

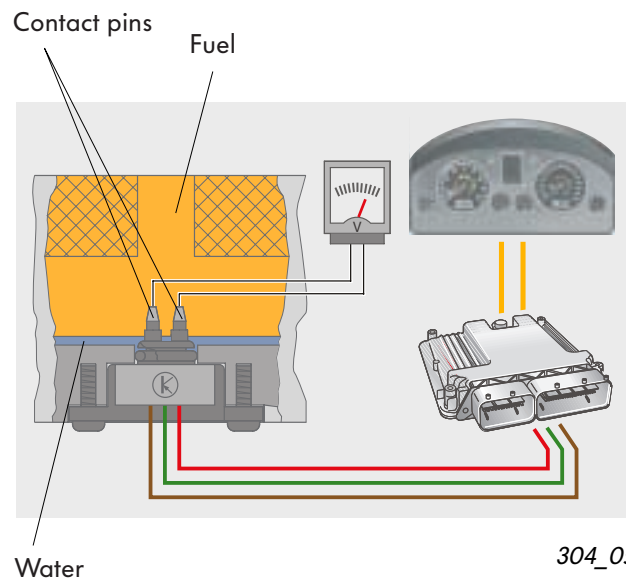
### This is how it works:

A constant voltage is applied to the fuel composition sender by the engine control unit.



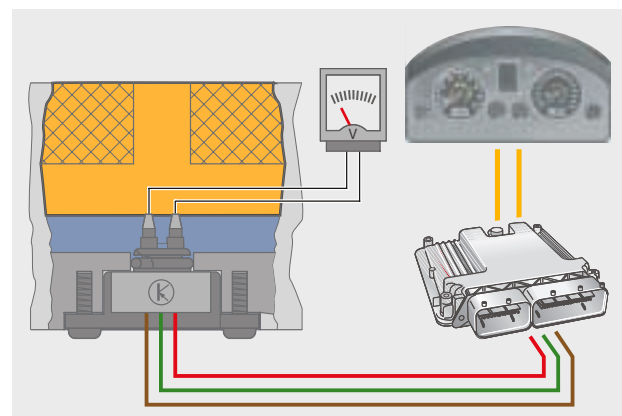
#### Water level OK

The contact pins are surrounded by diesel fuel. Because diesel fuel has a low level of conductivity, there is a high signal response. In this way, the engine control unit detects that the water level is OK and sends the information to the dash panel insert. The preglow warning lamp K29 does not light up.



#### Water level not OK

The contact pins are surrounded by water. Because water has a high level of conductivity, there is a low signal response. The engine control unit detects that the water level is too high and sends the information to the dash panel insert. The glow period warning lamp K29 will be actuated in the dash panel insert and it will flash. Flashing indicates a fault in the engine management system. The engine should be checked in a specialist workshop.



304\_055

#### Wiring colour key

 Positive	 Earth	 Input signal	 CAN drive train databus
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# Engine management

## Actuators

**Unit injector solenoid valves, cylinders 1 - 6**

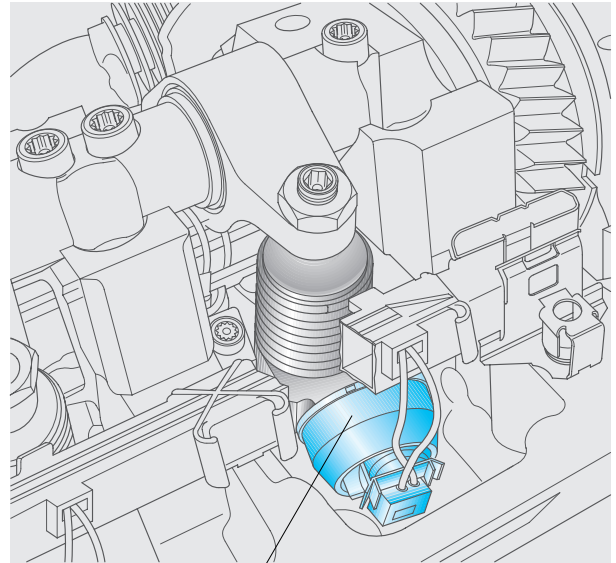
**N240 ... N244 and N245,**

**Unit injector solenoid valves, cylinders 7 - 10**  
**N303 ... 306**

The unit injector solenoid valves are secured to the unit injector bodies by union nuts. The solenoid valves are actuated by the engine control units. These control start of delivery and the amount of fuel injected.

As soon as a unit injector solenoid valve is actuated by the engine control unit, the valve needle is pushed onto its seat by the magnetic coil and this closes the path of fuel to the compression chamber of the unit injector. Thereafter, injection will start.

The amount of fuel injected is determined by the actuating period of the solenoid valve. As long as the unit injector solenoid valve is closed, fuel will be injected into the combustion chamber.



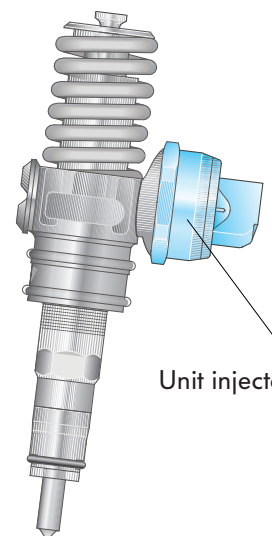
304\_022

Unit injector solenoid valve

## Effects of failure

If a unit injector solenoid valve should fail in its function, the engine will not run smoothly and performance will be impaired.

The unit injector solenoid valve has two safety functions. If the valve stays open, pressure cannot be built up in the unit injector. If the valve stays closed, the compression chamber of the unit injector can no longer be filled. In both cases, no fuel can be injected into the cylinder.



Unit injector solenoid valve

304\_032

### Turbocharger positioning motors V280 and V281 (V10-TDI-engine)

The turbocharger positioning motors are bolted to a bracket beneath the turbocharger. One control unit can be found in each positioning motor.

#### Task

The positioning motors are actuated by the respective engine control unit via a CAN databus. This improves regulation and fault diagnosis. The improvement is thanks to information about guide vane positioning and detected faults that the engine control units receive. The turbocharger guide vanes are actuated via a rod assembly.

#### Effects of failure

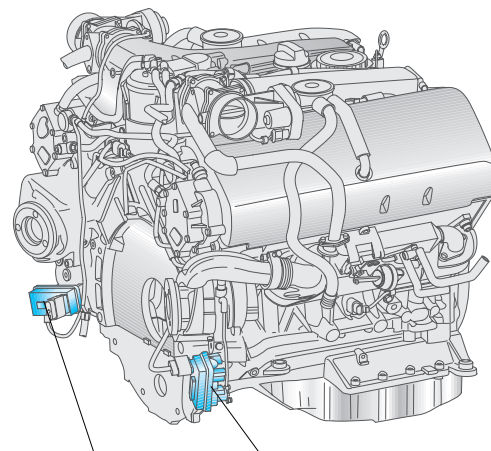
If the positioning motors fail in their function, charge pressure control is no longer possible. The amount of fuel injected is limited according to the engine speed and engine performance will be impaired.

### Charge pressure limitation solenoid valve N75 (R5-TDI-engine)

The charge pressure limitation solenoid valve can be found beneath the variable turbocharger.

#### Task

The charge pressure limitation solenoid valve is actuated by the engine control unit. Vacuum is built up in the vacuum unit for guide vane adjustment depending on the duty cycle.



304\_010

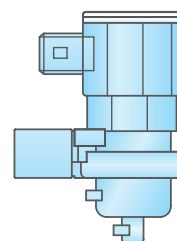
Turbocharger 2  
positioning motor V281

Turbocharger 1  
positioning motor V280



The turbocharger positioning motor is designed specifically for use with the turbocharger. For this reason, both parts should be only be removed or replaced together.

It is critical that reference be made to the workshop manual.



304\_078

#### Effects of failure

The vacuum unit is filled with atmospheric pressure. Charge pressure is lower as a result and engine performance is impaired.



# Engine management

## Exhaust gas recirculation solenoid valves N18 and N213

The solenoid valves for exhaust gas recirculation can be found on the suspension strut domes on each side. The valves are electro-pneumatic.

### Task

The valves are actuated with a duty cycle by the engine control unit depending on the map. In this way, the control pressure for the recirculation valve can be set. The cross section of the exhaust manifold is changed in the exhaust gas recirculation valve depending on the control pressure and the amount of recirculated exhaust gas set.

