

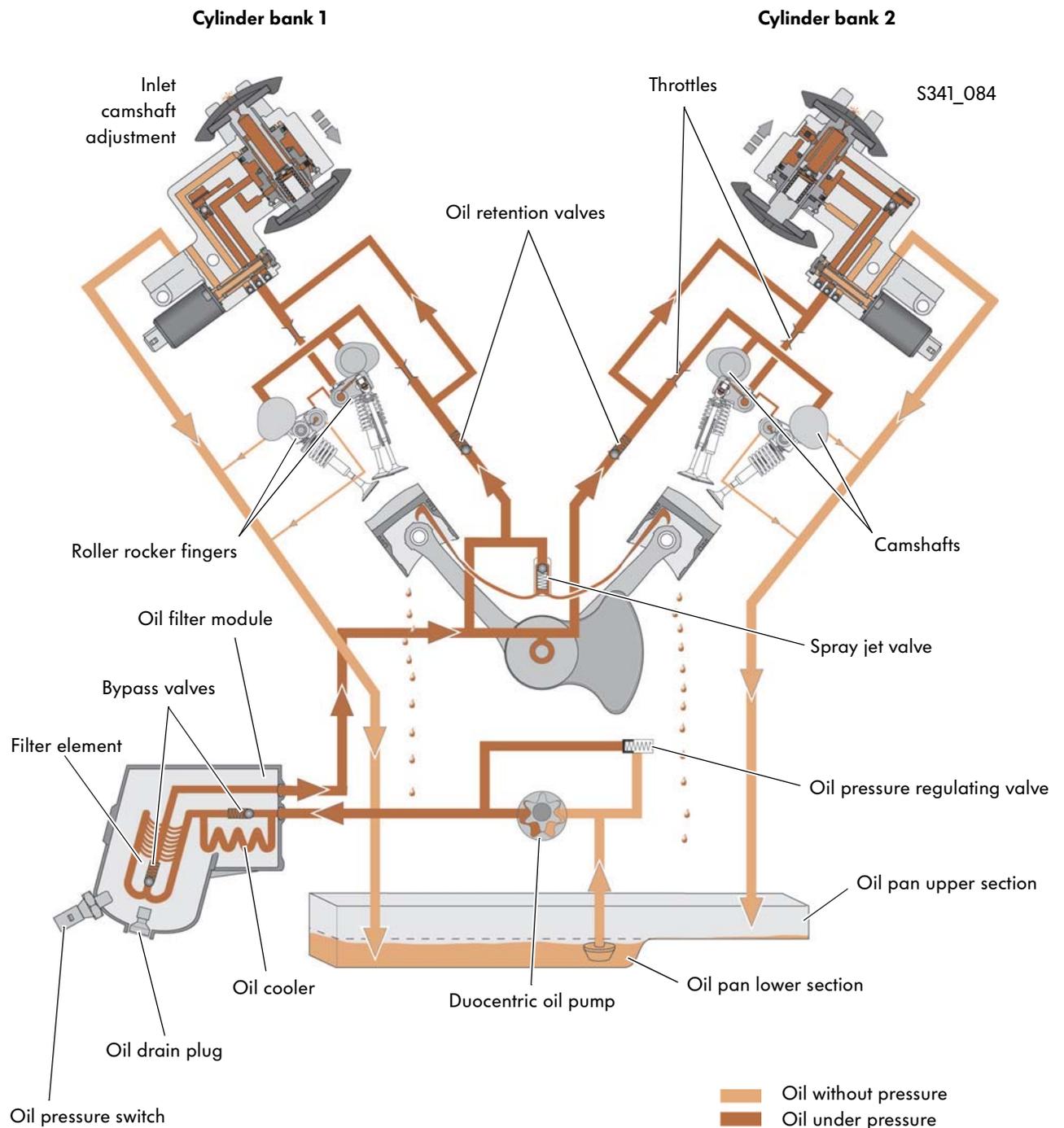


# Engine mechanical system

## Oil circuit

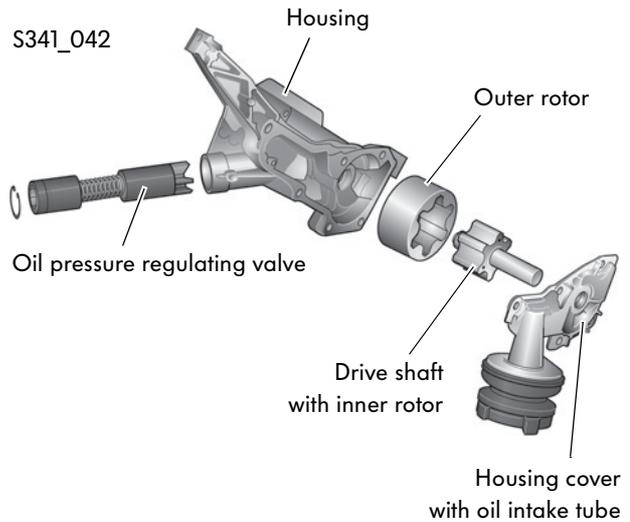
The oil circuit fitted in the 4.2l V8 5V engine in the Phaeton and the Touareg is primarily identical. However, the oil intake system differs due to the Touareg's off-road capability. The particulars of, and differences between, the oil circuits will be presented over the next few pages.

The Figure shows the oil circuit fitted in the 4.2l V8 5V engine in the Phaeton.



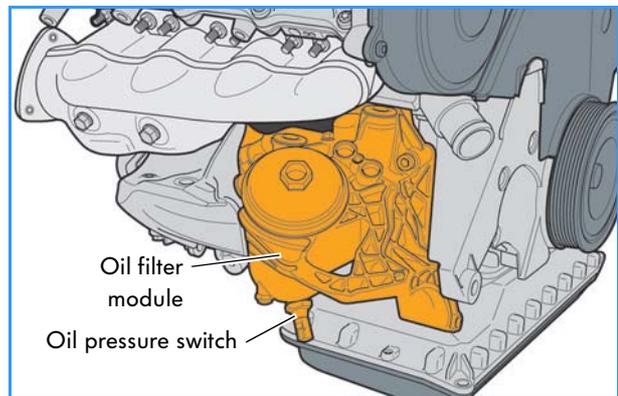
## Duocentric oil pump

The duocentric oil pump is bolted to the cylinder block and is driven by the crankshaft via a chain drive. The oil pressure regulating valve is integrated into the oil pump and regulates the engine's oil pressure.

