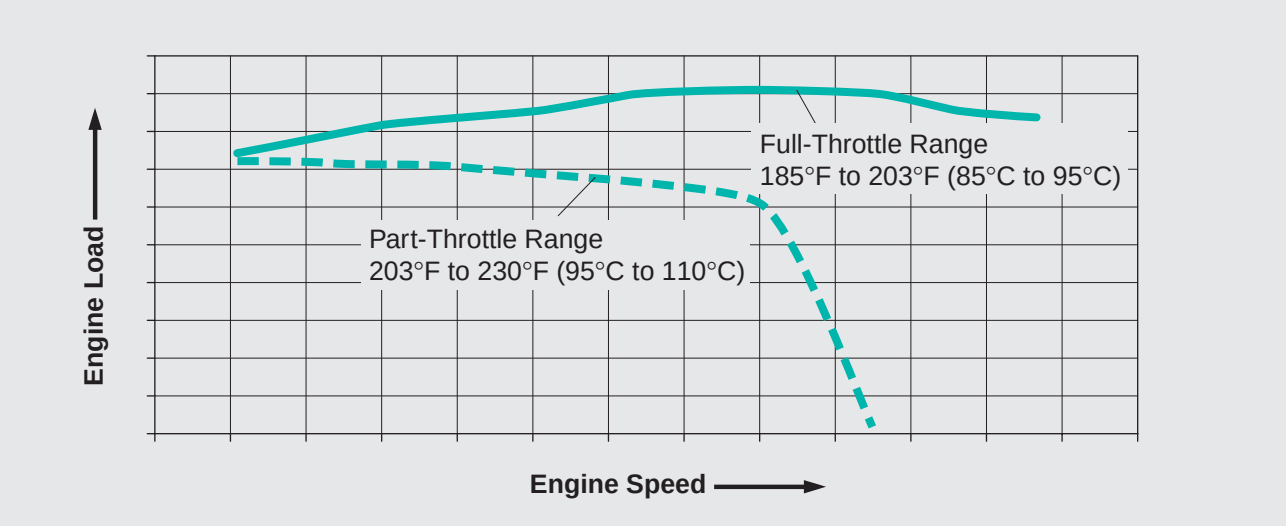
Engine performance is dependent on proper engine cooling.

In the electronically controlled cooling system, the coolant temperatures range from 203°F to 230°F (95°C to 110°C) in the part-throttle range and from 185°F to 203°F (85°C to 95°C) in the full-throttle range.

Engine load and cooling should always be considered together.

- Higher temperatures in the part-throttle range improve efficiency, which in turn reduces fuel consumption and pollutants in the exhaust gases.
- Lower temperatures in the full-throttle range increase power output. The inducted air is heated to a lesser degree, boosting performance.

Coolant Temperature Level as a Function of Engine Load with Mapped Cooling



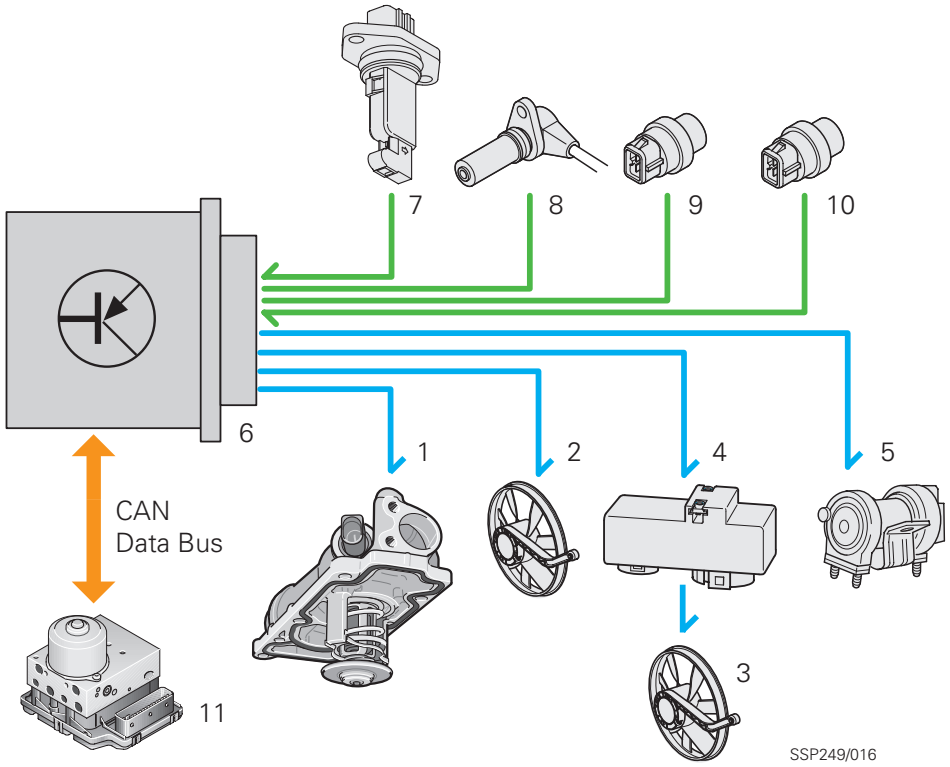
SSP222-013

Input Signals:

- Signal from Engine Speed (RPM) Sensor G28
- Engine load signal from Mass Air Flow (MAF) Sensor G70
- Coolant temperature at engine outlet from Engine Coolant Temperature (ECT) Sensor G62
- Coolant temperature at radiator outlet from Engine Coolant Temperature (ECT) Sensor (On Radiator) G83
- Vehicle Speed Signal from ABS Control Module J104

If the input signals indicate the need for a larger cooling capacity, the Map Controlled Engine Cooling Thermostat F265 is actuated to open the larger coolant circuit.

To further increase the cooling capacity, both radiator fans are controlled by the Motronic Engine Control Module J220. A signal from the Motronic Engine Control Module J220 to the Coolant Fan Control Module J293 enables it to turn on Coolant Fan V7 as needed.



1 Map Controlled Engine Cooling Thermostat F265
2 Coolant Fan -2- V177
3 Coolant Fan V7
4 Coolant Fan Control Module J293
5 Coolant Pump V36
6 Motronic Engine Control Module J220

7 Mass Air Flow (MAF) Sensor G70
8 Engine Speed (RPM) Sensor G28
9 Engine Coolant Temperature (ECT) Sensor G62
10 Engine Coolant Temperature (ECT) Sensor (On Radiator) G83
11 Speed Signal from ABS Control Module J104

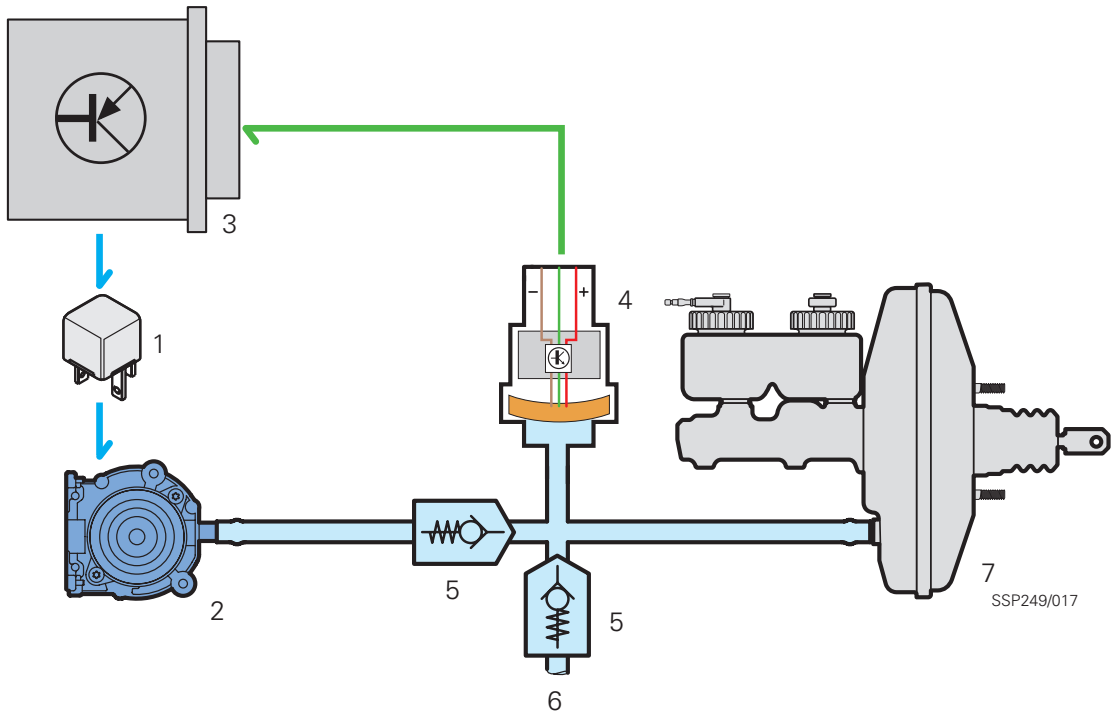
Regulated Vacuum Pump System
(Vehicles with Automatic Transmissions Only)

Input Signal:

- Signal from Brake Booster Pressure Sensor G294

Vehicles with automatic transmissions are equipped with an electric Brake System Vacuum Pump V192. This pump supports the brake booster by ensuring that there is sufficient vacuum at the connection point for the brake booster.

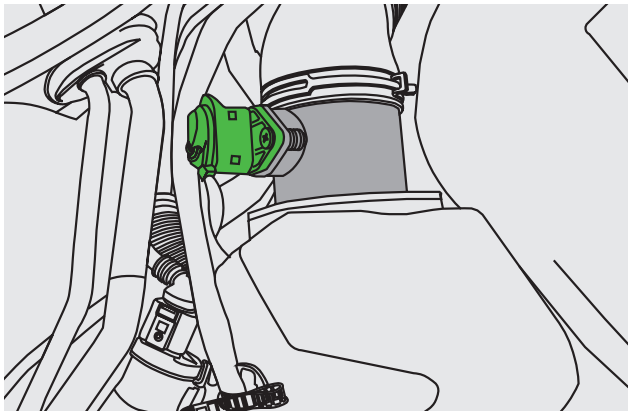
The Brake Booster Pressure Sensor G294 measures the current pressure within the brake booster and sends this value to the Motronic Engine Control Module J220. The Motronic Engine Control Module J220 compares the actual value with the stored specification and actuates the Brake System Vacuum Pump V192 via Brake Booster Relay J569.



1 Brake Booster Relay J569
2 Brake System Vacuum Pump V192
3 Motronic Engine Control Module J220
4 Brake Booster Pressure Sensor G294
5 Non-Return Valve
6 To Intake Manifold
7 Brake Booster

Mass Air Flow (MAF) Sensor G70 Combined with Intake Air Temperature (IAT) Sensor G42

The Mass Air Flow (MAF) Sensor G70 with backflow recognition and the Intake Air Temperature (IAT) Sensor G42 are integrated in one component which is located in the intake duct at the air filter housing. The Mass Air Flow (MAF) Sensor G70 determines the mass of the inducted air. The Intake Air Temperature (IAT) Sensor G42 measures its temperature.



SSP249/018

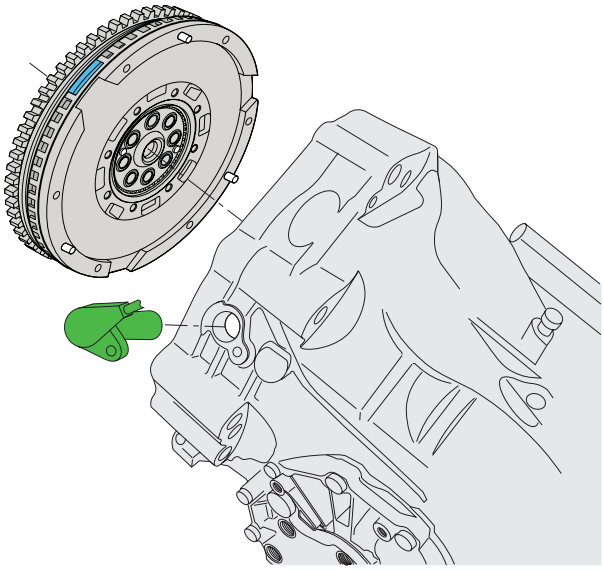
Use of the Signal

The Mass Air Flow (MAF) Sensor G70 signal is used for calculating all functions that depend on engine speed and load information, such as the fuel injection period, ignition timing, variable valve timing and fuel tank ventilation.

Effects of Failure

If the signal fails, the Motronic Engine Control Module J220 calculates a substitute value.

For further information, please refer to *1998 New Beetle*, Self-Study Program Course Number 891802.



SSP249/019

Engine Speed (RPM) Sensor G28

The Engine Speed (RPM) Sensor G28 is located in the transmission housing.

A reluctor wheel is attached to the dual mass flywheel or torque converter drive plate. The reluctor wheel includes a large tooth gap which acts as a reference point and sends reference signals to the Motronic Engine Control Module J220. On the basis of these signals, the Motronic Engine Control Module J220 determines the engine speed and the crankshaft position.