### Effects of failure

If the signal fails, exhaust gas recirculation may no longer be possible.

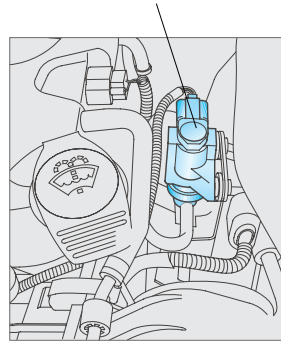
## Intake manifold flap motors V157 and V275

The V10-TDI-engine has two electrically adjustable intake manifold flaps and there is one electric motor for each flap. These can be found directly in front of the respective exhaust gas recirculation valve.

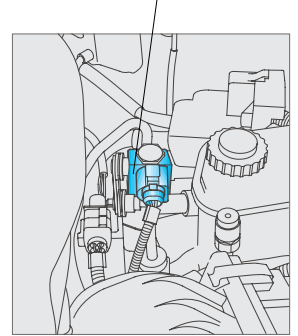
### Task

- With the electrically adjustable intake manifold flaps, differences between air intake pressure and exhaust gas pressure are generated in certain operating conditions. Effective exhaust gas recirculation is guaranteed thanks to the differences in pressure.
- When the engine is switched off, the flap is closed and the flow of air interrupted. In this way, less air is drawn in and compressed which helps smooth run-down of the engine.

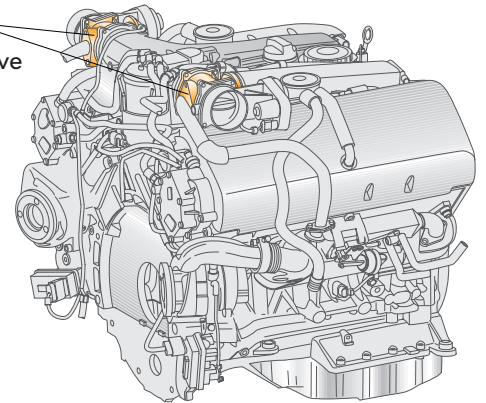
Exhaust gas  
recirculation valve 2 N213



Exhaust gas  
recirculation valve N18



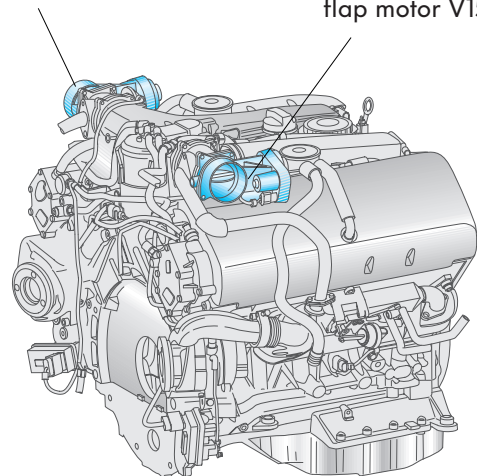
Exhaust gas  
recirculation valve



304\_012

Intake manifold  
flap motor 2 V275

Intake manifold  
flap motor V157



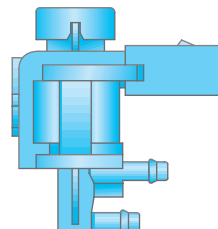
304\_011

### Effects of failure

In case of failure, effective exhaust gas recirculation is no longer possible.

### **Intake manifold flap changeover valve N239 (R5-TDI-engine)**

The intake manifold flap changeover valve can be found on the right-hand suspension strut dome.



304\_048



#### **Task**

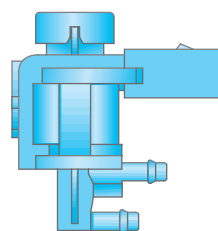
When the engine is switched off, the intake manifold flap changeover valve is actuated by the engine control unit. Following this, the intake manifold flap is closed and the flow of air interrupted. In this way, less air is drawn in and compressed and the engine will run down smoothly as a result.

#### **Effects of failure**

If the changeover valve fails in its function, the intake manifold flap will stay in the open position. If this happens, strong jolts will be noticeable when the engine is switched off.

### **EGR cooler changeover valves N345 and N381 (Phaeton only)**

The exhaust gas recirculation cooler changeover valves can be found in the vicinity of the exhaust gas recirculation cooler.



304\_048

#### **Task**

The changeover valve is actuated by the engine control unit depending on the temperature. It clears the path from the vacuum pump to the membrane valve, the exhaust gas cooling flap is actuated and the path through the cooler is cleared.

#### **Effects of failure**

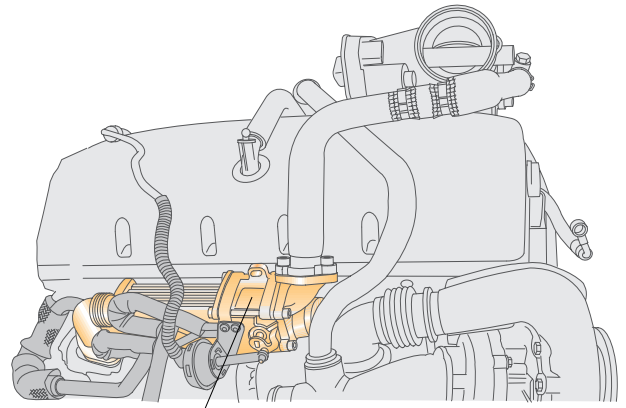
If the changeover valve fails in its function, the exhaust gas cooling flap will stay in the closed position and the exhaust gas will no longer be cooled. This can lead to an increase in nitrogen oxide emissions.

# Engine management

## Exhaust gas recirculation cooler (Phaeton only)

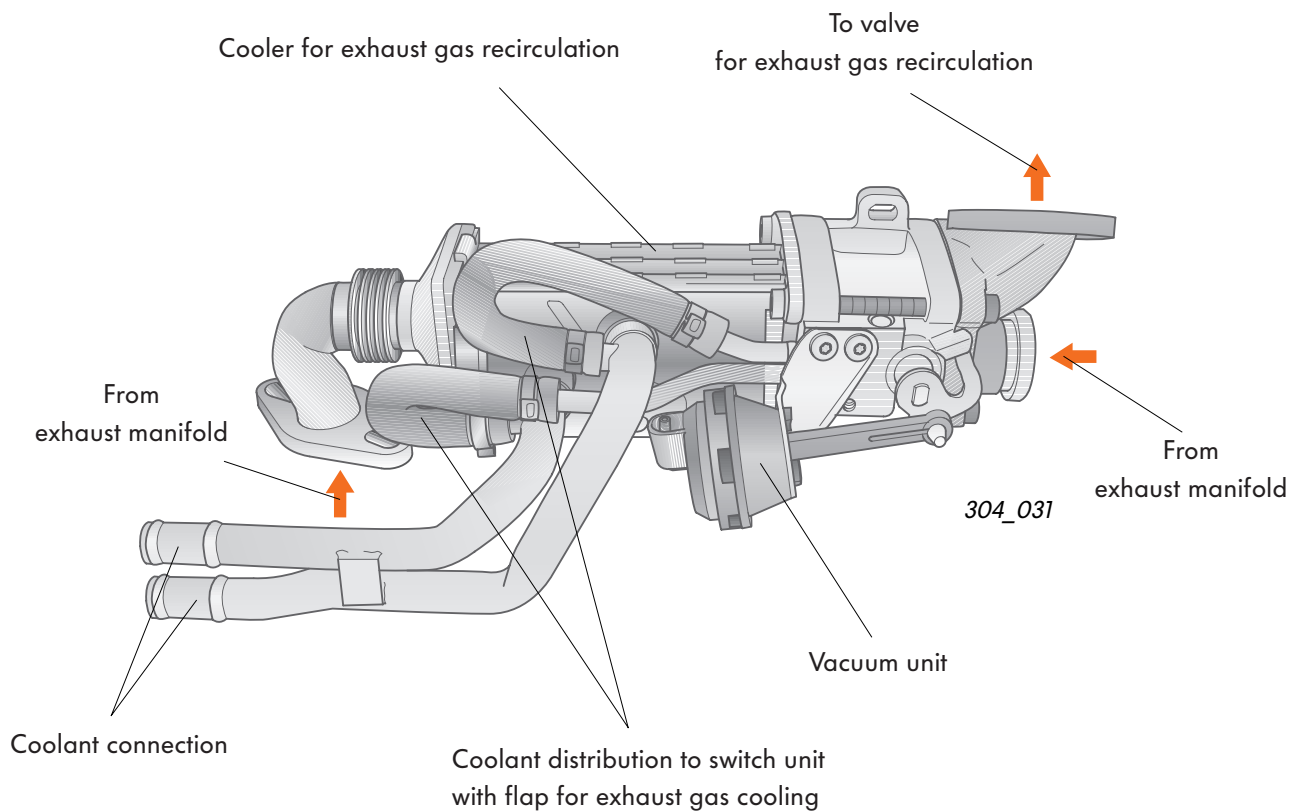
The V10-TDI-engine in the Phaeton is equipped with independent coolers for the exhaust gas recirculation system.