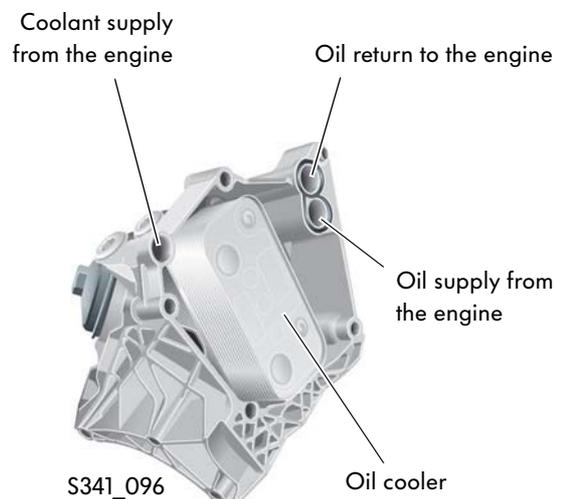
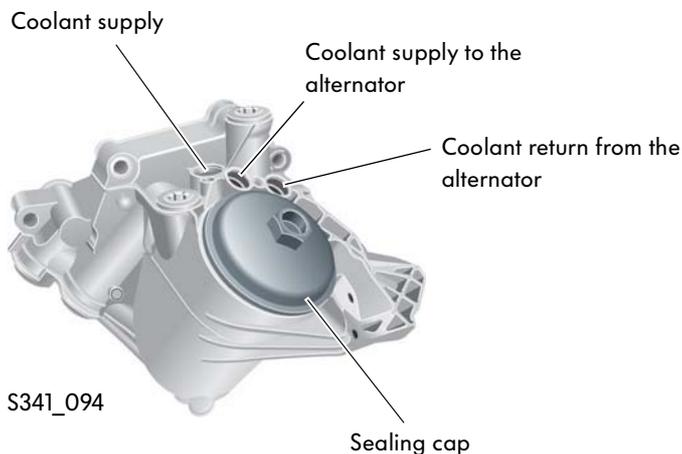


## Oil filter module

The oil filter module is bolted onto the side of cylinder bank 1. It contains the oil filter element, the oil pressure switch and an oil cooler. The oil cooler is bolted onto the oil filter module and is connected to the coolant circuit. The oil filter module also houses the connections for cooling the alternator.



S341\_095



# Engine mechanical system

## Oil pan

The oil pan is comprised of two components; an upper oil pan section and a lower oil pan section. The oil pans in the Phaeton and the Touareg differ due to their differing requirements.

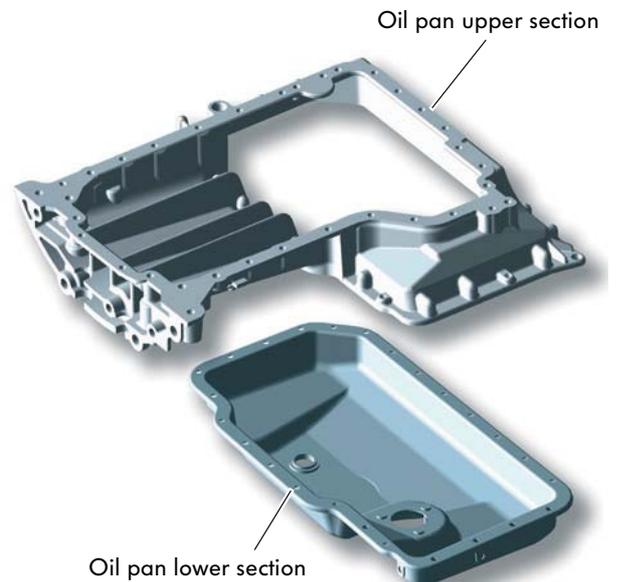
The seal between the two parts and the cylinder block is achieved by means of a liquid silicone seal.



### Phaeton oil pan

The upper section of the oil pan is manufactured from die-cast aluminium and the lower section of the oil pan from sheet steel.

Due to the installation space conditions, the oil pan lower section is designed very flat and broad.



S341\_049

### Touareg oil pan

In the Touareg, both parts are manufactured from die-cast aluminium. Higher stiffness is achieved in this way.

Due to the vehicle's off-road capability requirements, the oil pan lower section is designed to be narrow and deep. Due to the low oil intake point and, in comparison with the Phaeton, lower oil level, guaranteed oil intake with little oil foaming is achieved on gradients.

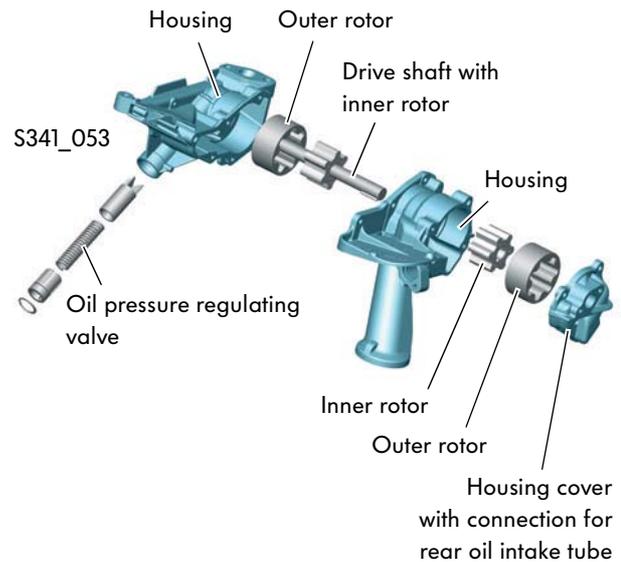


S341\_051

## Off-road capability measures

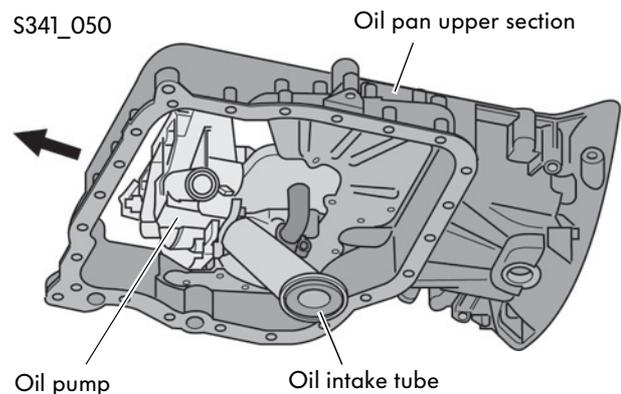
### Oil pump

A two-stage oil pump is fitted to ensure that the engine is supplied with oil under all operating conditions, even off-road. This is comprised of the main oil pump and a so-called suction oil pump. Both pump gear sets are identical.



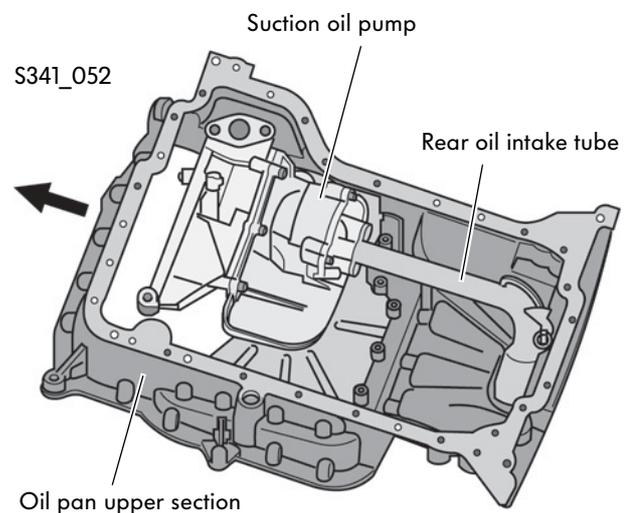
### Normal travel and hill descent

During normal travel and hill descent, the majority of the oil is located in the lower section of the oil pan. The oil is intaken by the duocentric oil pump and pumped into the oil circuit.