Use of the Signal

This Engine Speed (RPM) Sensor G28 signal is used to calculate the fuel injection time, the fuel injection quantity, and the ignition timing. It is also used for variable valve timing and fuel tank ventilation.

Effects of Failure

If the Engine Speed (RPM) Sensor G28 signal fails, the engine will not run.

Engine Coolant Temperature (ECT) Sensor G62 and Engine Coolant Temperature (ECT) Sensor (On Radiator) G83

The actual values of the engine coolant temperature are measured at two different points.

- Engine Coolant Temperature (ECT) Sensor G62 is located at the coolant outlet at the rear of the engine.
- Engine Coolant Temperature (ECT) Sensor (On Radiator) G83, as its official name indicates, is located at the radiator outlet.

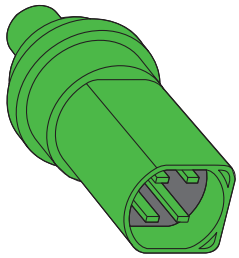
Use of Signal

The signals of both Engine Coolant Temperature (ECT) Sensor G62 and Engine Coolant Temperature (ECT) Sensor (On Radiator) G83 serve the coolant temperature regulation in the coolant circuit.

The signal from Engine Coolant Temperature (ECT) Sensor G62 is also used as an input signal to the Motronic Engine Control Module J220 for calculating injection periods and ignition timing, for idle speed regulation, for fuel tank ventilation, and for the secondary air system.

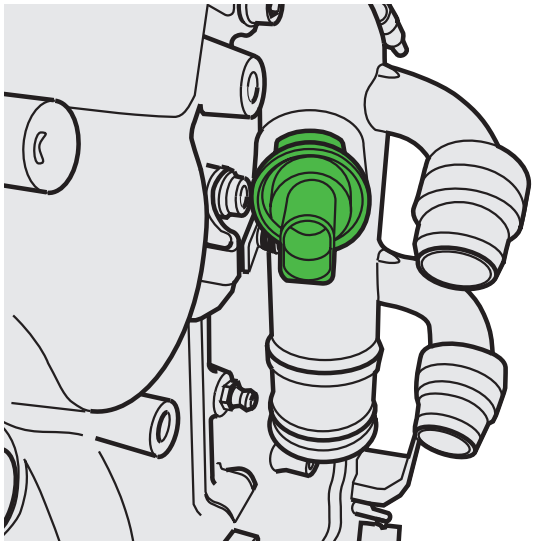
Effects of Signal Failure

If the signal fails, the Motronic Engine Control Module J220 uses a substitute temperature stored in it. The Coolant Fan V7 and Coolant Fan -2- V177 go into emergency operation (both fans run).



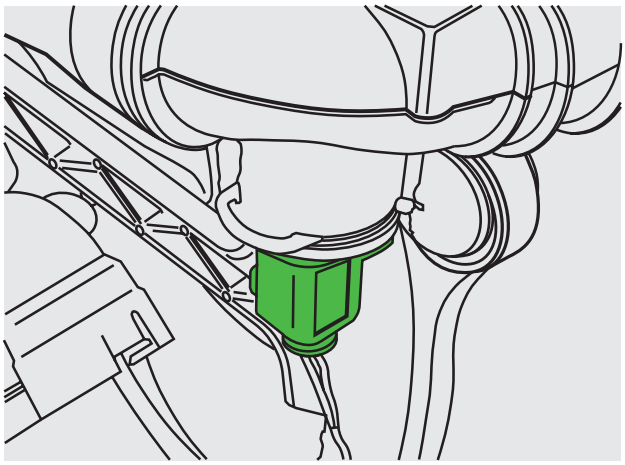
SSP249/020

Engine Coolant Temperature (ECT) Sensor G62 at Coolant Outlet at Rear of Engine



SSP249/021

Engine Coolant Temperature (ECT) Sensor (On Radiator) G83 at Radiator Outlet



SSP249/022

Oxygen Sensors

Pre-Catalyst Broad-Band Oxygen Sensors:

- Heated Oxygen Sensor (HO2S) G39
- Heated Oxygen Sensor (HO2S) 2 G108

Each pre-catalytic converter broad-band oxygen sensor is located on the catalytic converter housing upstream from the monolith. With these broad-band oxygen sensors, the oxygen content in the exhaust gas can be determined over a wide measuring range.

Post-Catalyst Planar Oxygen Sensors

- Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
- Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

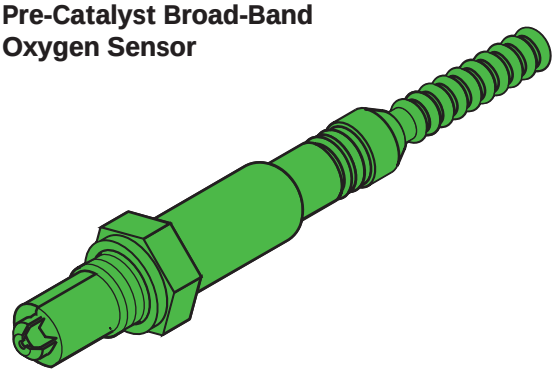
Each post-catalytic converter planar oxygen sensor is located on the catalytic converter housing downstream from the monolith.

Use of Signals

The pre-catalyst sensors (Heated Oxygen Sensor (HO2S) G39 and Heated Oxygen Sensor (HO2S) 2 G108) supply the signals for fuel-air mixture preparation.

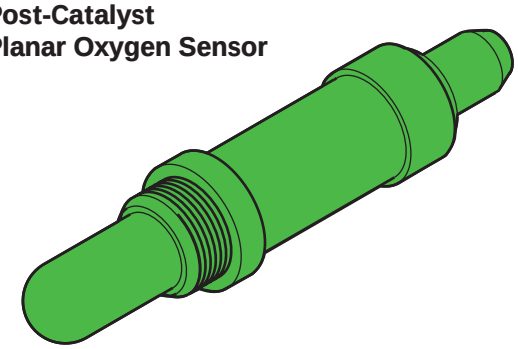
The post-catalyst sensors (Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 and Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131) provide information about the function of the catalytic converters and the oxygen sensor control.

Pre-Catalyst Broad-Band Oxygen Sensor

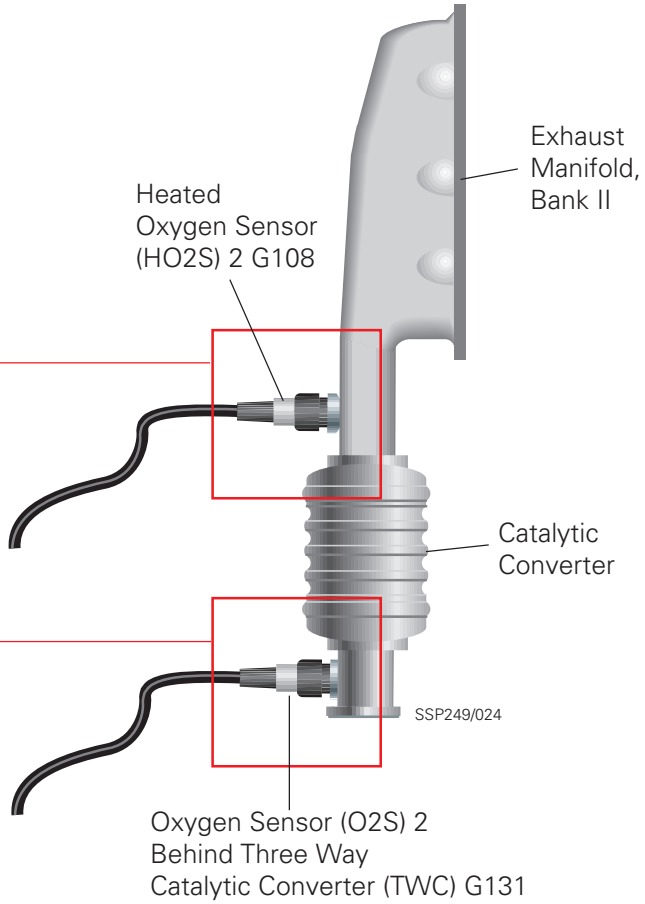


SSP249/023

Post-Catalyst Planar Oxygen Sensor



SSP249/025



Effects of Signal Failure

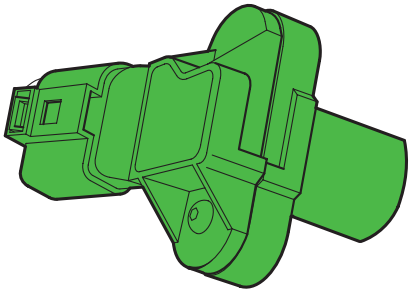
If a pre-catalyst sensor fails, oxygen sensor control can no longer occur. Adaptation is blocked. The engine will continue to run using default values available in the Motronic Engine Control Module J220 control map.

If a post-catalyst sensor fails, oxygen sensor control can continue, but the function of the catalytic converter can no longer be monitored.

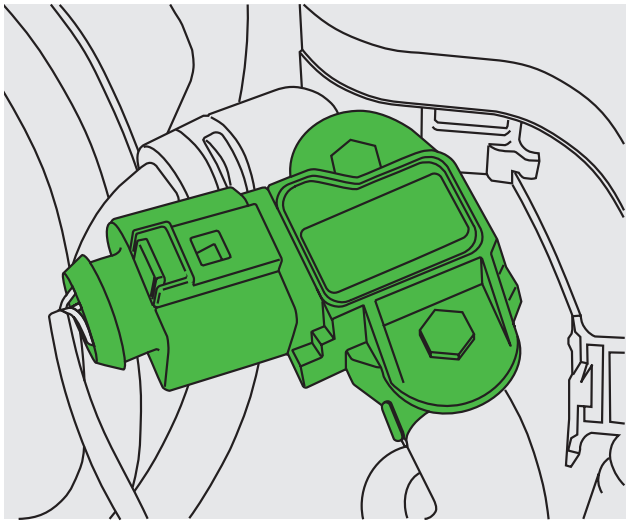
For further information, please refer to *Engine Management Systems,* Self-Study Program Course Number 841003.

Brake Booster Pressure Sensor G294
(Vehicles with Automatic Transmissions Only)

The Brake Booster Pressure Sensor G294 is located in the engine compartment below the vacuum line to the brake booster. It measures the current pressure in the brake booster system and transmits this value as a voltage signal to the Motronic Engine Control Module J220.



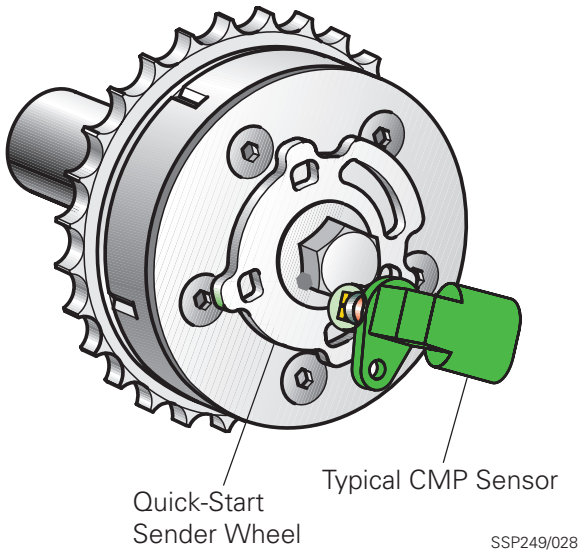
SSP249/027

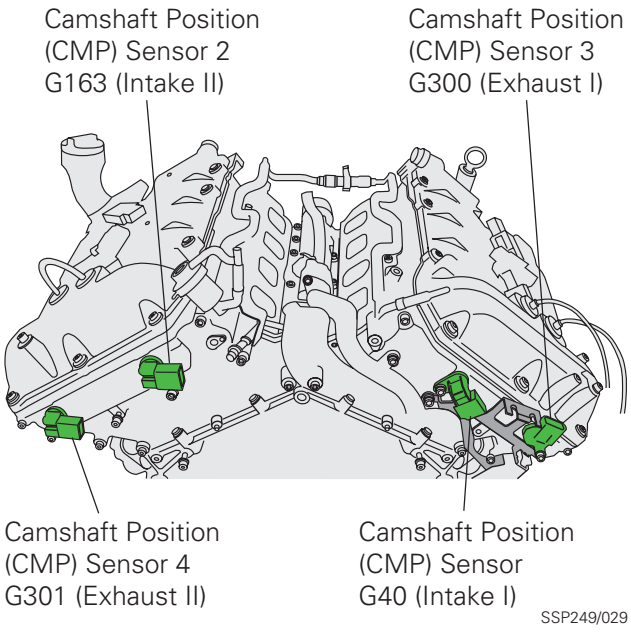


SSP249/026

Effects of Signal Failure

If the signal fails, the Motronic Engine Control Module J220 calculates the vacuum likely to be present in the brake booster on the basis of the input values for engine load, engine speed, throttle valve position, and Brake Light Switch F, and actuates the Brake System Vacuum Pump V192 via Brake Booster Relay J569 when the need is anticipated.