The pneumatically controlled flaps for exhaust gas cooling allow activation of the cooler from a coolant temperature of 50 °C.

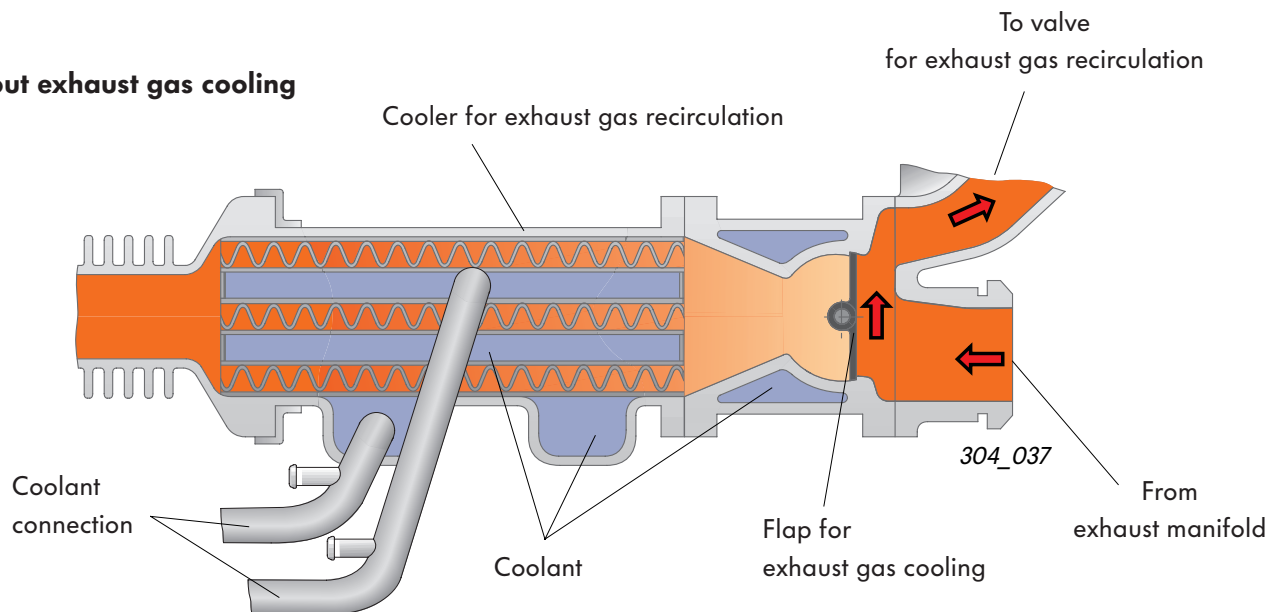


Cooler for exhaust gas recirculation

304\_014

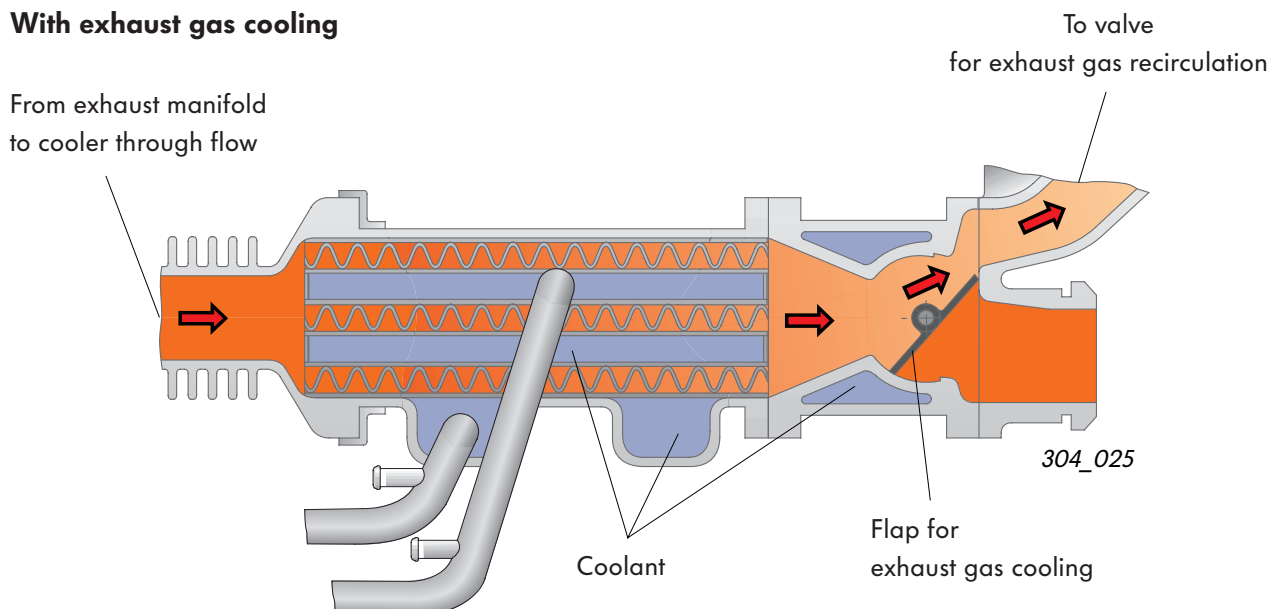


### Without exhaust gas cooling



The engine and the catalyst are cold. The exhaust gas cooling flap is closed. The exhaust gases are directed past the cooler and are therefore not cooled. In this way, the engine will reach its effective operating temperature quickly.

### With exhaust gas cooling



The engine and the catalyst have reached effective operating temperature. The exhaust gas cooling flap is open. The exhaust gas is directed through the cooler and is therefore cooled. The combustion temperature is reduced due to the cooled exhaust gases and a greater amount of exhaust gas can be recirculated. In this way, fewer nitrogen oxides are produced and carbon build-up is avoided.