### Hill ascent

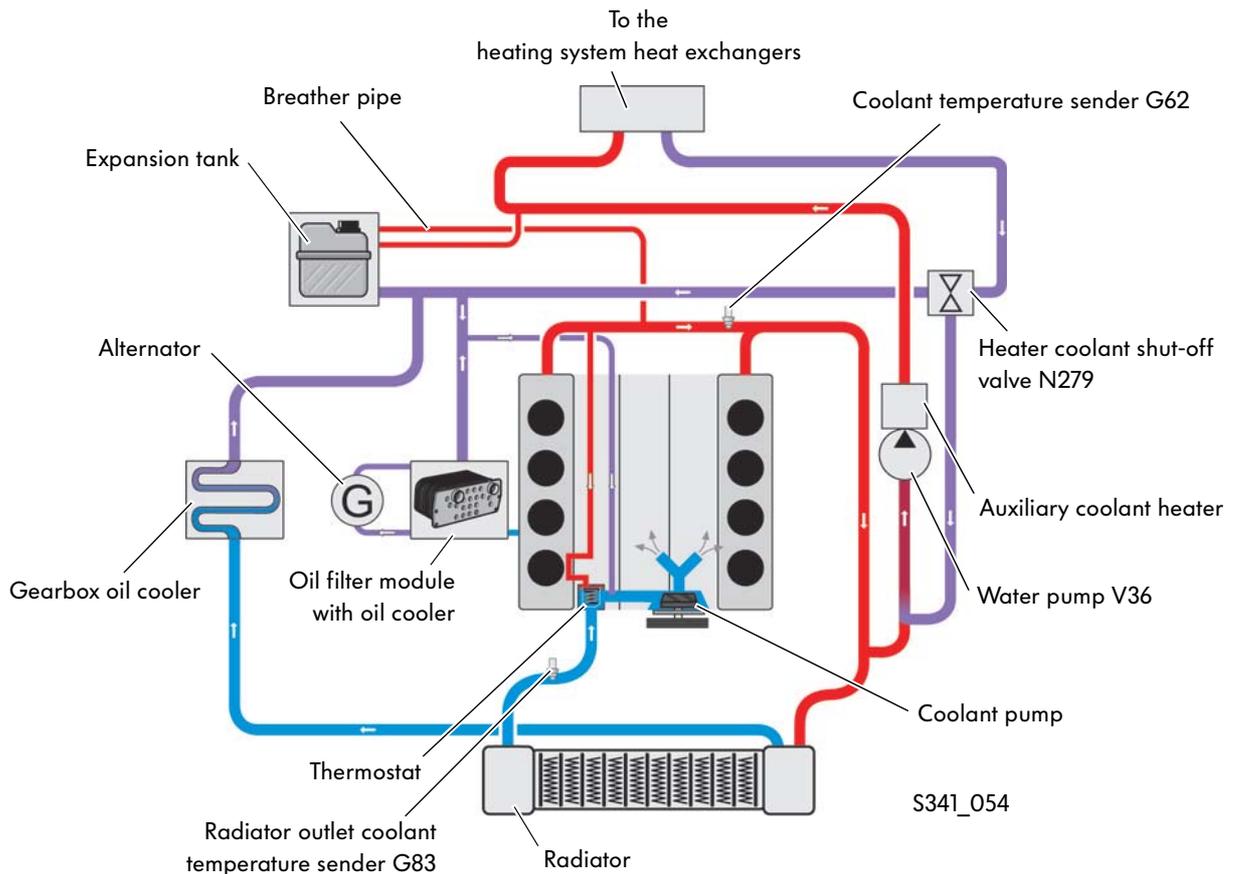
During hill ascent, part of the oil is located in the rear area of the oil pan upper section. It is now pumped into the lower section of the oil pan by the suction oil pump, where it is again intaken by the duocentric oil pump.



# Engine mechanical system

## Cooling circuit

The Figure shows the cooling circuit fitted in the 4.2l V8 5V engine in the Phaeton with an auxiliary coolant heater.



### Water pump V36

The water pump ensures coolant circulation for the auxiliary coolant heater whilst the engine is switched off.

### Heater coolant shut-off valve N279

During auxiliary coolant heater operation, the shut-off valve disconnects the engine coolant circuit from the heating system heat exchangers in the vehicle's interior.

### Radiator outlet coolant temperature sender G62 and G83

Comparison between the two coolant temperature senders forms the basis of actuation of the electric coolant fans.

### Alternator

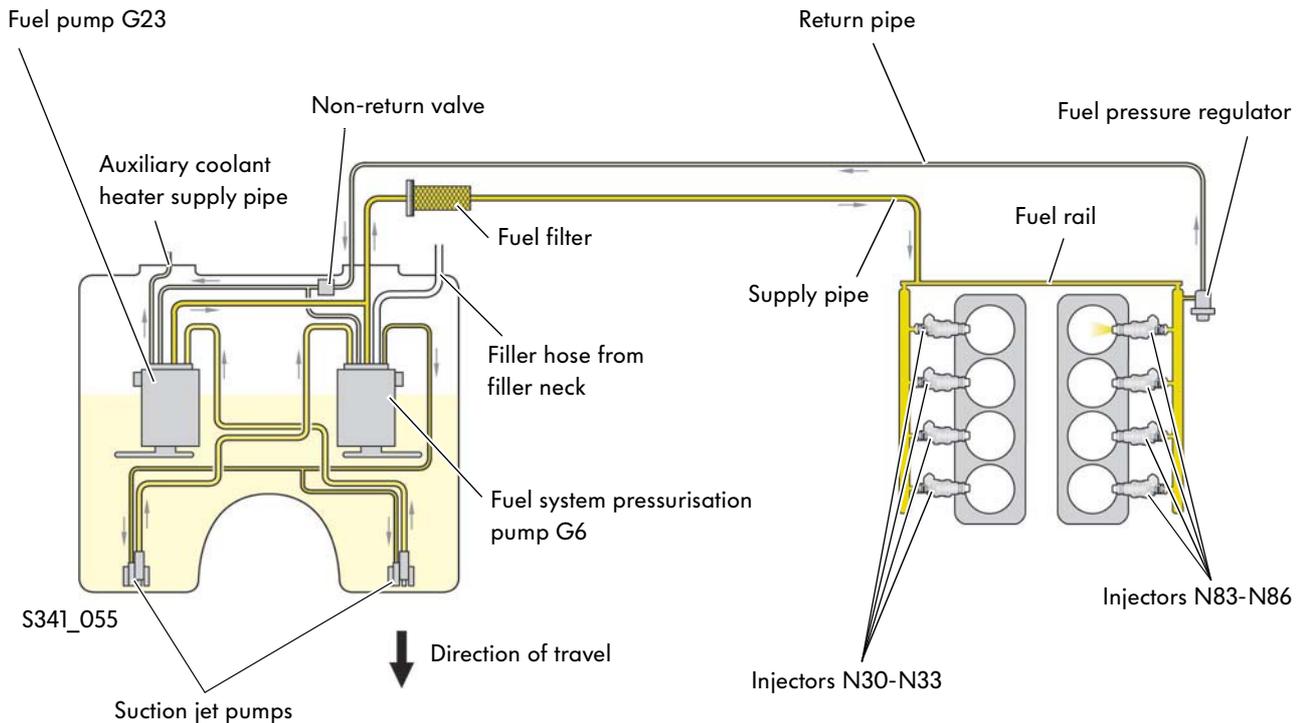
Cooling the alternator via the engine coolant circuit protects it against overheating and therefore ensures a longer service life and better efficiency.