Camshaft Position Sensors

All of the camshaft position sensors are Hall sensors. They are mounted in the engine timing case cover. They have the task of informing the Motronic Engine Control Module J220 of the positions of the intake and exhaust camshafts by sensing the positions of quick-start sender wheels located at the ends of their respective camshafts.

Use of Signal

Camshaft Position (CMP) Sensor G40 and Camshaft Position (CMP) Sensor 2 G163 indicate the positions of the intake camshafts to the Motronic Engine Control Module J220. Camshaft Position (CMP) Sensor 3 G300 and Camshaft Position (CMP) Sensor 4 G301 indicate the positions of the exhaust camshafts.

The signals of all four CMP sensors serve as input signals for variable valve timing as well as for the calculation of sequential injection and ignition timing.

The signal from Camshaft Position (CMP) Sensor G40 is also used for determining the top dead center point of the number 1 cylinder piston.

Effects of Signal Failure

If a CMP sensor fails, the camshafts cannot be adjusted. The engine will continue to run and will start again after it has been turned off, using default settings stored in control maps in the Motronic Engine Control Module J220.

Knock Sensors

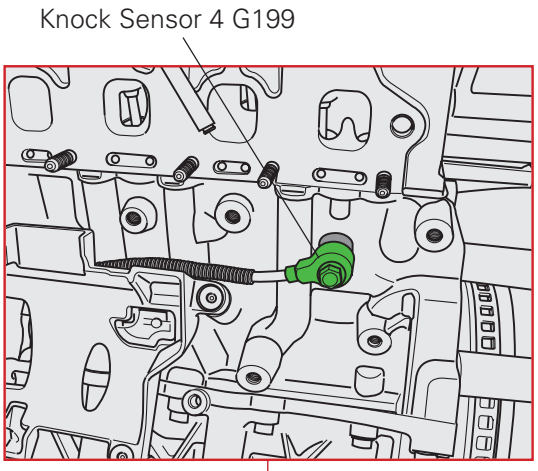
The electronic regulation of ignition timing is based on cylinder-specific knock control. The W8 engine has two knock sensors on each bank, located on the crankcase.

Use of Signal

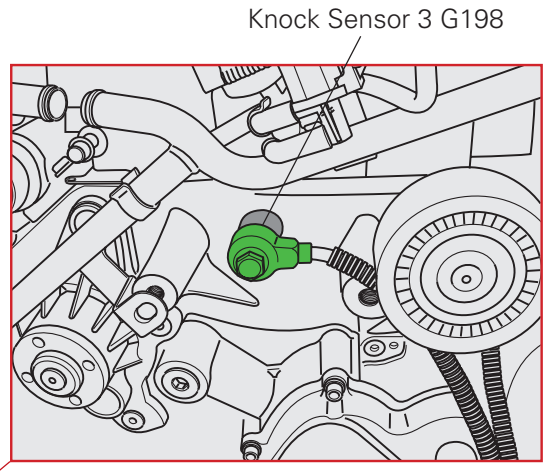
The knock sensors indicate to the Motronic Engine Control Module J220 when knocking combustion occurs. It initiates an ignition timing adjustment until the knocking ceases.

Effects of Signal Failure

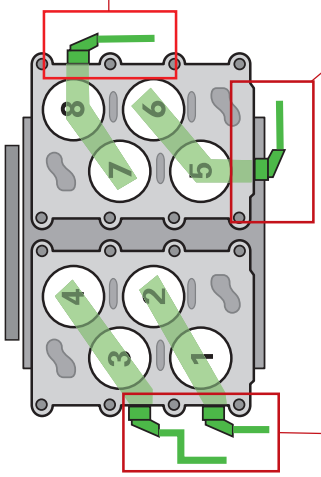
If a knock sensor fails, the ignition timing of the affected cylinders is retarded. If all knock sensors fail, the engine management system switches to emergency knock control, during which the ignition timing is generally retarded so that the maximum engine output is not available.



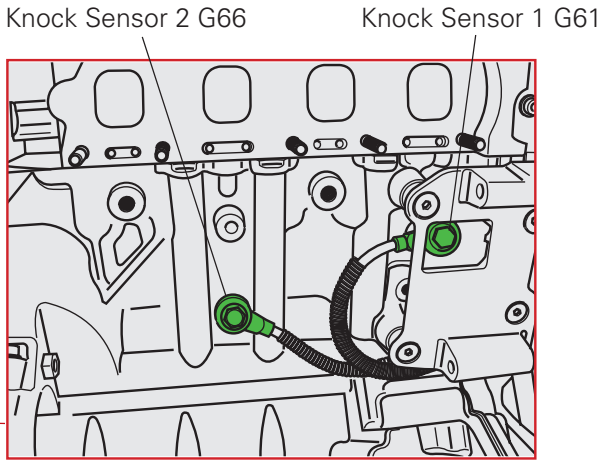
SSP249/033



SSP249/030



SSP249/031



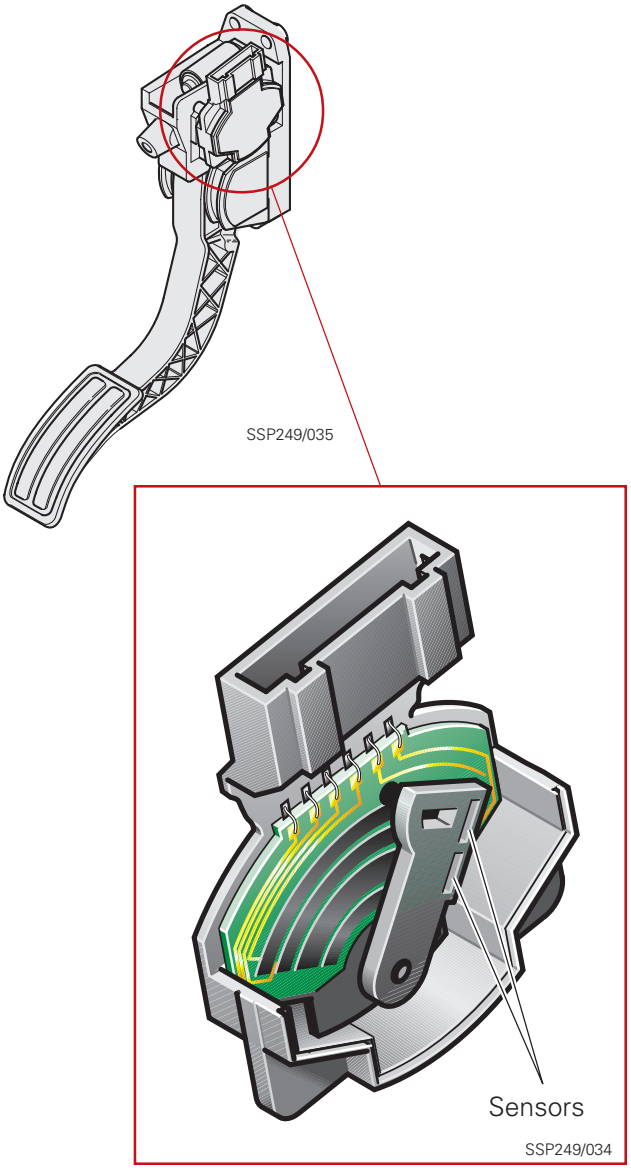
SSP249/032

Accelerator Pedal Module

The accelerator pedal module is located on the pedal bracket and consists of:

- Accelerator pedal
- Throttle Position (TP) Sensor G79
- Sender -2- for Accelerator Pedal Position G185

Both sensors are sliding-contact potentiometers located on a common shaft.



Every change in the accelerator pedal position changes the resistance of the sliding-contact potentiometers and consequently the voltage transmitted to the Motronic Engine Control Module J220.

Use of Signal

The signals from the Throttle Position (TP) Sensor G79 and Sender -2- for Accelerator Pedal Position G185 serve to communicate the driver's input to the Motronic Engine Control Module J220 and also as kickdown information for the automatic transmission.

No separate switch is used for kickdown information. A mechanical pressure point is integrated in the accelerator pedal module that communicates the "kickdown feeling" to the driver.

Effects of Signal Failure

If one sensor fails, the pedal value is limited to a defined value. At full load, the output is increased slowly. If the differences in signals between Throttle Position (TP) Sensor G79 and Sender -2- for Accelerator Pedal Position G185 are implausible, the lower value is used. The Electronic Power Control (EPC) Warning Lamp K132 will indicate a fault.

If both sensors fail, the engine will run only at idle and will not respond to changes in accelerator pedal position. The Electronic Power Control (EPC) Warning Lamp K132 will indicate a fault.

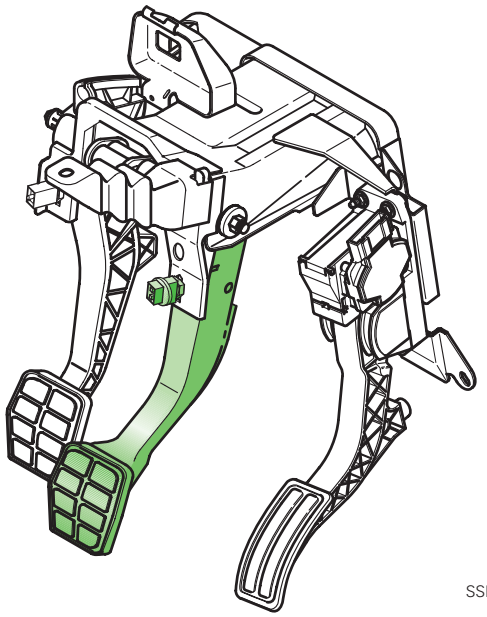
For further information, please refer to *Motronic ME 7 Engine Management System,* Self-Study Program Course Number 842002.

Brake Light Switch F Combined with Brake Pedal Switch F47

The Brake Light Switch F and the Brake Pedal Switch F47 are combined in a single component located on the pedal bracket.

Use of Signal

When the brake pedal is pressed, both of these switches send a "brake operated" signal to the Motronic Engine Control Module J220, which immediately turns the cruise control system off if it is in use.



SSP249/037

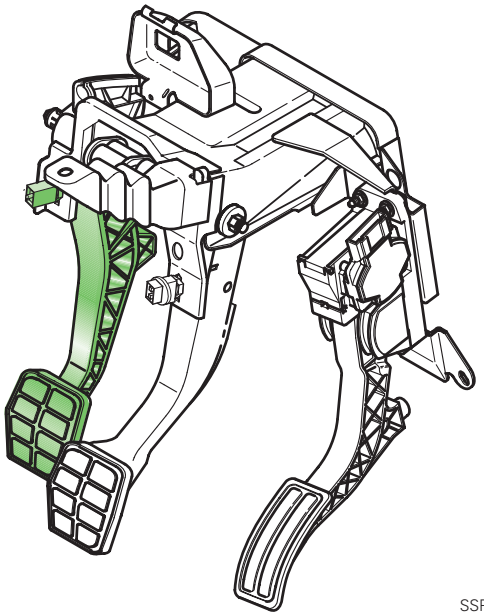
Clutch Vacuum Vent Valve Switch F36

The Clutch Vacuum Vent Valve Switch F36 is located on the pedal bracket.

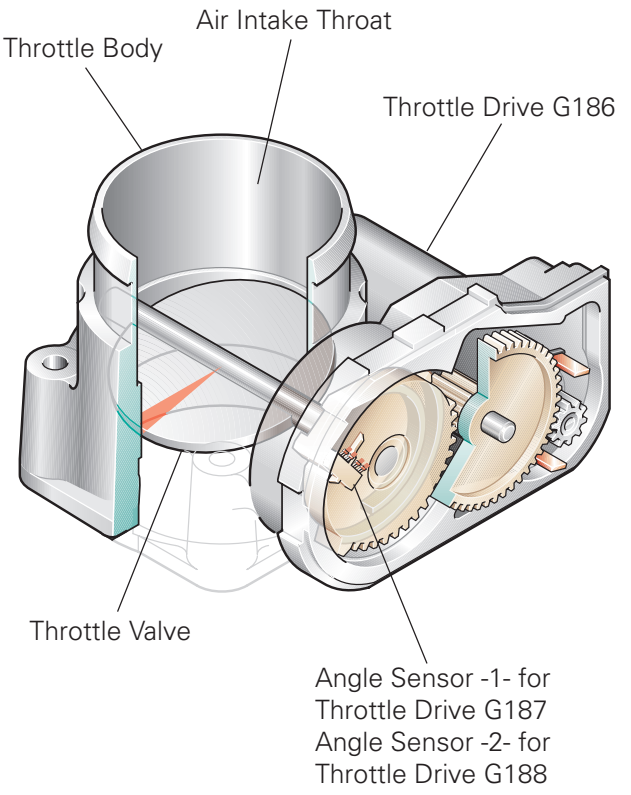
Use of Signal

When the clutch pedal is operated, the Clutch Vacuum Vent Valve Switch F36 sends a signal to that effect to the Motronic Engine Control Module J220, which immediately turns the cruise control system off if it is in use.

The Motronic Engine Control Module J220 also reduces the quantity of fuel injected briefly when the clutch pedal is pressed to prevent the engine speed from increasing while the gear is being changed. This reduces the jolt when load returns as the clutch is engaged.