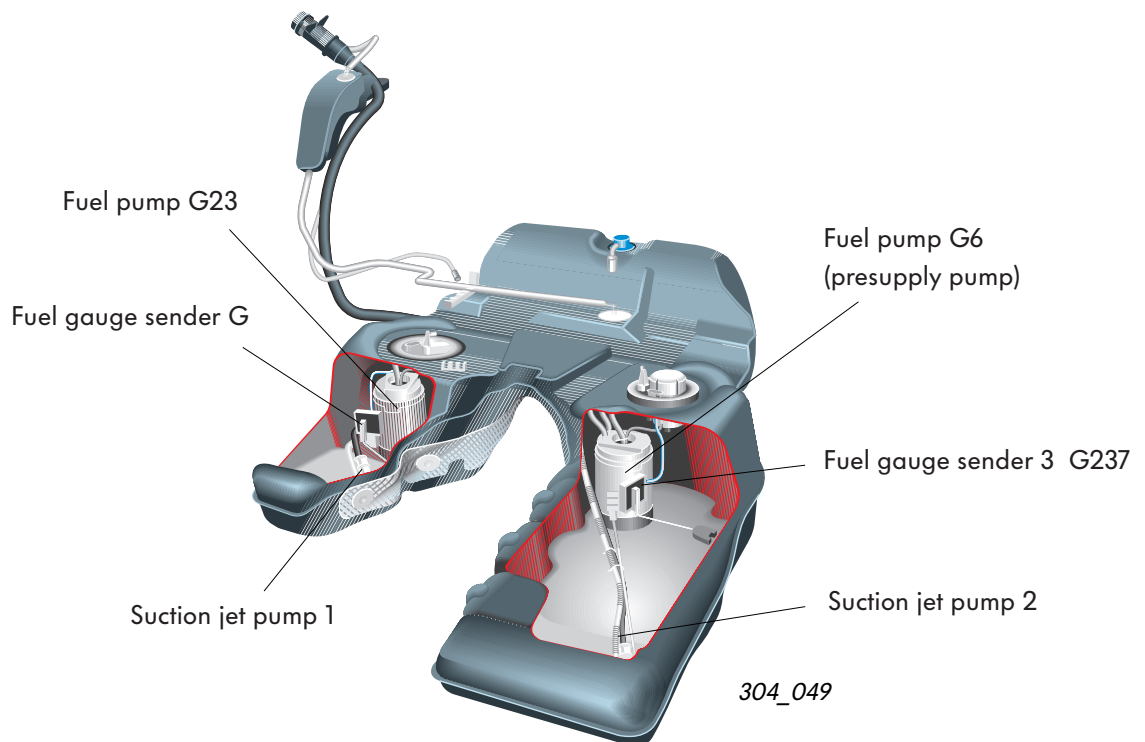
# Engine management

## Fuel pumps G6 and G23

Both electrical fuel pumps are installed in the fuel tank.

- Fuel pump G23 with fuel gauge sender G and a suction jet pump can be found in the main chamber of the fuel tank.
- Fuel pump G6 with fuel gauge sender 3 G237 and a suction jet pump can be found in the secondary chamber of the fuel tank.

Actuation of both electrical fuel pumps is done in parallel sequence via the fuel pump relay J17.



Suction jet pump 1 draws fuel from the main chamber into the presupply reservoir of fuel pump G6 and suction jet pump 2 pumps out the secondary chamber into the presupply reservoir of fuel pump G23. Both suction jet pumps are driven by the electrical fuel pumps.

## Effects of failure

If one pump fails, engine performance will be impaired due to a restriction in the amount of fuel supplied.

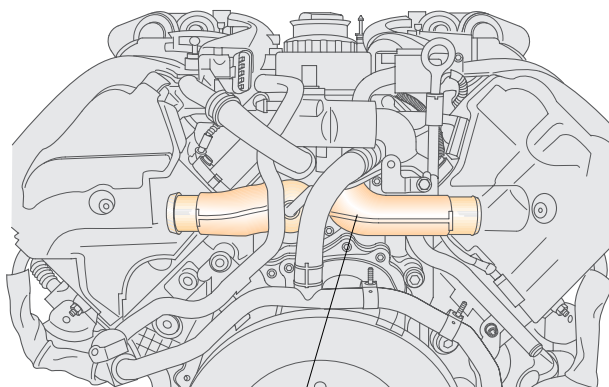
The maximum speed is unattainable and the engine will not run smoothly at high revs.



## Thermostat for map-controlled engine cooling F265

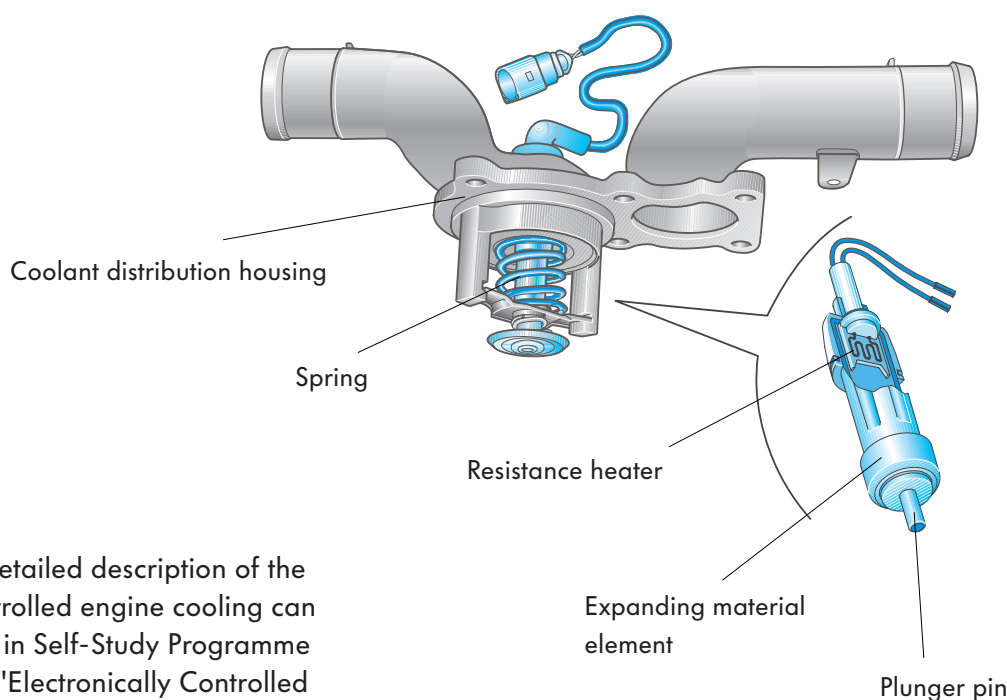
The thermostat for map-controlled engine cooling can be found in the coolant distribution housing. It has the task of switching between the large and small coolant circuits. To do this, it is actuated by the engine control unit according to the engine operating conditions. Maps are stored in the engine control unit which contain temperature specifications depending on the engine load.

Map-controlled engine cooling has the advantage that the coolant temperature can be adapted to the current operating conditions of the engine. This helps to reduce fuel consumption in the part-throttle range and also exhaust gas emissions.



304\_016

Coolant distribution housing



304\_029



A more detailed description of the map-controlled engine cooling can be found in Self-Study Programme No. 222 "Electronically Controlled Cooling System".

# Engine management

## Additional coolant pump relay J496, Continued coolant circulation pump V51



The continued coolant circulation pump can be found on cylinder bank 1 on the vibration damper side.

Due to the high working current, the pump is actuated via a relay.

The additional coolant pump relay is installed in the electronics box which can be found in the plenum chamber.

### Task

When the engine is switched off, the continued coolant circulation pump will remain activate for a maximum of 10 minutes. In this way, controlled cooling of the engine is achieved.

### Effects of failure

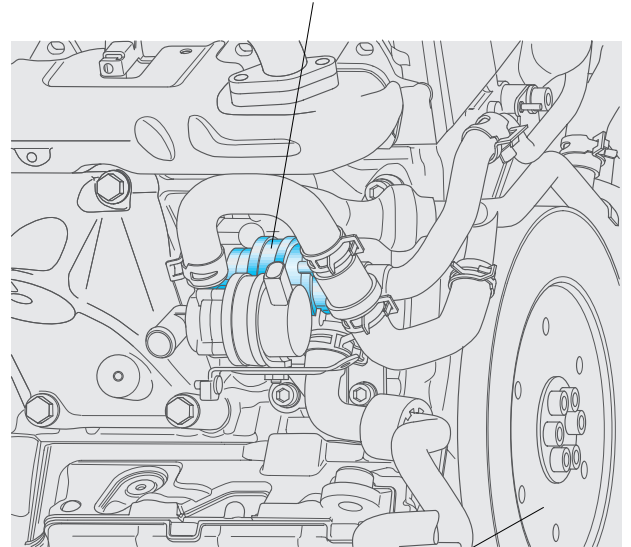
If the relay or the continued coolant circulation pump fail, continued coolant circulation is no longer possible. If the relay is defective, a fault will be stored. A defective pump cannot be detected.

### Electrical actuation

The engine control unit actuates the continued coolant circulation pump via the additional coolant pump relay.

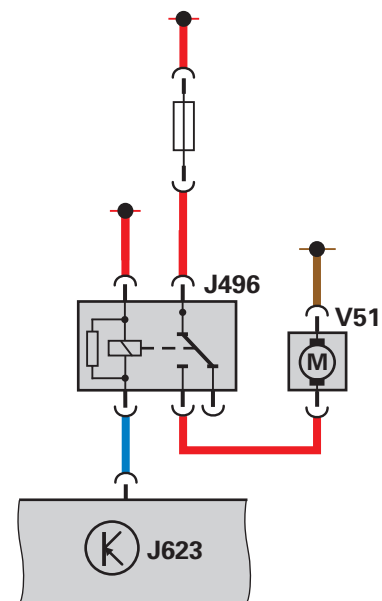
J623	Engine control unit 1
J496	Additional coolant pump relay
V51	Continued coolant circulation pump

Continued coolant circulation pump V51



304\_027

Vibration damper



304\_067

## Fuel cooling pump relay J445 and fuel cooling pump V166 (Touareg)

The fuel cooling pump can be found on cylinder bank 1 on the vibration damper side.