### Oil cooler

The oil cooler is bolted onto the oil filter module; the coolant flows through it.

## Fuel system

The Figure shows the fuel system fitted in the Phaeton. It differs slightly from the fuel system installed in the Touareg. The Touareg has a return-free fuel system, in which the fuel pressure regulator is installed in the fuel filter.



### Filler hose from filler neck

On fuelling, the fuel is pumped into the tank by the fuel system pressurisation pump G6.

### Electric fuel pumps

Two fuel pumps are required due to the shape of the fuel tank. These pump the fuel to the fuel rail, to the suction jet pumps (fuel system pressurisation pump G6 only) and to the auxiliary coolant heater (fuel pump G23 only).

### Non-return valve

This prevents fuel flowing from the fuel tank to the fuel pressure regulator.

### Suction jet pumps

These are supplied with fuel by the fuel system pressurisation pump G6. The suction jet pumps then pump the fuel to each of the fuel pumps positioned opposite them.

### Fuel pressure regulator

This is located on the fuel rail. A springloaded diaphragm valve regulates the fuel pressure to 4bar. During this process, the cross-section to the fuel return is enlarged or reduced depending on the pressure.

### Injectors

These inject the fuel into the cylinders.



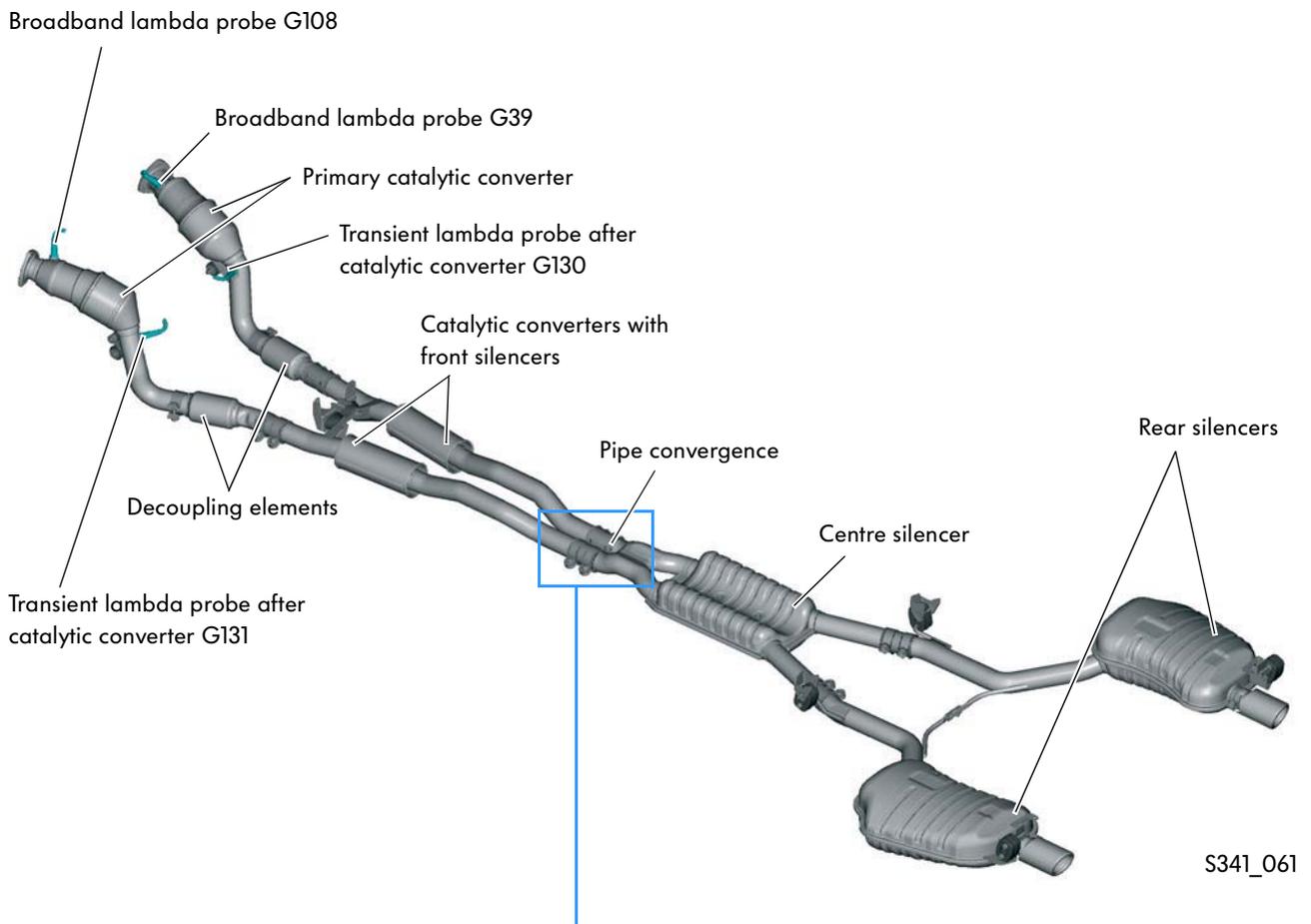
# Engine mechanical system

## Exhaust system

The exhaust system is a twin-branch design.

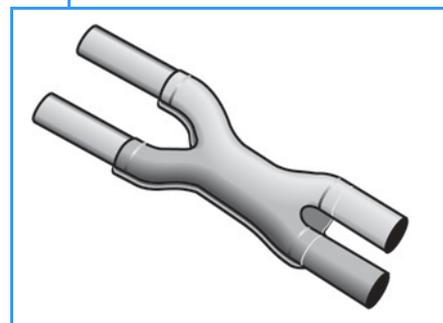
It is comprised of two catalytic converters beneath the bonnet, two flexible decoupling elements, two front silencers designed as baffled silencers, a centre silencer designed as an absorption silencer and two rear silencers designed as baffled silencers.

The catalytic converters' substrate material is comprised of ceramic.