SSP249/036



SSP249/038

Throttle Valve Control Module J338

The Throttle Valve Control Module J338 is located on the intake manifold. It has the task of providing the engine with the required quantity of air under all conditions.

The air intake throat on the W8 engine application has a larger diameter than the similar control module used on the VR6 engine. This is necessary because the W8 engine has a greater need for air due to its greater displacement. The connection for throttle valve heating has been eliminated.

To open or close the throttle valve as well as to adjust to a particular throttle valve setting, the Motronic Engine Control Module J220 actuates the Throttle Drive G186.

Both the Angle Sensor -1- for Throttle Drive G187 and the Angle Sensor -2- for Throttle Drive G188 transmit the current position of the throttle valve to the Motronic Engine Control Module J220.

Effects of Signal Failure

If the Throttle Drive G186 fails, the throttle valve is automatically drawn to the emergency running position, permitting limited operation with an increased idling speed.

If one angle sensor fails, the maximum output will not be available. However, the engine can be started and the vehicle driven.

If both angle sensors fail, the Throttle Drive G186 is turned off. The engine will only run at an increased idling speed.

For further information, please refer to *Motronic ME 7 Engine Management System,* Self-Study Program Course Number 842002.

Leak Detection Pump V144

The Leak Detection Pump V144 has been added to all Volkswagen vehicles to check the integrity of the EVAP system.

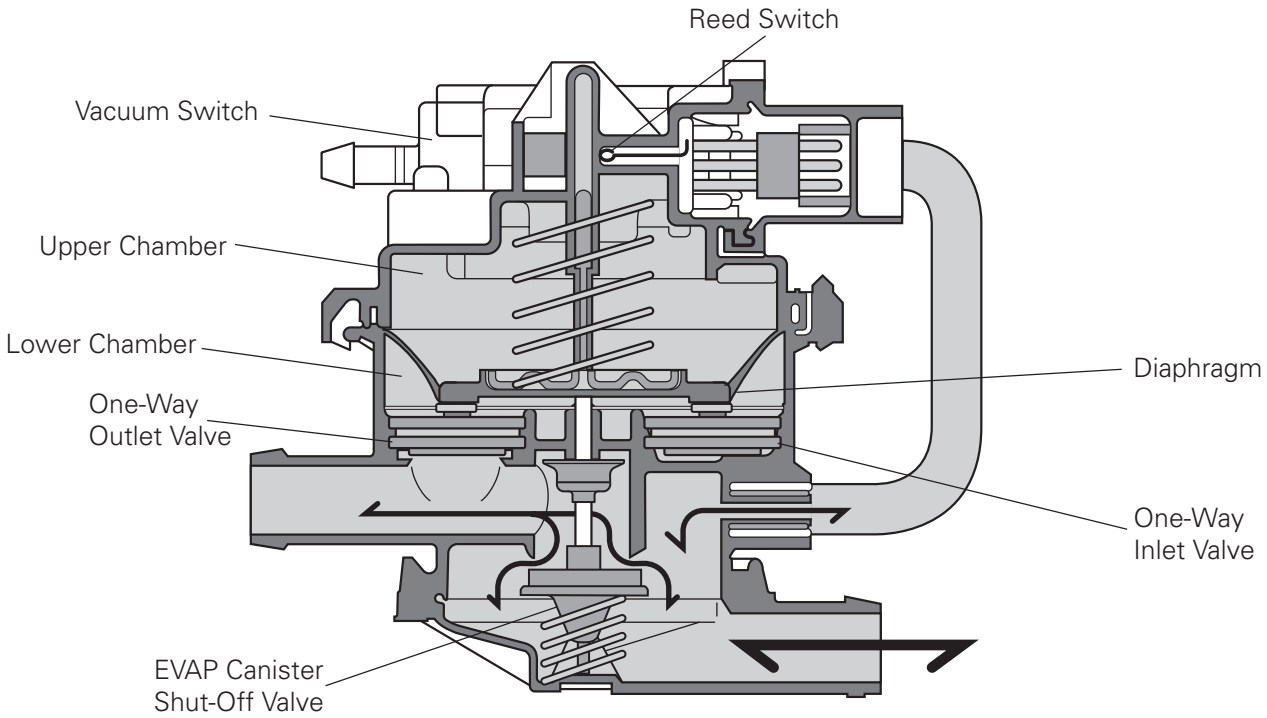
Leak Detection Pump V144 is integrated into the EVAP system and can have two functions:

- 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 Leak Detection Pump V144 is made of the following components:

- Vacuum switch
- Reed switch
- Diaphragm
- Inlet valve
- Outlet valve
- Upper pump chamber
- Lower pump chamber
- EVAP shut-off valve
- Diaphragm spring

The Leak Detection Pump V144 is a vacuum-driven diaphragm pump, controlled by the Motronic Engine Control Module J220. In order for it to operate, the engine must be running and vacuum must be applied to the vacuum switch.



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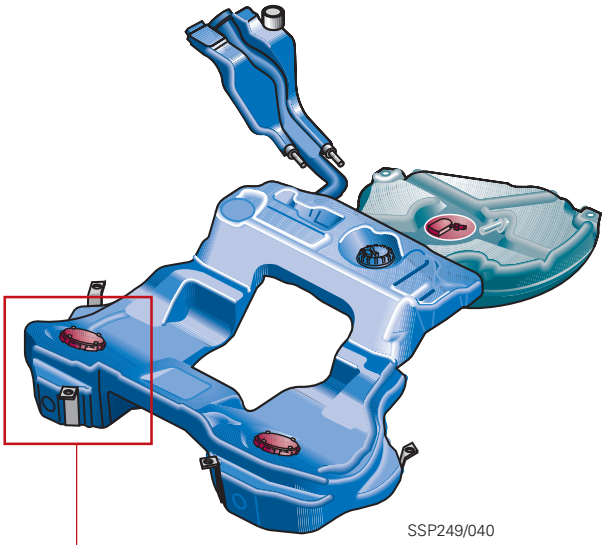


SSP249/040

SSP249/039

Fuel Pump G6

The Fuel Pump G6 is installed directly in the fuel tank. With the aid of the fuel pressure regulator, it creates a pressure of 58 psi (400 kPa) in the fuel system.

To supply the engine, fuel is delivered from the Fuel Pump G6 through the fuel filter to the fuel rail.

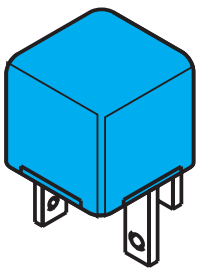
Effects of Failure

If the Fuel Pump G6 fails, no fuel is delivered. The engine stops.

Additional Fuel Delivery Components

The Transfer Fuel Pump G23 is located in the auxiliary fuel tank and there is a suction jet pump in the left chamber of the main fuel tank. The Transfer Fuel Pump G23 is actuated by the Fuel Pump Control Module J538. It delivers fuel from the auxiliary fuel tank to the main fuel tank. The suction jet pump ensures that fuel from the left chamber of the main fuel tank reaches the Fuel Pump G6. Neither Transfer Fuel Pump G23 nor the suction jet pump are actuated by the Motronic Engine Control Module J220.

For further information on the fuel delivery system, please refer to *The Passat W8*, Self-Study Program Course Number 822203.



SSP249/041

Fuel Pump Relay J17

The Fuel Pump Relay J17 actuates the Fuel Pump G6 when it receives an impulse from the Motronic Engine Control Module J220.

Effects of Failure

If the Fuel Pump Relay J17 fails, the engine cannot be started.

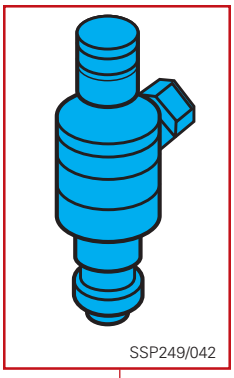
Fuel Injectors

The fuel injectors are actuated by the Motronic Engine Control Module J220 according to the cylinder firing order.

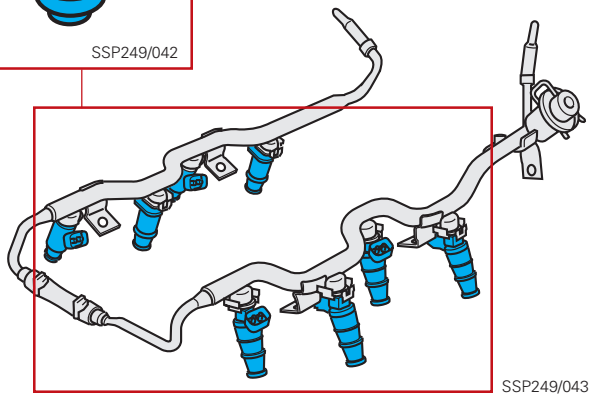
They are secured with retaining clips directly to a common fuel rail and inject atomized fuel into the intake manifold immediately before the intake valve.

Effects of Failure

If individual fuel injectors fail, fuel is not injected at that cylinder. This means that the engine runs at reduced output.



SSP249/042



SSP249/043

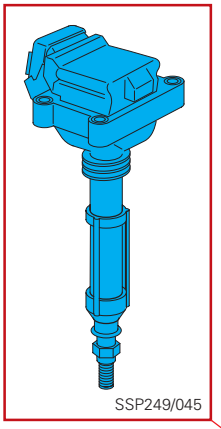
Ignition Coils

The individual single-spark ignition coils installed at each cylinder deliver impulses for one spark per spark plug per ignition cycle.

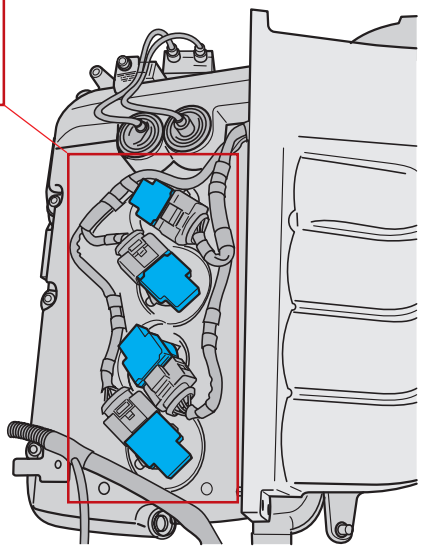
Their design incorporates an output stage and an ignition coil combined in each so that the engine management system can individually control the ignition for each cylinder.

Effects of Failure

If an ignition coil fails, fuel injection is turned off for that cylinder. This prevents damage to the catalytic converter.



SSP249/045



SSP249/044

Camshaft Adjustment Valves

These electronically actuated solenoid valves are installed on the oil supply modules of the camshaft adjusters. They direct oil pressure to the camshaft adjusters bolted to the end faces of the camshafts, determining the direction and distance of adjustment of their inner rotors according to the Motronic Engine Control Module J220 control maps.

Valve 1 for Camshaft Adjustment N205 and Valve 2 for Camshaft Adjustment N208 are responsible for the continuous adjustment of the intake camshafts. The intake camshafts are continuously adjustable and can be advanced or retarded relative to their neutral positions at any angle within a range of 52 degrees.

Camshaft Adjustment Valve 1 (Exhaust) N318 and Camshaft Adjustment Valve 2 (Exhaust) N319 adjust the positions of the exhaust camshafts. The exhaust camshaft adjusters can only be adjusted to the fully "advanced" or fully "retarded" position across a range of 22 degrees.

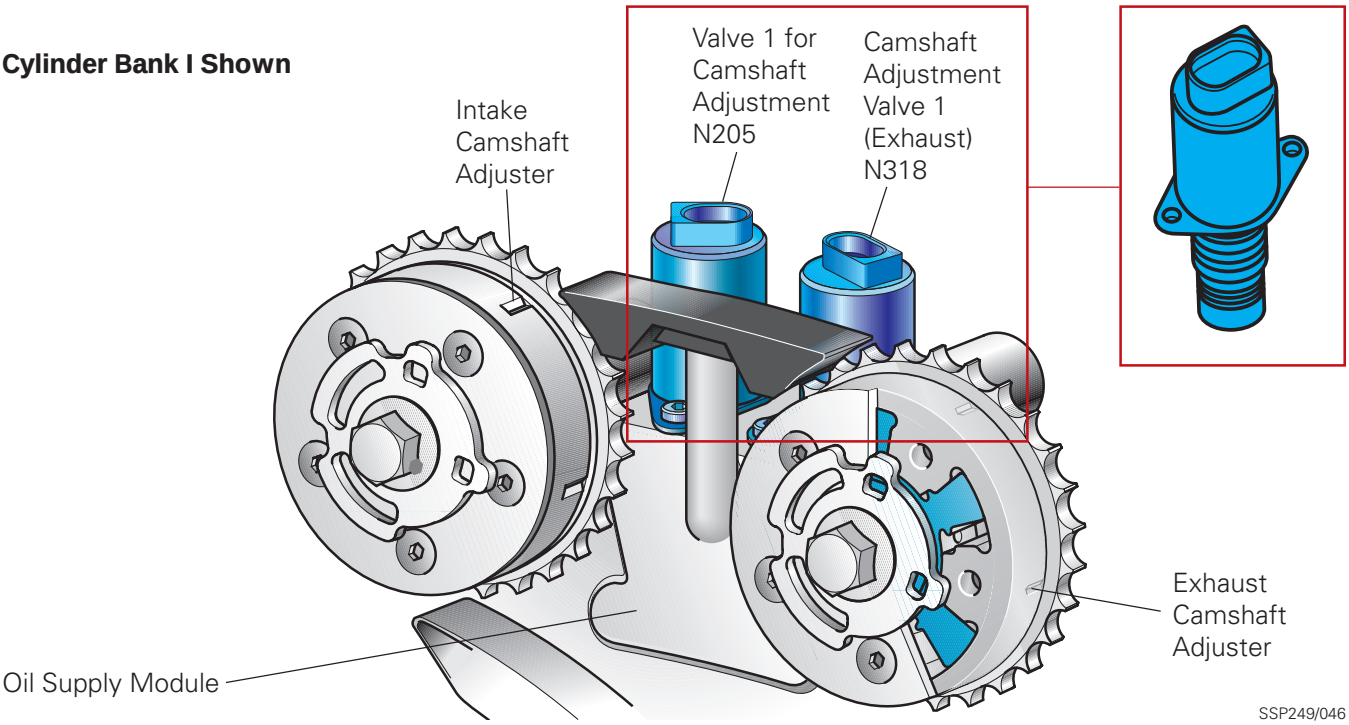
Effects of Signal Failure

If an electrical wire to a camshaft adjuster is defective or if a camshaft adjuster fails, no camshaft adjustment can take place. In the event of an electrical fault, the camshafts remain in their reference positions (emergency running positions).