The pump is actuated via a relay due to the high working current.

The relay for the fuel cooling pump is installed in the electronics box which can be found in the plenum chamber.

### Task

The engine control unit actuates the fuel cooling pump relay at and above a fuel temperature of approximately 70 °C. The engine control unit sends a working current to the fuel cooling pump and the fuel cooler is then surrounded by coolant. Fuel temperature will drop.

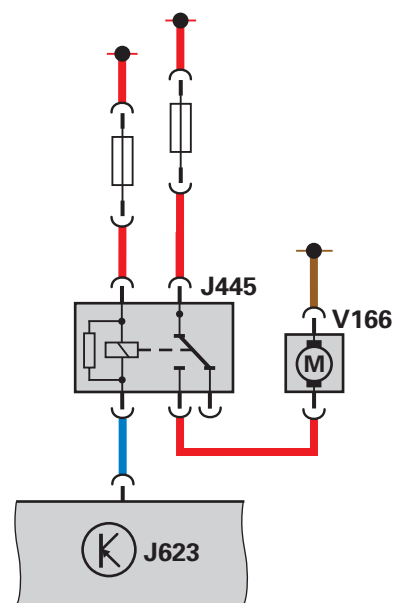
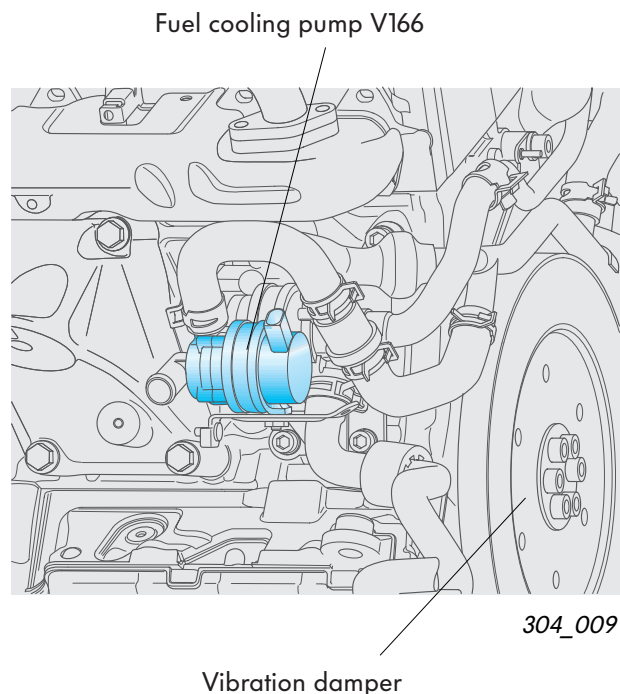
### Effects of failure

If the fuel cooling relay or fuel cooling pump fail, fuel will no longer be cooled. The fuel tank and the fuel gauge sender could become damaged. A defective relay is stored as a fault. A defective pump cannot be detected.

### Electrical actuation

The fuel cooling pump is actuated via fuel cooling pump relay J445 by engine control unit 1 J623.

J623	Engine control unit 1
J445	Fuel cooling pump relay
V166	Fuel cooling pump



304\_068



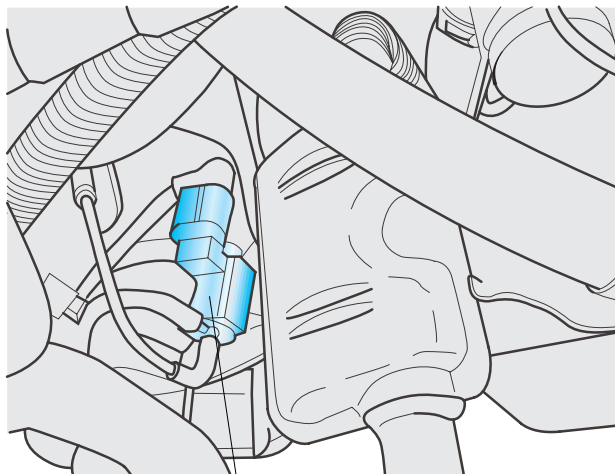
# Engine management

## Right solenoid valve for electro-hydraulic engine mounting N145 (Phaeton)



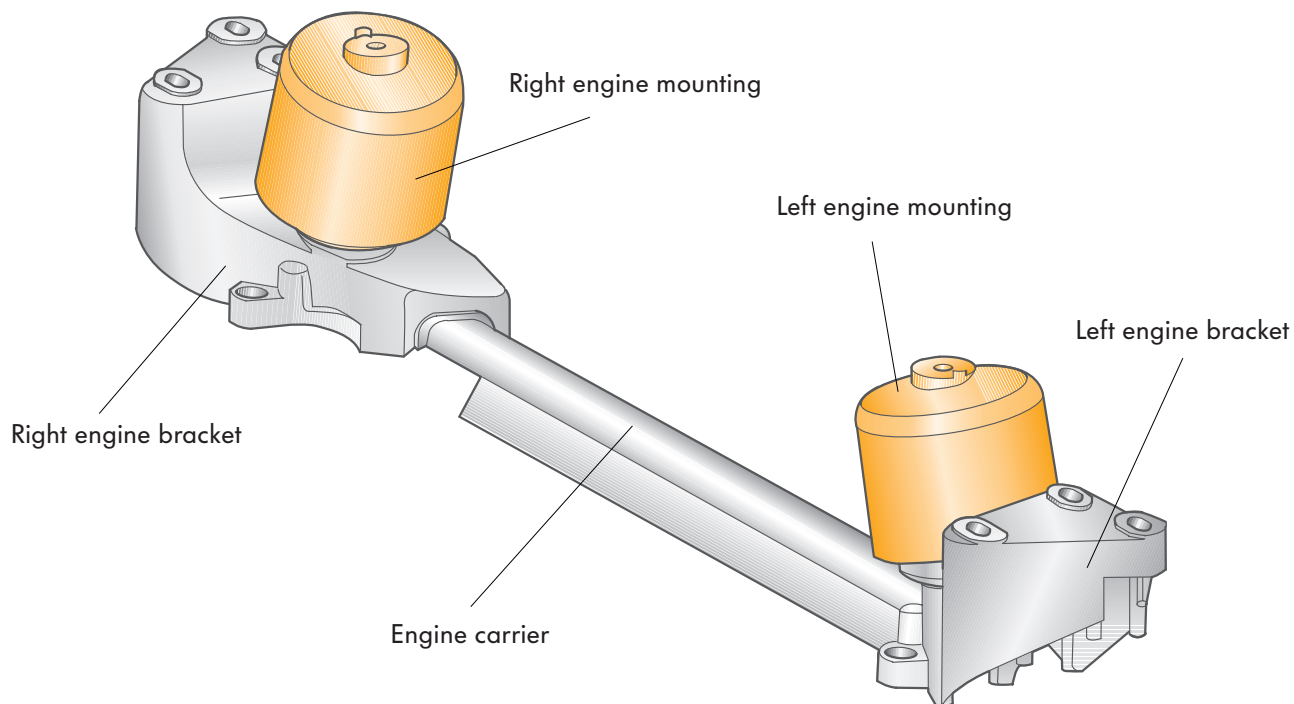
The V10-TDI-engine in the Phaeton features hydraulically dampening engine mountings.

These engine mountings reduce the transmission of engine vibration to the body and in doing so provide a high level of driving comfort.