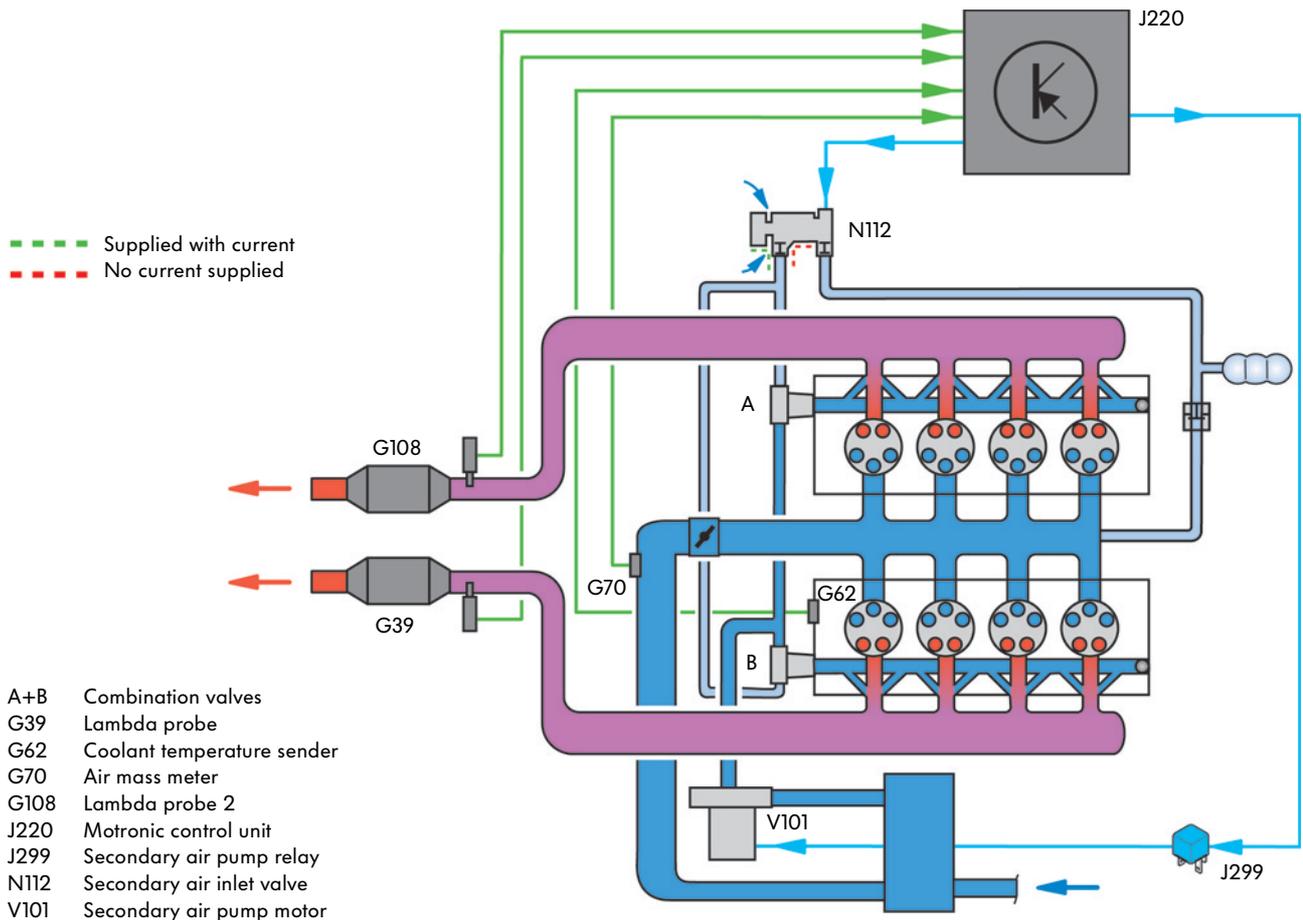


### Pipe convergence

The exhaust gases of both exhaust pipes converge upstream of the centre silencer. In this case, the sound waves overlap and noise emissions decrease.



## Secondary air system



S341\_064

Due to the high level of mixture enrichment during cold starting and the warm-up phase, a high percentage of uncombusted hydrocarbons occurs in the exhaust gas in this period.

The catalytic converter is unable to process this high percentage of hydrocarbons, because:

- the catalytic converter has not yet reached its necessary operating temperature and
- a lambda 1 mixture has to be present for full conversion to take place.

Thanks to air injection downstream of the exhaust valves, the exhaust gases are enriched with oxygen, leading to oxidation (afterburning) of the hydrocarbons and the carbon monoxide. The heat released during this process additionally heats the catalytic converter, helping it to reach its operating temperature faster.

The secondary air system is comprised of:

- the secondary air pump motor V101,
- two combination valves A + B and
- the secondary air inlet valve N112.



# Engine management system

## System overview

### Sensors

Air mass meter G70 with  
intake air temperature sender G42  
Air mass meter 2 G246

Engine speed sender G28

Hall sender G40, G163

Lambda probe G39, G108

Lambda probe after catalytic converter G130, G131

Throttle valve module J338  
Throttle valve drive angle sender for electric throttle  
G187, G188

Coolant temperature sender G62

Radiator outlet coolant temperature sender G83

Knock sensor G61, G66

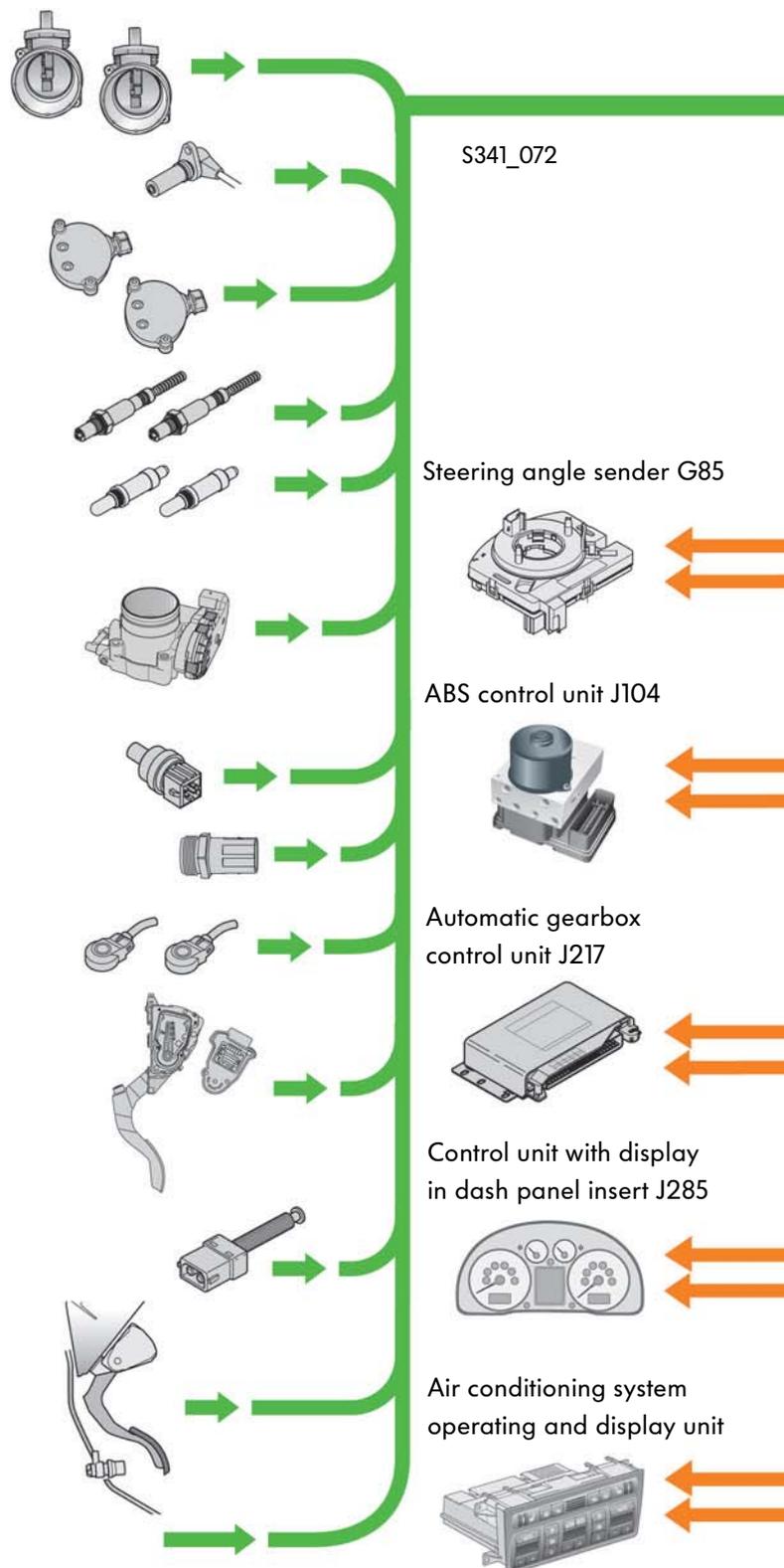
Accelerator position sender G79  
Accelerator position sender 2 G185