The reference point for all four camshafts is the retarded position.

For further information, please refer to *The 2001 EuroVan,* Self-Study Program Course Number 892103.

Cylinder Bank I Shown

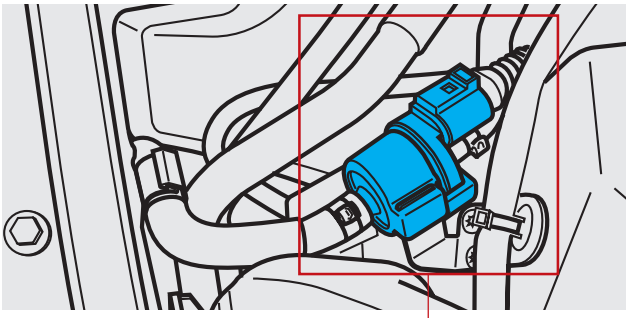


Evaporative Emission (EVAP) Canister Purge Regulator Valve N80

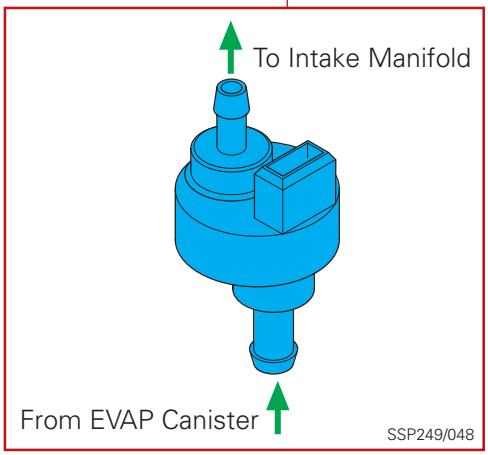
Opening the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 vents the fuel vapor collected in the EVAP canister activated-charcoal filter to the intake manifold for combustion.

Effects of Signal Failure

If current is interrupted, the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 remains closed and EVAP canister purge cannot occur. Fuel tank ventilation will be inhibited as the EVAP canister activated-charcoal filter becomes saturated with fuel.



SSP249/049



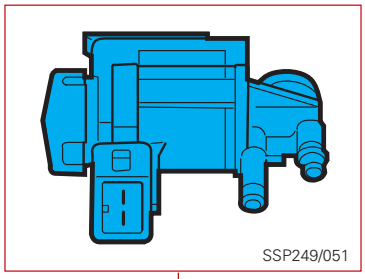
SSP249/048

Secondary Air Injection Solenoid Valve N112

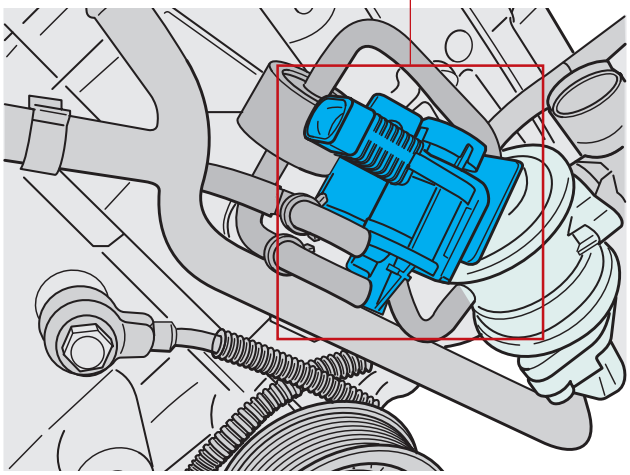
This solenoid valve is actuated by the Motronic Engine Control Module J220 and controls the two secondary air system combination valves through vacuum lines.

Effects of Failure

If the Motronic Engine Control Module J220 signal to the Secondary Air Injection Solenoid Valve N112 fails, the combination valves will not open and the Secondary Air Injection Pump Motor V101 cannot inject air into the exhaust gas stream.

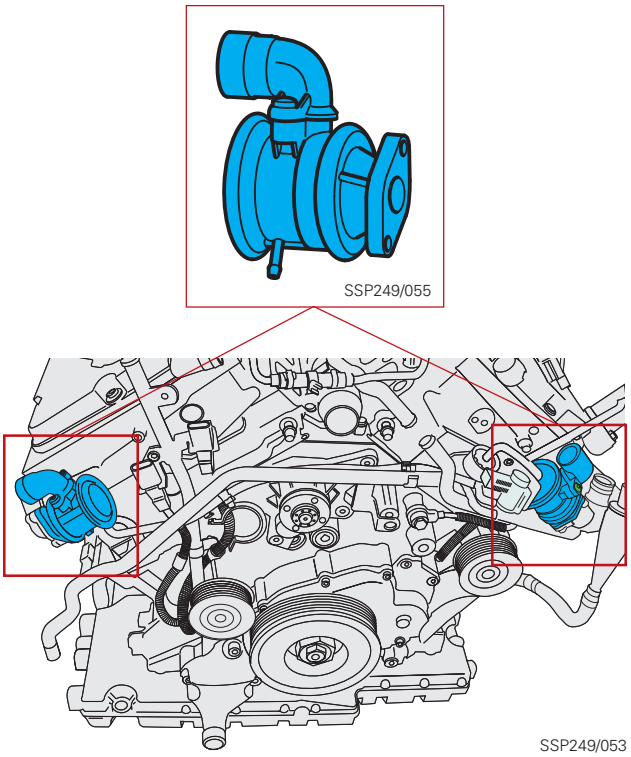


SSP249/051



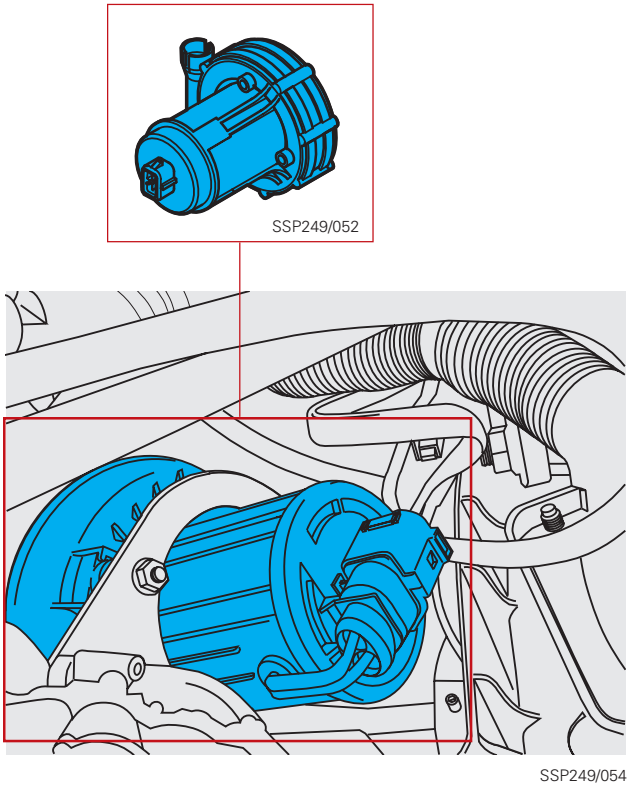
SSP249/050

Actuators



Combination Valve

Vacuum from the Secondary Air Injection Solenoid Valve N112 operates the combination valve, opening the path for air from the Secondary Air Injection Pump Motor V101 to the secondary air duct in the cylinder head. At the same time, the combination valve prevents hot exhaust gases from reaching the Secondary Air Injection Pump Motor V101.



Secondary Air Injection Pump Motor V101

The Secondary Air Injection Pump Motor V101 moves the fresh air in the secondary air system.

Effects of Failure

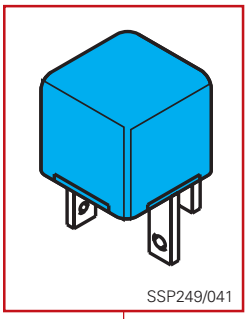
If the power supply is interrupted, the Secondary Air Injection Pump Motor V101 does not operate and no fresh air is pumped into the exhaust gas stream.

Secondary Air Injection Pump Relay J299

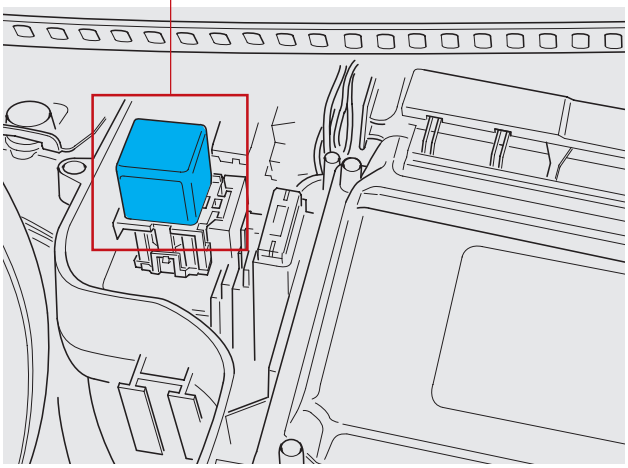
The Secondary Air Injection Pump Relay J299 is controlled by the Motronic Engine Control Module J220 to turn the Secondary Air Injection Pump Motor V101 on and off.

Effects of Failure

If the control circuit fails or the Secondary Air Injection Pump Relay J299 fails to function, the Secondary Air Injection Pump Motor V101 will not run.



SSP249/041

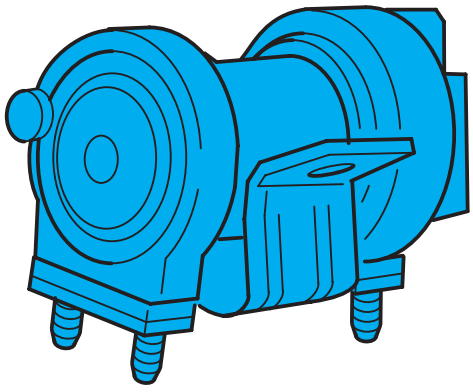


SSP249/056

Coolant Pump V36

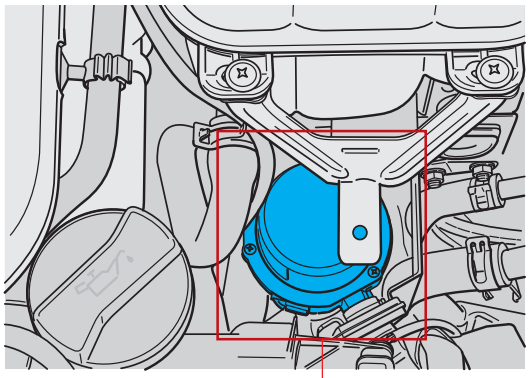
The Coolant Pump V36 is located on the left side of the engine compartment on the suspension strut mount. It circulates engine coolant so that the engine block and cylinder heads cool uniformly.

Depending on the coolant temperature at the radiator and engine outlets, the Coolant Pump V36 will be operated by the Motronic Engine Control Module J220 on the basis of a control map after the engine is turned off.