304\_041

Right solenoid valve for electro-hydraulic engine mounting N145

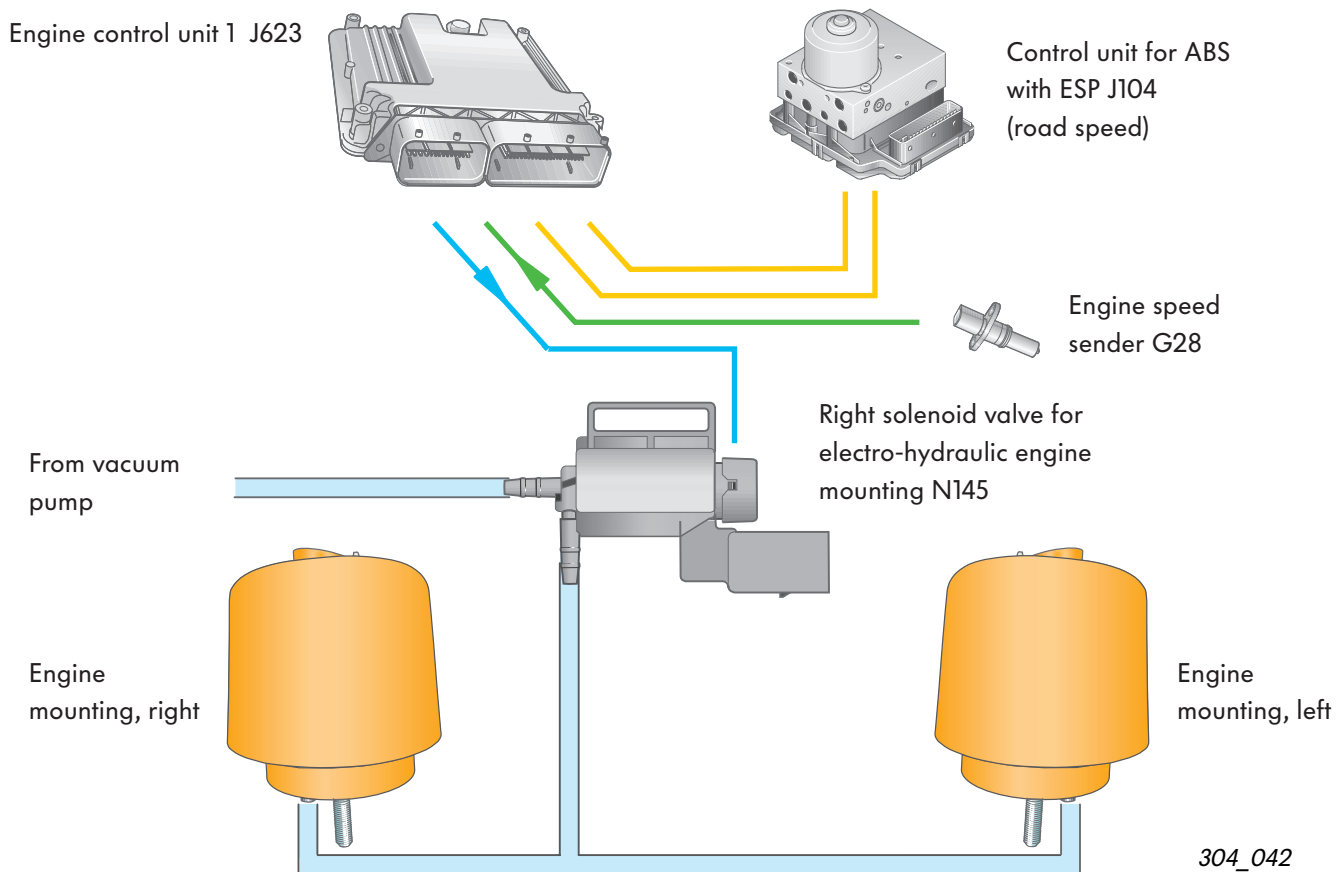


304\_040

### This is how it works:

The hydraulically dampening engine mountings are actuated pneumatically via solenoid valve N145. The engine mountings reduce vibrations that are transmitted to the body by the engine across the entire throttle range.

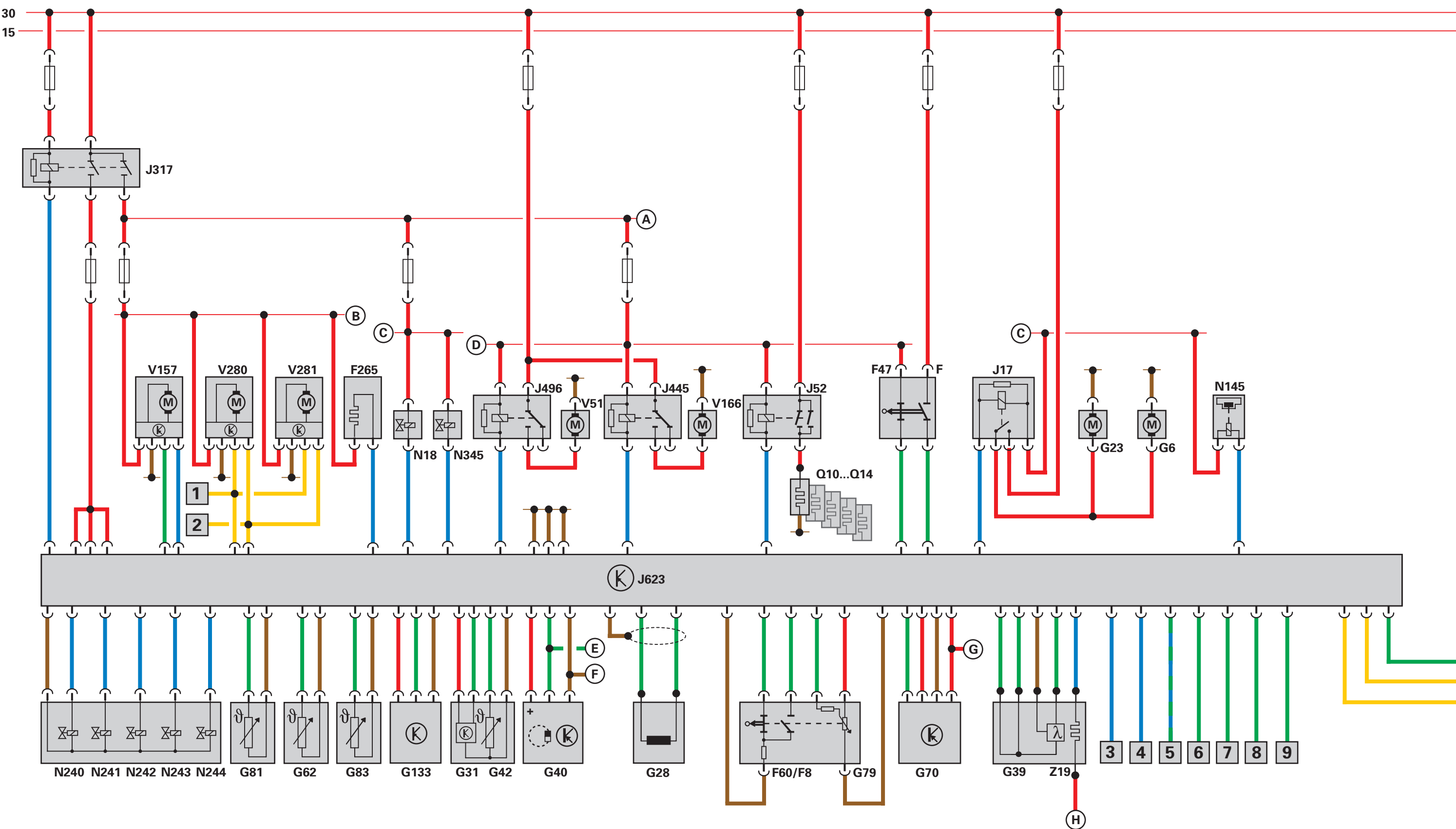
The road speed and engine speed are used as input signals.