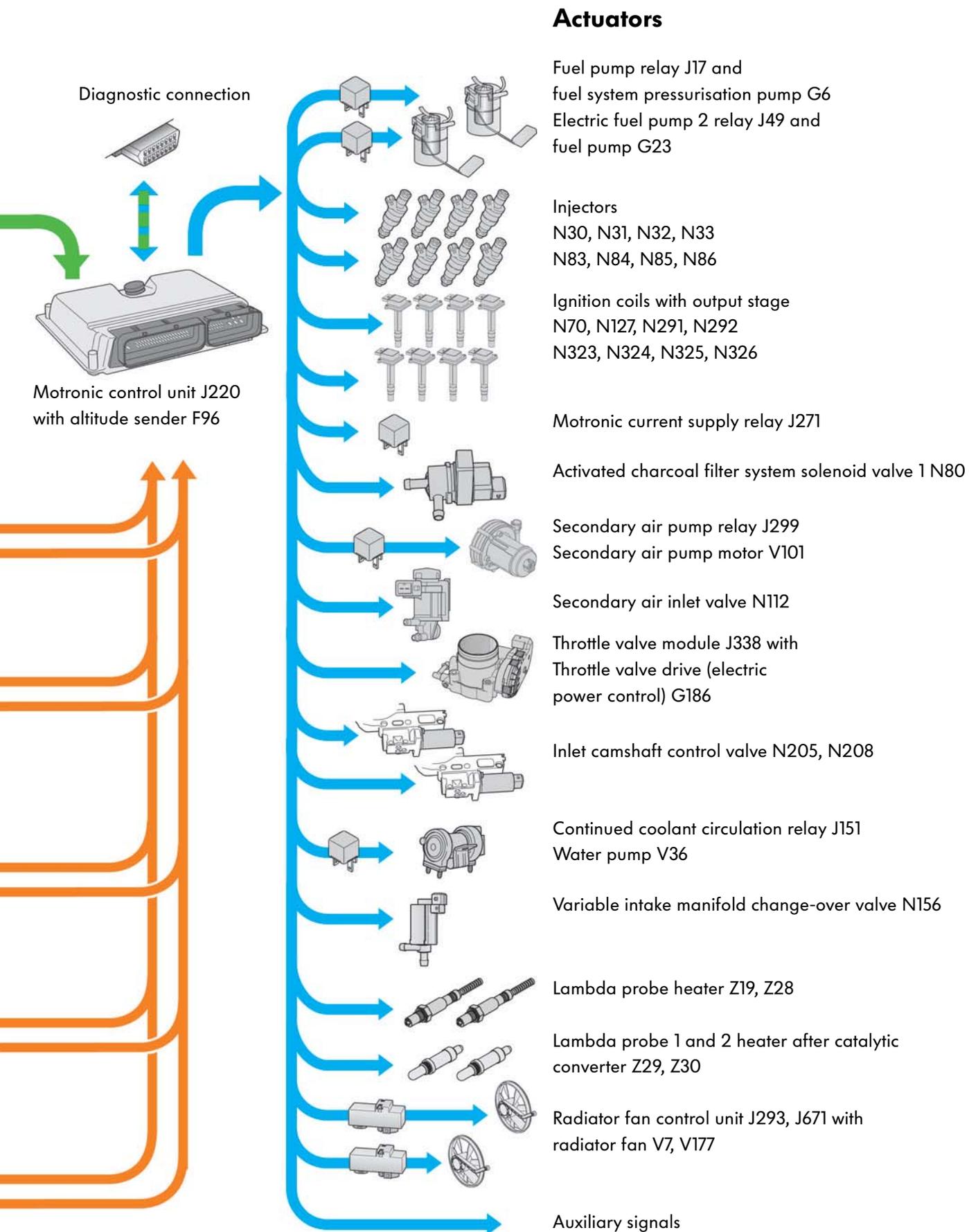
Brake light switch F and  
brake pedal switch F47

Kick-down switch F8

Auxiliary signals

The system overview shows the 4.2l V8 5V engine fitted in the Phaeton.





# Engine management system

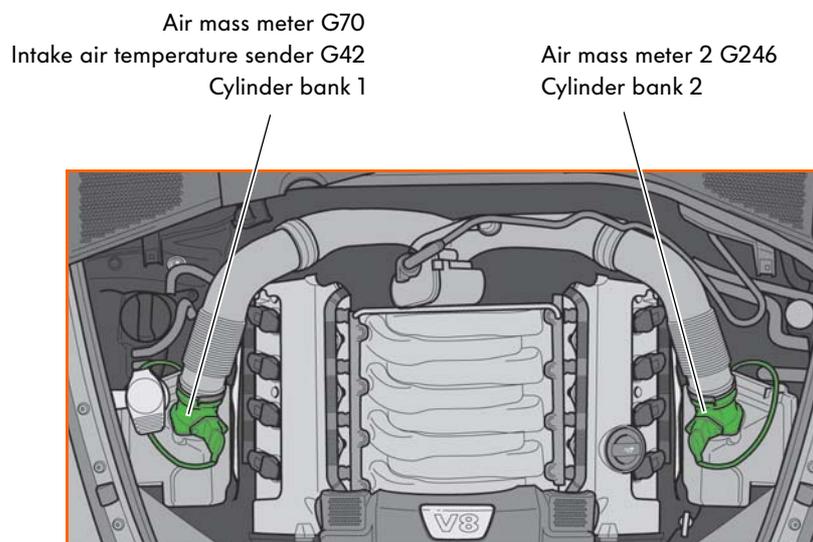
## Sensors

### Air mass meter G70 with intake air temperature sender G42 and air mass meter 2 G246

Due to the available installation space, the intake tract has a twin-branch design.

Air mass meter G70 is installed along with intake air temperature sender G42 in the intake tract on the cylinder bank 1 side. Air mass meter G246 is installed in the intake tract on the cylinder bank 2 side.

From the signals transmitted by the two air mass meters and the intake air temperature sender, the engine control unit calculates the mass and the temperature of the intaken air respectively.



S341\_102

### Signal usage

The signals are used to calculate all load- and engine speed-dependent functions. These include the injection period, ignition timing or camshaft adjustment, for example.

### Effects in the event of failure

If an air mass meter fails, the throttle valve position and the engine speed are used as correction values. If the intake air temperature sender fails, a substitute value is assumed.