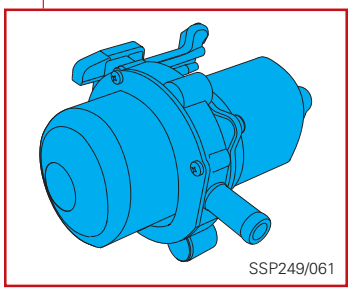


SSP249/057

Actuators



SSP249/060



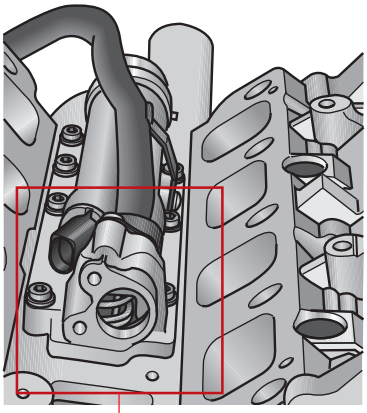
SSP249/061

Brake System Vacuum Pump V192 (Vehicles with Automatic Transmissions Only)

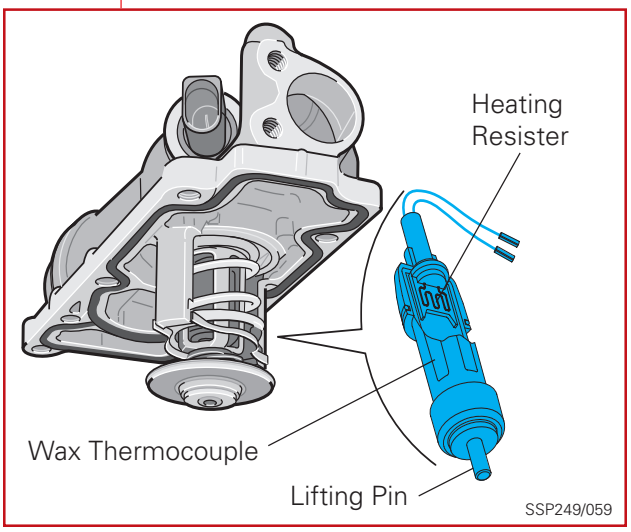
The regulated electric Brake System Vacuum Pump V192 is located on the left side of the engine compartment under a cover. When activated, it supplements the engine vacuum to support the needs of the brake booster.

Effects of Failure

Under certain circumstances, such as during frequent braking, sufficient vacuum cannot be built up and the power assist to the brakes is reduced.



SSP249/058



SSP249/059

Map Controlled Engine Cooling Thermostat F265

The Map Controlled Engine Cooling Thermostat F265 and thermostat housing is installed in the upper part of the crankcase from above. It controls coolant flow between the small and the large cooling circuits.

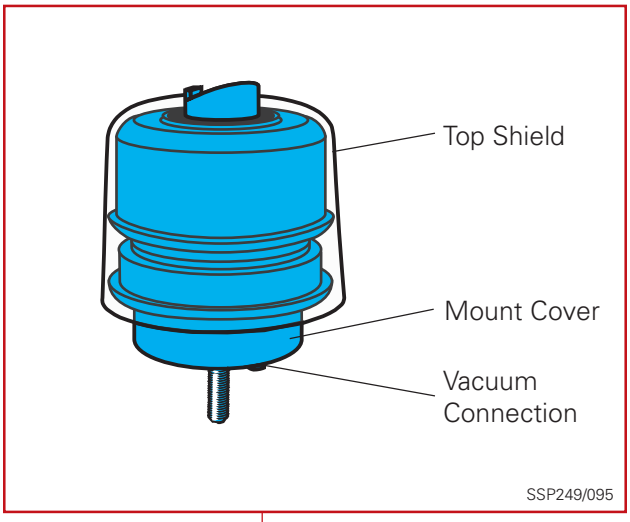
The individual engine operating phases require different engine temperatures. The Map Controlled Engine Cooling Thermostat F265 is controlled by the Motronic Engine Control Module J220 to attain the desired temperature in accordance with a control map that takes the engine operating state into account.

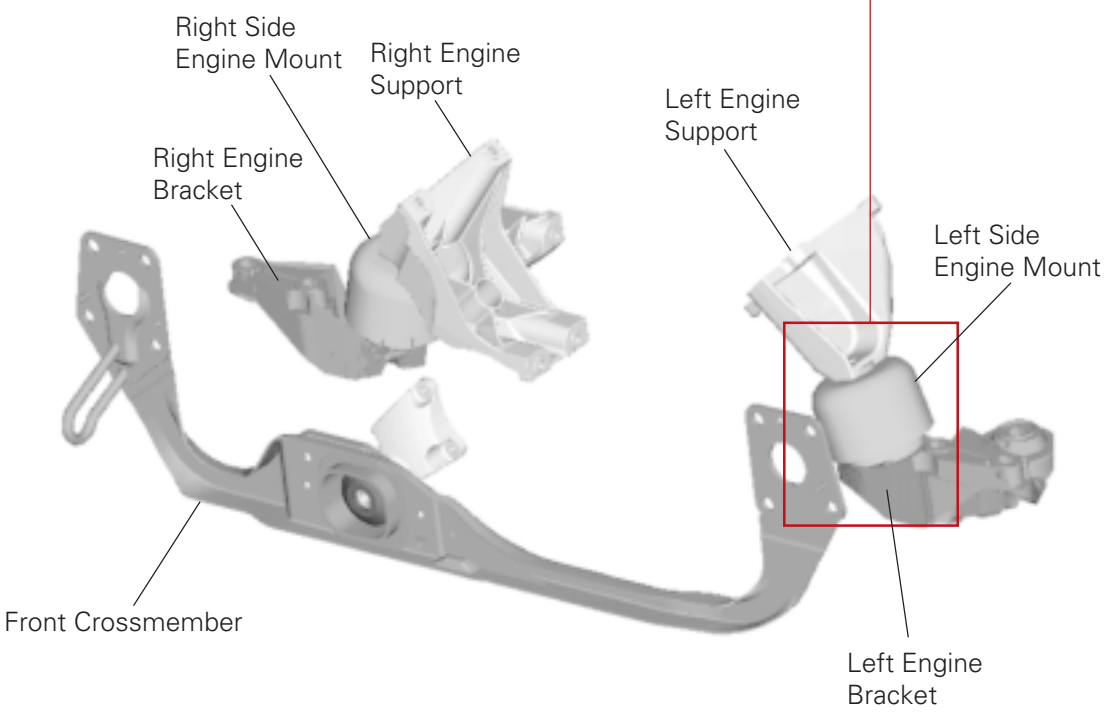
Effects of Failure

If there is no operating voltage present, the large cooling circuit is opened by the wax thermocouple expansion element at a temperature of 230°F (110° C) or above and the radiator fans are actuated.

Hydraulically Damped Engine Mounts

Two hydraulically damped engine mounts ensure improved driving comfort. They reduce the transfer of engine vibration to the body across the entire rpm range.



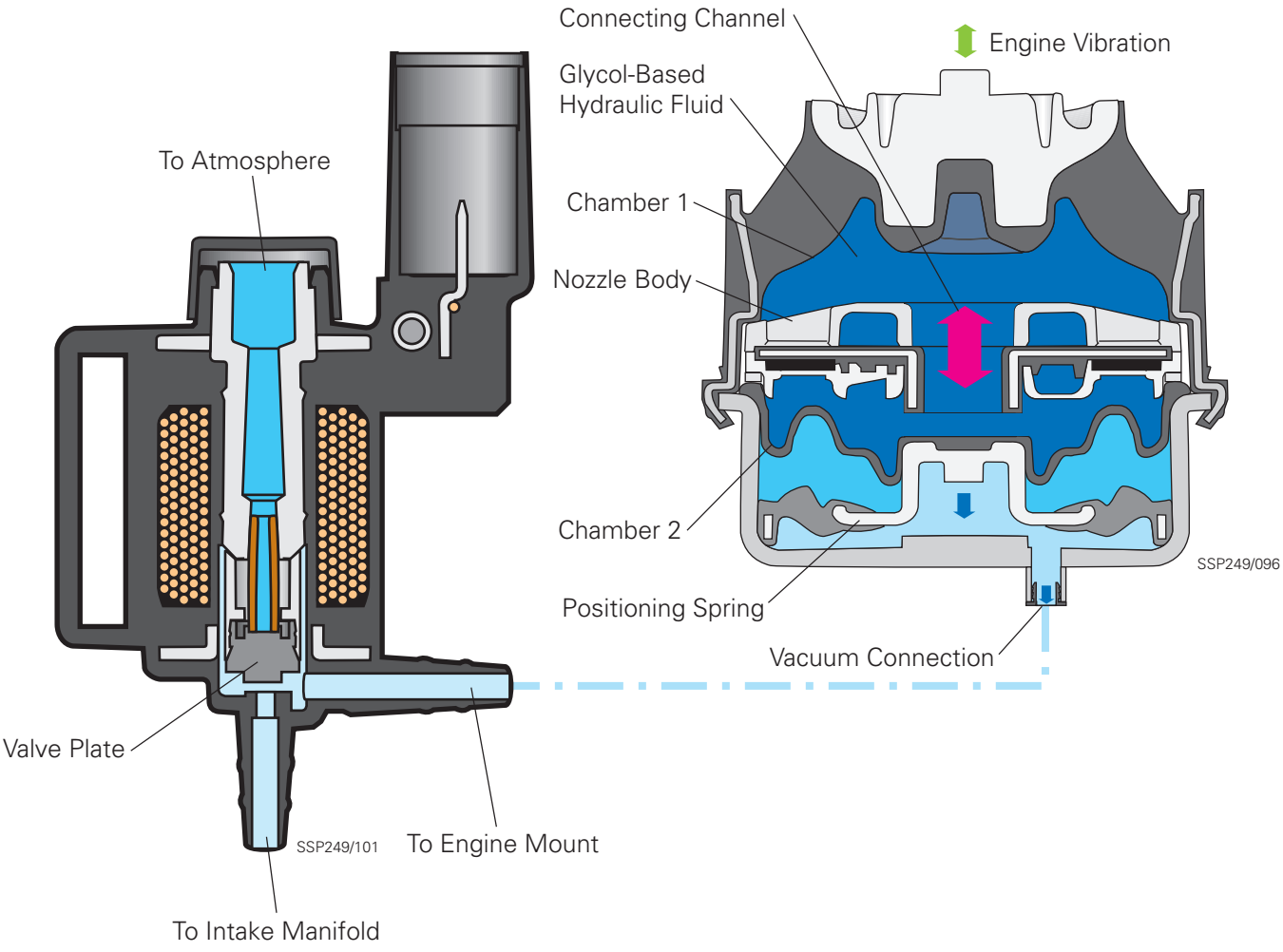


Hydraulically Damped Engine Mount Operation

The engine vibration on a bad road surface is damped by the flow of a glycol-based hydraulic fluid between chambers 1 and 2 in the engine mounts. This damping reduces the resonant engine vibrations caused by the uneven road surface. The amount of maximum damping is determined by the length and diameter of the spiral-shaped channel through which the hydraulic fluid flows.

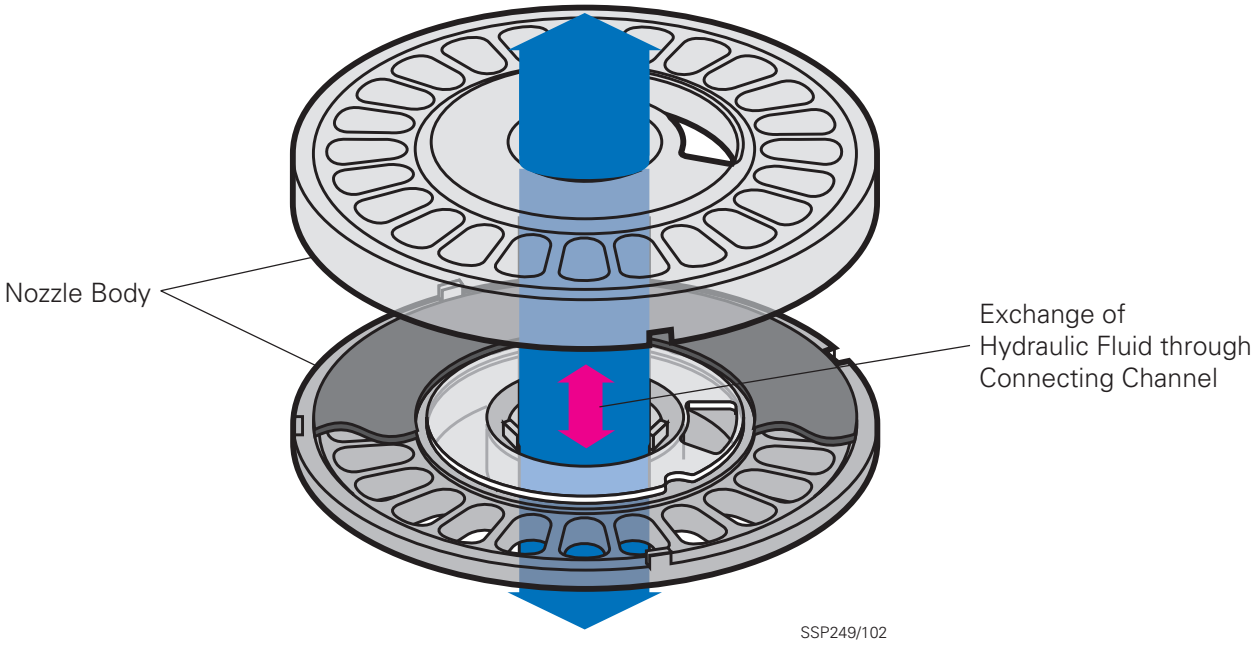
Engine mount operation – idling mode

Voltage Applied to Electro-Hydraulic Engine Mount Solenoid Valve N144



The engine mount is pneumatically actuated by the Electro-Hydraulic Engine Mount Solenoid Valve N144. The Electro-Hydraulic Engine Mount Solenoid Valve N144 directs vacuum or atmospheric pressure to the positioning spring of the engine mount. When current is applied, the valve plate lifts, opening the connection between the intake manifold and the engine mount. The vacuum present at the vacuum connection of the engine mount pulls the positioning spring downward, which opens the connecting channel between chambers 1 and 2.