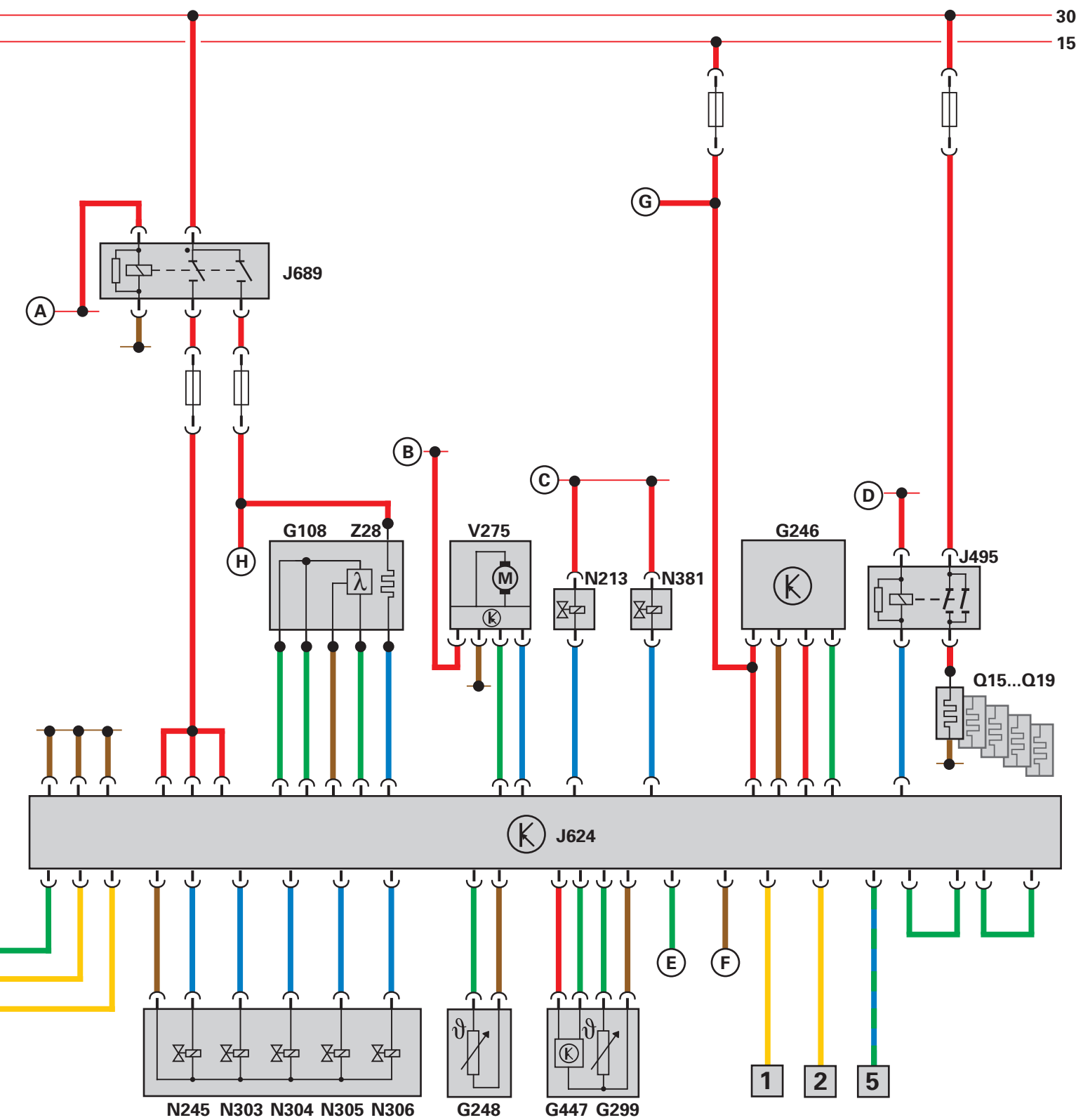


More detailed information about the function of the engine mountings can be found in Self-Study Programme No. 249 "Management of the W8 Engine in the Passat".

# Engine management

Functional diagram for V10-TDI-engine





## Key

F	Brake light switch
F8	Kick-down switch
F47	Brake pedal switch
F60	Idle switch
F265	Thermostat for map-controlled engine cooling
G6	Fuel pump (presupply pump)
G23	Fuel pump
G28	Engine speed sender
G31	Charge pressure sender
G39	Lambda probe
G40	Hall sender
G42	Intake air temperature sender
G62	Coolant temperature sender
G70	Air mass meter
G79	Accelerator pedal position sender
G81	Fuel temperature sender
G83	Coolant temperature sender radiator outlet
G108	Lambda probe 2
G133	Fuel composition sender
G246	Air mass meter 2
G248	Fuel temperature sender 2
G299	Intake air temperature sender 2
G447	Charge pressure sender 2
J17	Fuel pump relay
J52	Glow plug relay
J317	Voltage supply relay - term. 30
J445	Fuel cooling pump relay
J495	Glow plug relay 2
J496	Additional coolant pump relay
J623	Engine control unit 1
J624	Engine control unit 2
J689	Voltage supply relay 2 term. 30
N18	Exhaust gas recirculation valve
N145	Electro-hydraulic engine mounting solenoid valve
N213	Exhaust gas recirculation valve 2
N240	Unit injector solenoid valves
... N245	
N303	
... N306	
N345	EGR cooler changeover valve
N381	EGR cooler changeover valve 2

Q10	Glow plugs
... Q19	
V51	Continued coolant circulation pump
V157	Intake manifold flap motor
V166	Fuel cooling pump
V275	Intake manifold flap motor 2
V280	Turbocharger 1 positioning motor
V281	Turbocharger 2 positioning motor
Z19	Lambda probe heating
Z28	Lambda probe heating 2

## Additional signal

1	CAN drive train databus (high)
2	CAN drive train databus (low)
3	Radiator fan output stage 1
4	Radiator fan output stage 2
5	Coms lead (diagnosis connection)
6	Cruise control system switch (ON/OFF)
7	Road speed signal
8	Alternator terminal DFM
9	Starter relay J...

A	
B	
C	
D	
E	
F	
G	
H	

Connections within functional diagram



## Self-diagnosis

### Diagnosis

On vehicle diagnosis, testing and information systems VAS 5051 and VAS 5052:

- Guided fault finding\* and
- Vehicle self-diagnosis

can be selected.

### Operating mode "Guided fault finding"

checks all vehicle-specific control units for stored faults and automatically compiles an individual testing plan based on the results.

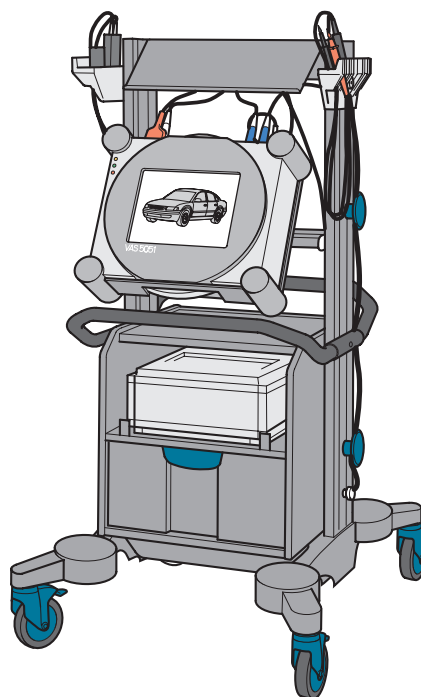
This plan is carried out in conjunction with ELSA information, such as current flow diagrams or workshop manuals, selected to aid fault finding.

In addition to this, you can also compile your own testing plan. The tests you choose from the selection of functions and components will be added to the testing plan and can be carried out as a diagnostic sequence in any order.

### Operating mode "Vehicle Self-Diagnosis"

can be used in the same way as normal but no additional information is available from ELSA.

\* Not with vehicle diagnosis and service information system VAS 5052



304\_051

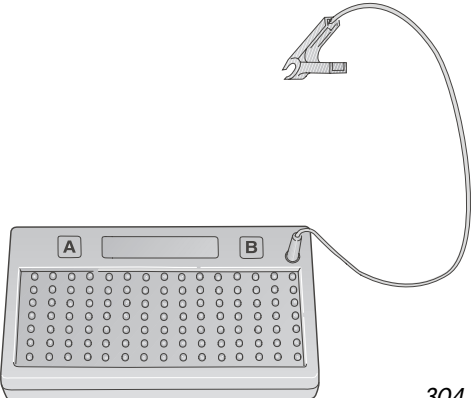
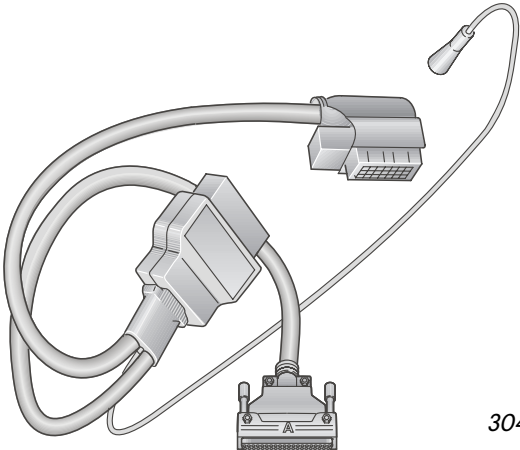
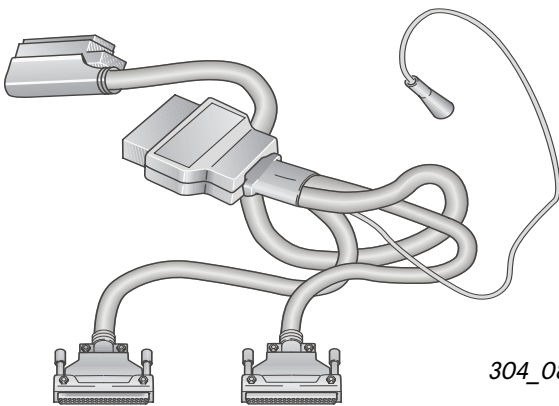


304\_052



More detailed information about guided fault finding can be found in chapter 7 of the VAS 5051 operating handbook.