## Engine speed sender G28

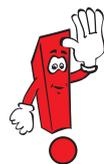
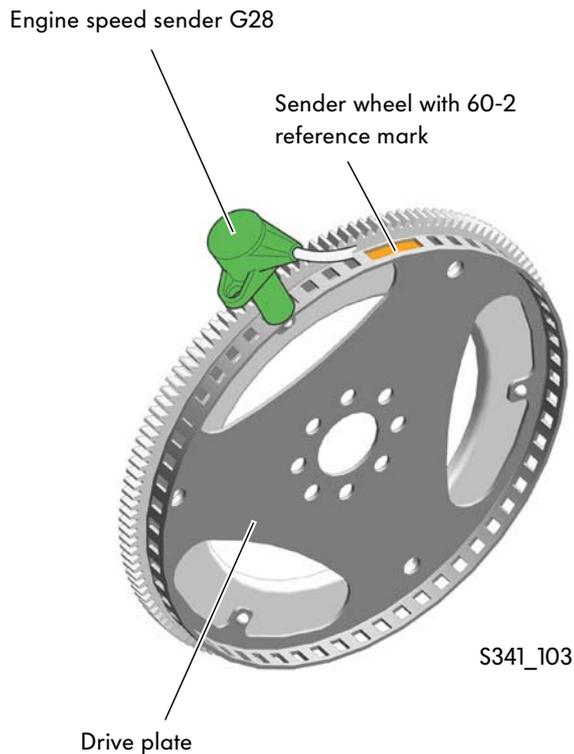
The engine speed sender is secured to the gearbox housing. It samples a 60-2 sender wheel, which is secured to the drive plate. Based on these signals, the engine control unit detects the engine speed and the position of the crankshaft. A segment gap on the sender wheel serves the sender as a reference mark.

### Signal usage

The signal is used to calculate the injection point, the quantity injected and the ignition timing. It is additionally used for camshaft adjustment and the activated charcoal filter system.

### Effects in the event of failure

In the event that the sender fails, the engine continues to run, but re-starting it is no longer possible.



Due to the different gearboxes which are fitted, the drive plate installed in the Phaeton is secured to the crankshaft with eight bolts and that in the Touareg with ten bolts.



# Engine management system

## Hall sender G40 and G163

Hall sender G40 is located on cylinder bank 1, and hall sender 2 G163 is positioned on cylinder bank 2.

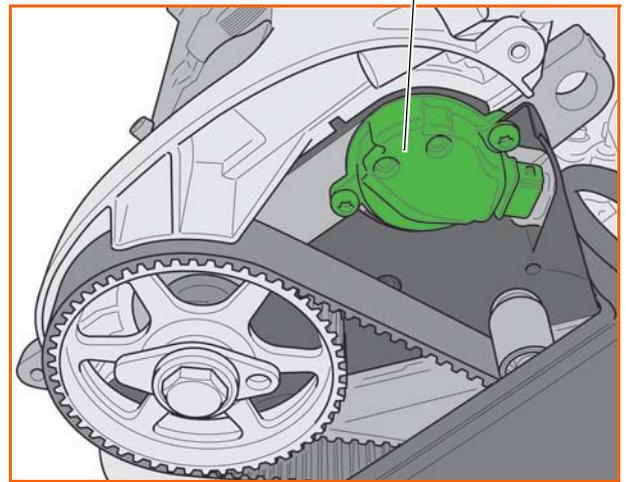
### Signal usage

Thanks to the two hall senders, the engine control unit recognises the position of each cylinder bank's inlet camshafts. The signals are used for camshaft adjustment, and to calculate the injection point and the ignition timing.

### Effects in the event of failure

No further camshaft adjustment takes place if a hall sender fails. The engine continues to run and also re-starts again after switching off thanks to run-on recognition.

Hall sender G40



S341\_099

Hall sender 2 G163



S341\_085



## Knock sensors G61 and G66

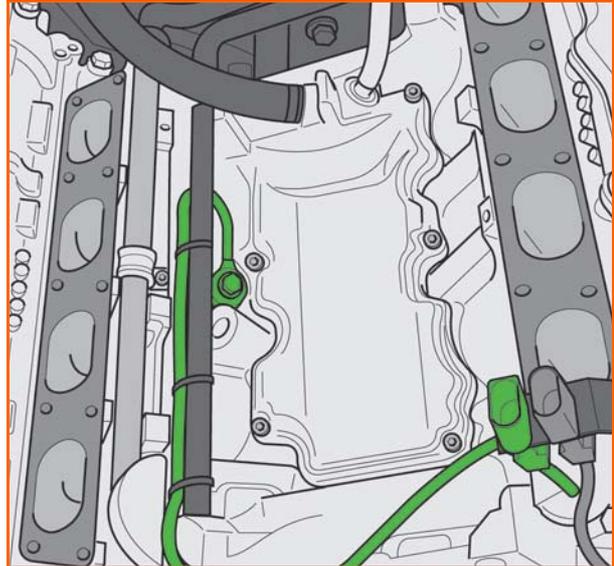
The 4.2l V8 5V engine is fitted with two knock sensors. Knock sensor 1 G61 is seated in the V on cylinder bank 1, and knock sensor 2 G66 is located on the outside on cylinder bank 2.

### Signal usage

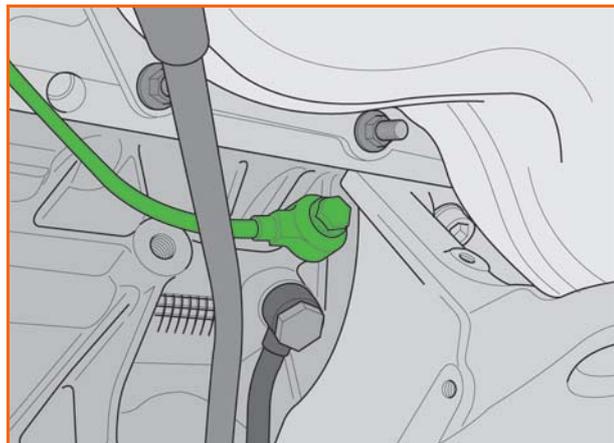
The knock sensors detect knocking combustion. Regulation enables the ignition timing to be shifted towards the knock limit, therefore increasing the engine's efficiency.

### Effects in the event of failure

If a knock sensor fails, the corresponding cylinder bank's ignition timing is adjusted in the "retard" direction. If both knock sensors fail, all of the cylinders' ignition timing is adjusted in the "retard" direction.



S341\_083



S341\_079



# Engine management system

## Actuators

### Inlet camshaft control valve 1 N205 and inlet camshaft control valve 2 N208

Both valves are bolted to the cylinder head. Inlet camshaft control valve 1 N205 is located on cylinder bank 1, and inlet camshaft control valve 2 N208 is positioned on cylinder bank 2.

#### Task

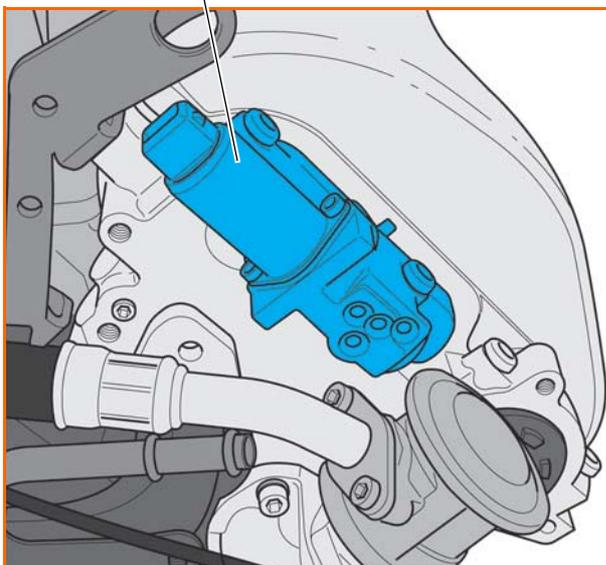
Depending on actuation by the engine control unit, these have the task of adjusting the inlet camshafts. Inlet camshaft adjustment equates to a crank angle of  $22^\circ$  in the "advance" direction.