Opening the connecting channel changes the damping. The mount is dynamically soft, which reduces the transfer of engine vibration to the body at idling speed.

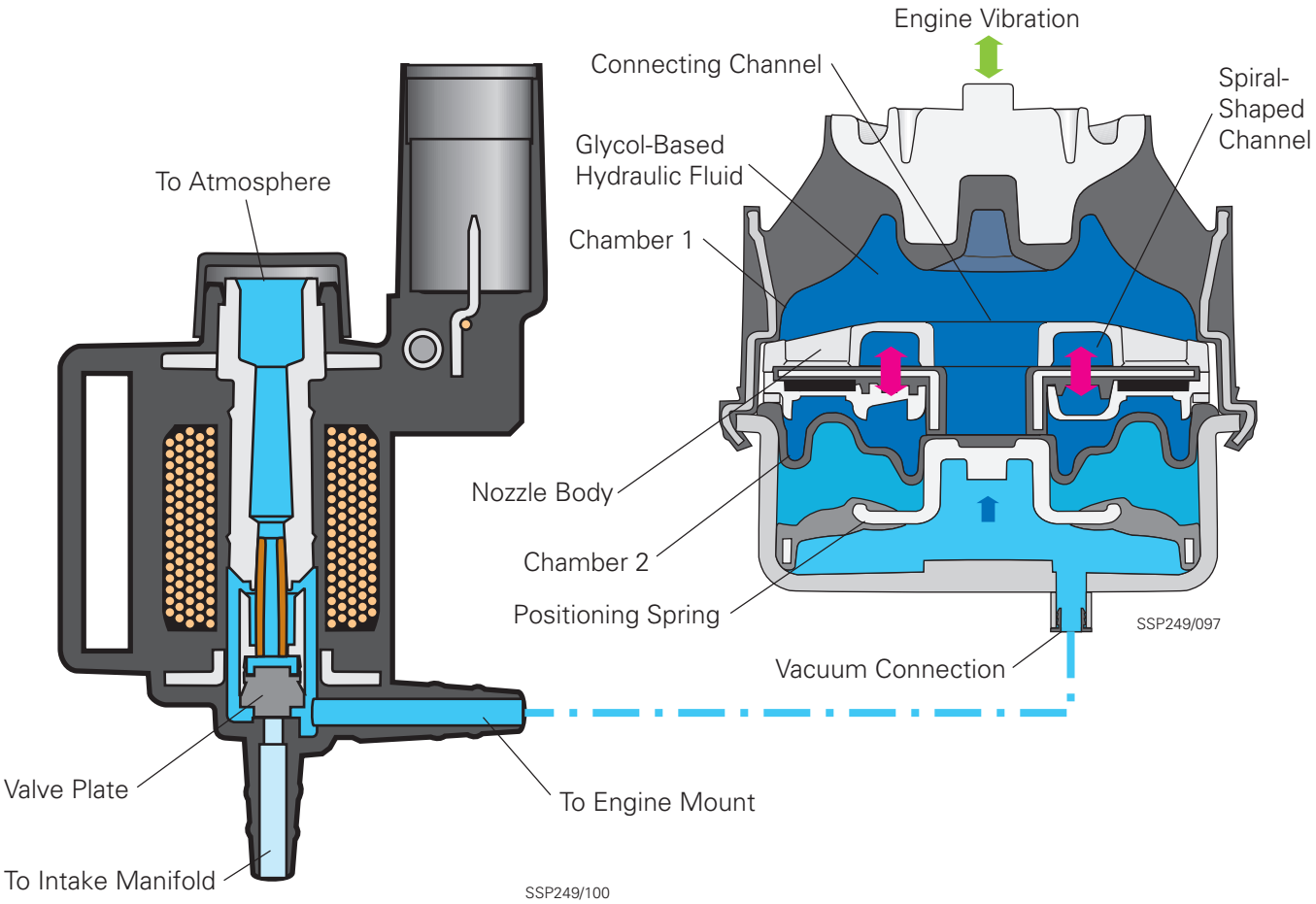


Engine mount operation – driving mode

At a speed of about 3.1 mph (5 km/h), the Motronic Engine Control Module J220 turns off voltage to the Electro-Hydraulic Engine Mount Solenoid Valve N144. Without voltage applied, the valve plate of the Electro-Hydraulic Engine Mount Solenoid Valve N144 closes the connection to intake manifold vacuum and opens the connection to atmospheric pressure which reaches the engine mount positioning spring and allows it to move upward.

With the engine mount positioning spring in this position, the large connecting channel between chambers 1 and 2 is closed. This restricts the exchange of hydraulic fluid between the two chambers to the spiral-shaped channel in the nozzle body and the engine mount damping state becomes relatively hard.

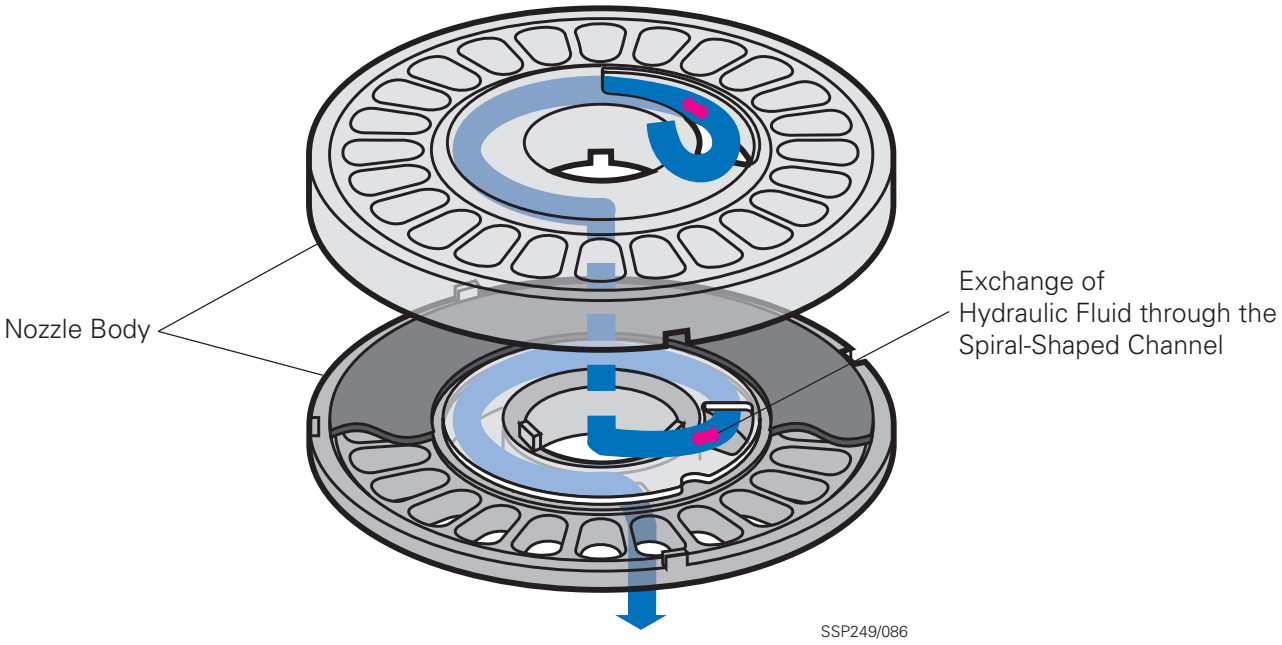
No Voltage Applied to Electro-Hydraulic Engine Mount Solenoid Valve N144 (Resting State)



The damping characteristics of the hydraulically damped engine mounts are adapted to the level of damping and resonance requirements for the W8 engine in the Passat by the length and diameter of the spiral-shaped channels. Damping forces within the engine mounts are in direct proportion to the intensity and frequency of the vibrations introduced by interaction of the vehicle with the road surface.

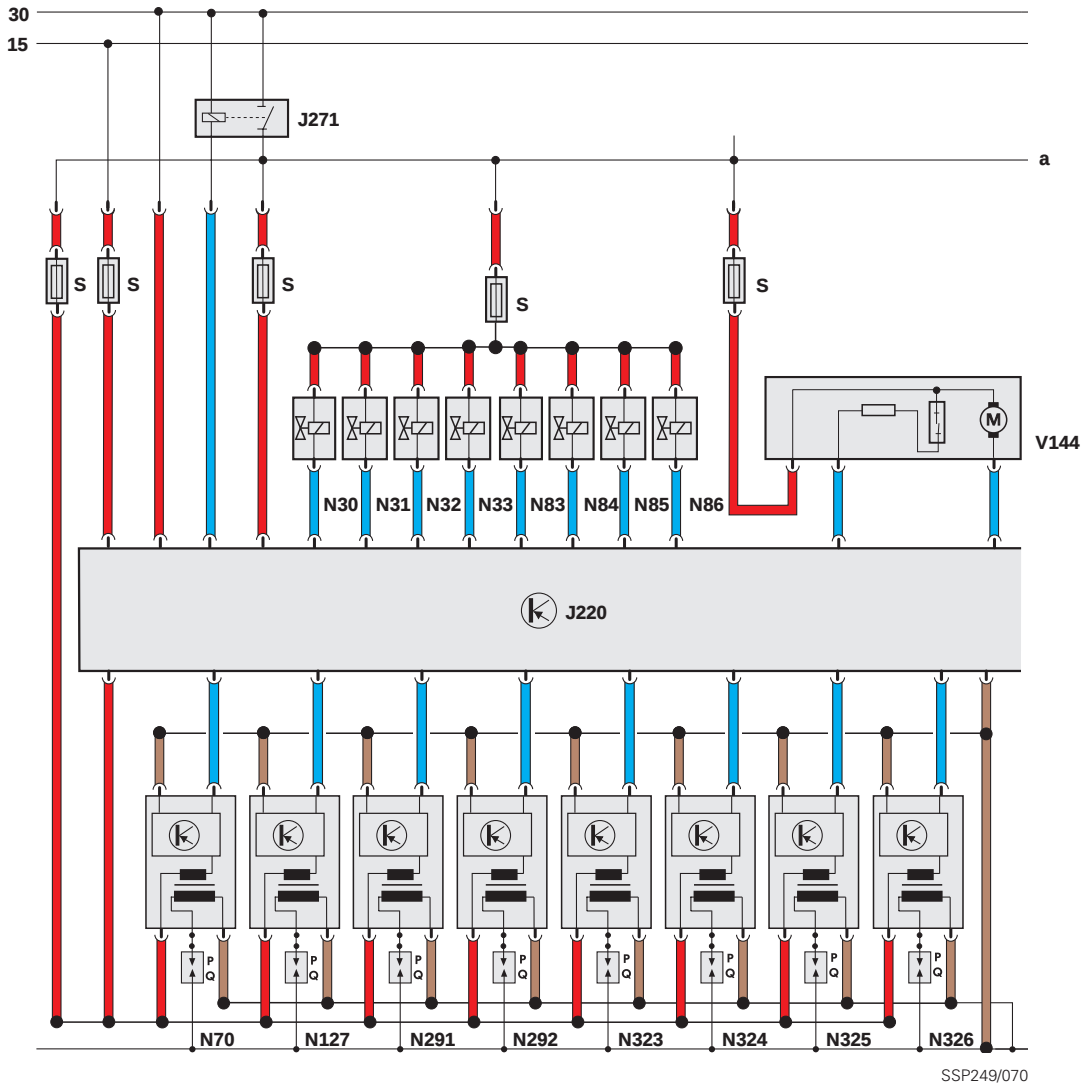
Effects of Failure

A fault in either the electrical circuit or the vacuum circuit will result in the engine mounts remaining in the driving mode. Damping at vehicle speeds below 3.1 mph (5 km/h) will remain relatively hard and the transfer of engine vibration to the body at idling speed will increase.