## Workshop Equipment

Designation	Tool
Test box V.A.G 1598/42	 <p>304_083</p>
Adapter lead V.A.G 1598/39-1	 <p>304_084</p>
Adapter lead V.A.G 1598/39-2	 <p>304_085</p>



# Test your knowledge

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## Which answers are correct?

One or more answers could be correct.

### 1. Which special features does Bosch EDC 16 have?

- ☐ a) It is designed for both single control unit and double control unit concepts.
- ☐ b) It was designed exclusively for the V10-TDI-engine.
- ☐ c) It has torque-orientated engine management.

### 2. Which statements about the V10-TDI-engine are correct?

- ☐ a) The basic functions for cylinder bank 1 are carried out by engine control unit 1 and the basic functions for cylinder bank 2 by engine control unit 2.
- ☐ b) Information that is received by engine control unit 1 is sent to engine control unit 2 via an internal CAN databus.
- ☐ c) Engine control unit 1 is responsible for injection and exhaust gas recirculation and engine control unit 2 is responsible for the remaining functions.

### 3. On the V10-TDI-engine, how are the engine control units allocated to the cylinder banks?

- ☐ a) The engine control units have different part numbers.
- ☐ b) The engine control units are coded using VAS 5051.
- ☐ c) In the connector for engine control unit 2 J624 there is an additional coding link which facilitates allocation.



**4. On the V10-TDI-engine, Lambda probes calculate the remaining oxygen content in the exhaust gas. In this way, ...**

- ☐ a) the amount of fuel injected is adapted.
- ☐ b) the amount of nitrogen oxide in the exhaust gas is calculated.
- ☐ c) the amount of recirculated exhaust gas is corrected.

**5. Why is an independent cooler for exhaust gas recirculation used on the V10-TDI-engine in the Phaeton?**

- ☐ a) To prevent excessive warm-up periods of the engine caused by cooled exhaust gases.
- ☐ b) So that the coolant does not get too hot.
- ☐ c) To prevent increased carbon dioxide and carbon monoxide emissions during warm-up.

**6. What are the advantages of turbocharger positioning motor actuation via the CAN drive train databus?**

- ☐ a) More precise regulation is made possible as the position of the guide vanes is detected.
- ☐ b) More precise fault diagnosis is made possible as detected faults are sent to the engine control units.
- ☐ c) It is cheaper.



# Test your knowledge

---

## 7. Which statements about the fuel cooling pump are correct?

- ☐ a) The fuel cooling pump operates continually while the engine is running.
- ☐ b) The fuel cooling pump can be found in the Touareg on the V10-TDI-and R5-TDI-engines.
- ☐ c) The fuel cooling pump is actuated when the fuel temperature is approximately 70 °C.

## 8. The engine speed sender G28 on the V10-TDI-engine ...

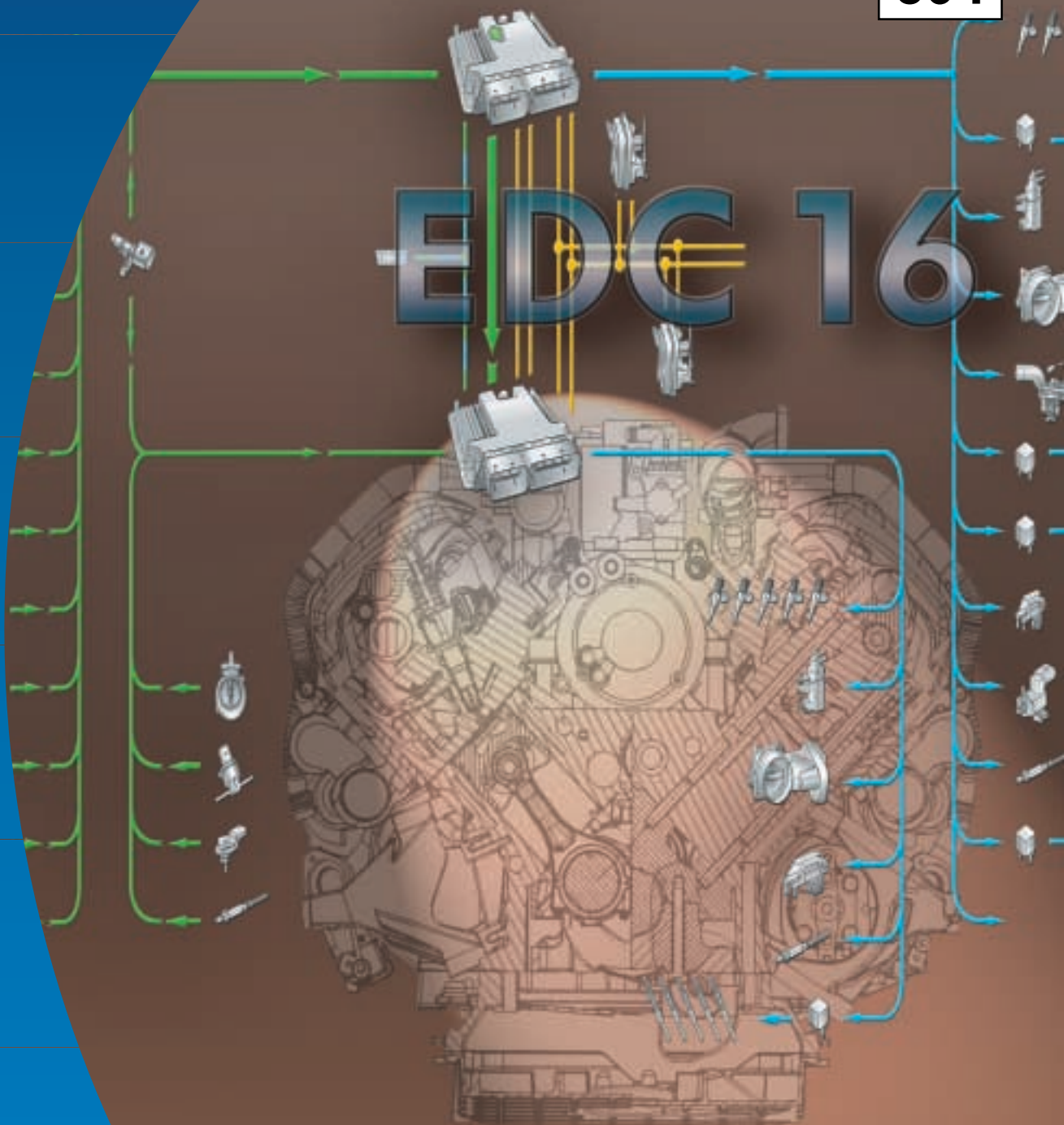
- ☐ a) sends its signals directly to both engine control units.
- ☐ b) sends its signals to engine control unit 1 J623 and these are then passed on to engine control unit 2 J624 via an internal CAN databus.
- ☐ c) sends its signals to engine control unit 1 J623 and these are then passed on to engine control unit 2 J624 via a separate cable.



1. a, c; 2. a, b; 3. c; 4. c; 5. a, c; 6. a, b; 7. b, c; 8. c

Answers





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000.2811.24.20 Technical status: 11/02

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