Functional Diagram

ME 7.1.1 Functional Diagram



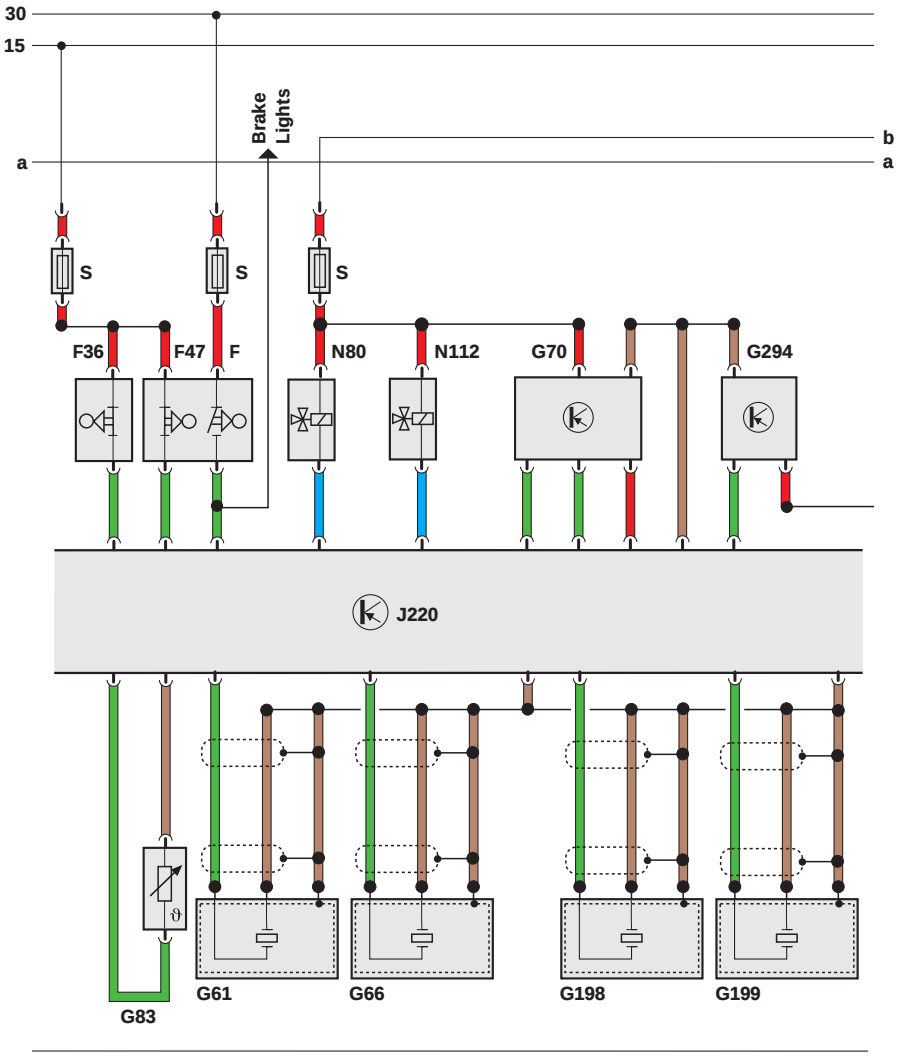
SSP249/070

J220 Motronic Engine Control Module
J271 Motronic Engine Control Module Power Supply Relay

N30 Cylinder 1 Fuel Injector
N31 Cylinder 2 Fuel Injector
N32 Cylinder 3 Fuel Injector
N33 Cylinder 4 Fuel Injector
N70 Ignition Coil 1 with Power Output Stage
N83 Cylinder 5 Fuel Injector
N84 Cylinder 6 Fuel Injector
N85 Cylinder 7 Fuel Injector
N86 Cylinder 8 Fuel Injector
N127 Ignition Coil 2 with Power Output Stage
N291 Ignition Coil 3 with Power Output Stage
N292 Ignition Coil 4 with Power Output Stage
N323 Ignition Coil 5 with Power Output Stage
N324 Ignition Coil 6 with Power Output Stage
N325 Ignition Coil 7 with Power Output Stage
N326 Ignition Coil 8 with Power Output Stage

P Spark Plug Connector
Q Spark Plug
S Fuse
V144 Leak Detection Pump

Functional Diagram



SSP249/071

F Brake Light Switch
F36 Clutch Vacuum Vent Valve Switch
F47 Vacuum Vent Valve, Brake

G61 Knock Sensor 1
G66 Knock Sensor 2
G70 Mass Air Flow (MAF) Sensor (combined with G42)
G83 Engine Coolant Temperature (ECT) Sensor (On Radiator)
G198 Knock Sensor 3
G199 Knock Sensor 4
G294 Brake Booster Pressure Sensor (Only with Automatic Transmissions)

J220 Motronic Engine Control Module

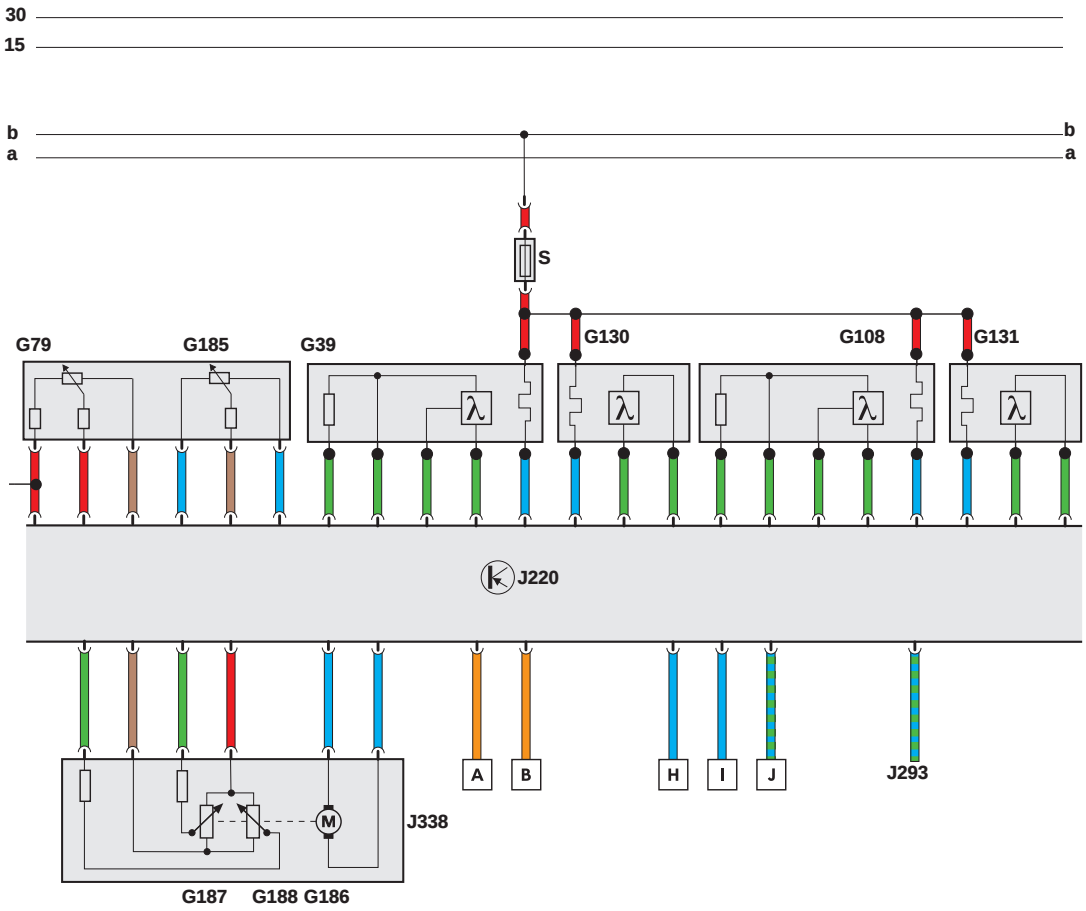
N80 Evaporative Emission (EVAP) Canister Purge Regulator Valve
N112 Secondary Air Injection Solenoid Valve

S Fuse

Color Coding

- Input Signal
- Output Signal
- Positive
- Ground
- CAN Data Bus

Functional Diagram



SSP249/072

G39 Heated Oxygen Sensor (HO2S)
G79 Throttle Position (TP) Sensor
G108 Heated Oxygen Sensor (HO2S) 2
G130 Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC)
G131 Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC)
G185 Sender -2- for Accelerator Pedal Position
G186 Throttle Drive (Power Accelerator Actuation)
G187 Angle Sensor -1- for Throttle Drive
G188 Angle Sensor -2- for Throttle Drive

J220 Motronic Engine Control Module
J293 Coolant Fan Control Module
J338 Throttle Valve Control Module

S Fuse

Color Coding

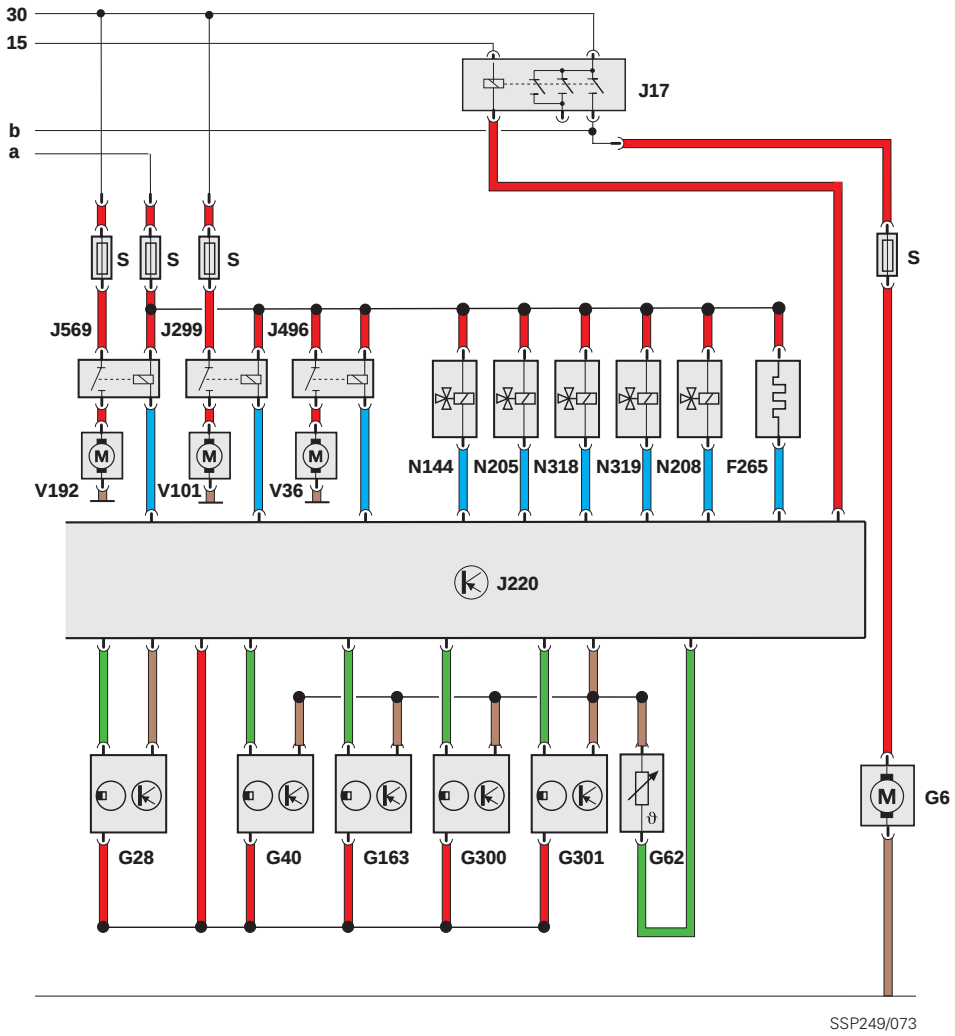
- Input Signal
- Output Signal
- Positive
- Ground
- CAN Data Bus

Auxiliary Signals

A CAN Data Bus Low
B CAN Data Bus High
H Coolant Fan Control
I Coolant Fan Control
J Diagnosis Wire

For detailed Cruise Control Wiring, please see the 2002 Passat Wiring Diagram No. 47.

Functional Diagram



F265 Map Controlled Engine Cooling Thermostat

G6 Fuel Pump
G28 Engine Speed (RPM) Sensor
G40 Camshaft Position (CMP) Sensor
G62 Engine Coolant Temperature (ECT) Sensor
G163 Camshaft Position (CMP) Sensor 2
G300 Camshaft Position (CMP) Sensor 3
G301 Camshaft Position (CMP) Sensor 4

J17 Fuel Pump Relay
J220 Motronic Engine Control Module
J299 Secondary Air Injection Pump Relay
J496 Auxiliary Engine Coolant (EC) Pump Relay
J569 Brake Booster Relay

N144 Left Electro-Hydraulic Engine Mount Solenoid Valve
N205 Valve 1 for Camshaft Adjustment
N208 Valve 2 for Camshaft Adjustment
N318 Camshaft Adjustment Valve 1 (Exhaust)
N319 Camshaft Adjustment Valve 2 (Exhaust)

S Fuse

V36 Coolant Pump
V101 Secondary Air Injection Pump Motor
V192 Brake System Vacuum Pump (Only with Automatic Transmissions)

Notes

Knowledge Assessment

An on-line Knowledge Assessment (exam) is available for this Self-Study Program.

This Knowledge Assessment may or may not be required for Certification. You can find this Knowledge Assessment under the Certification tab at:

www.vwwebsource.com

For assistance please call:

Certification Program Headquarters
1-877-CU4-CERT (1-877-284-2378)
(8:00 a.m. to 8:00 p.m. EST)

Or email: Comments@VWCertification.com