#### Effects in the event of failure

If an electrical cable to the camshaft adjusters is defective or a camshaft adjuster fails, no further camshaft adjustment is carried out. Less torque is available.

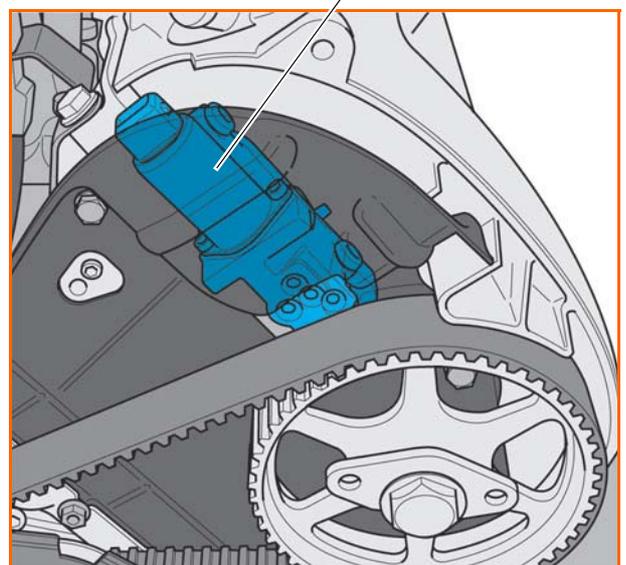


Inlet camshaft control valve 1 N205



S341\_100

Inlet camshaft control valve 2 N208



S341\_101

## Variable intake manifold change-over valve N156

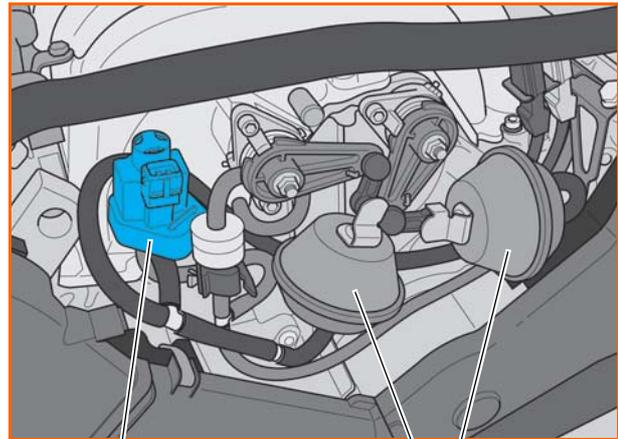
The variable intake manifold change-over valve is secured to the intake manifold on the toothed belt side.

### Task

This is a solenoid valve and is actuated by the engine control unit depending on load and engine speed. When this occurs, the valve either releases or seals the route from the vacuum reservoir to the vacuum units. The actuators then actuate the intake manifold change-over flaps and switch to the torque or the output position.

### Effects in the event of failure

If the variable intake manifold change-over valve fails, intake manifold change-over is no longer possible. The intake manifold remains in the output position, and less torque is available.



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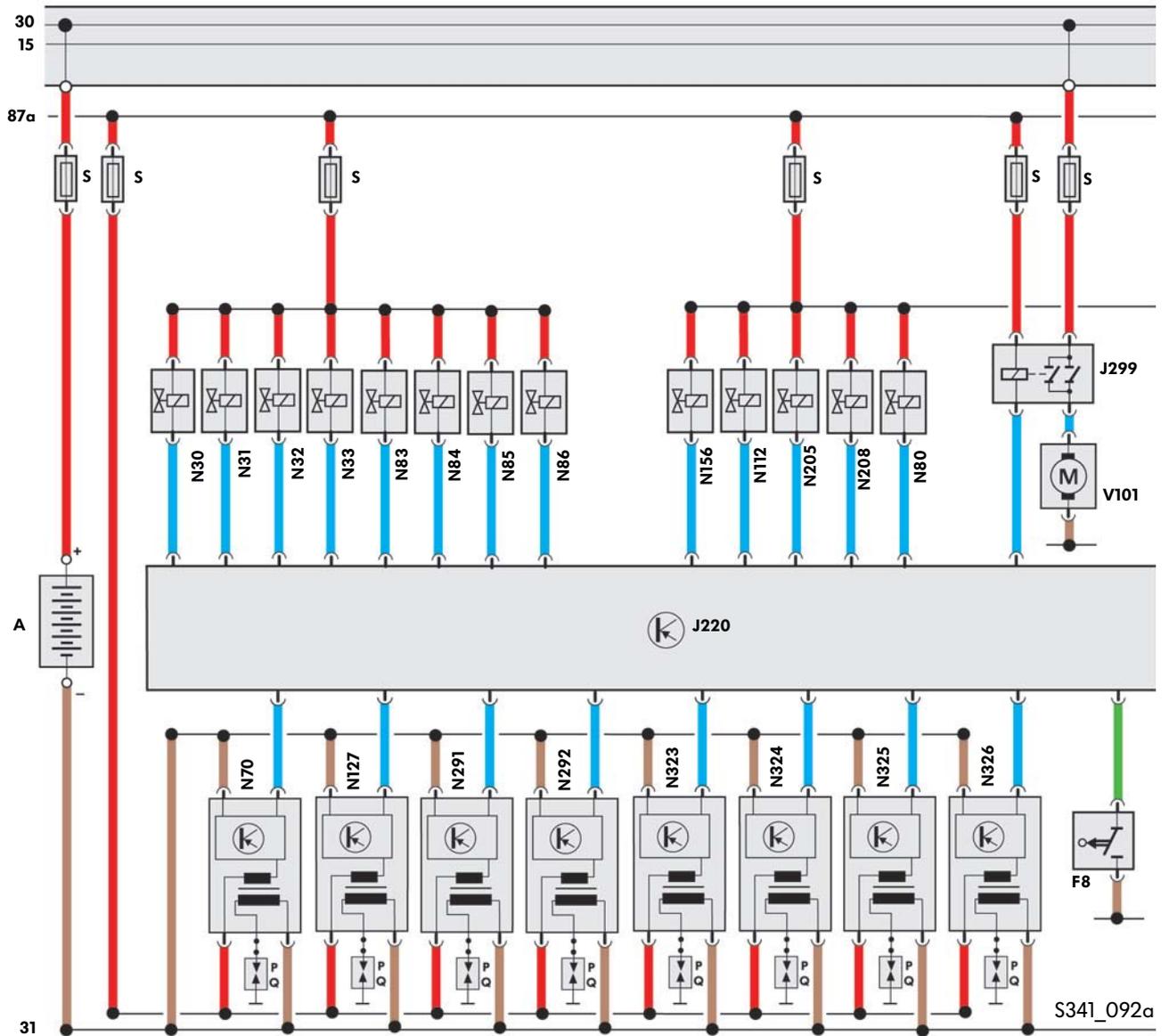
Vacuum units

Variable intake manifold change-over valve N156

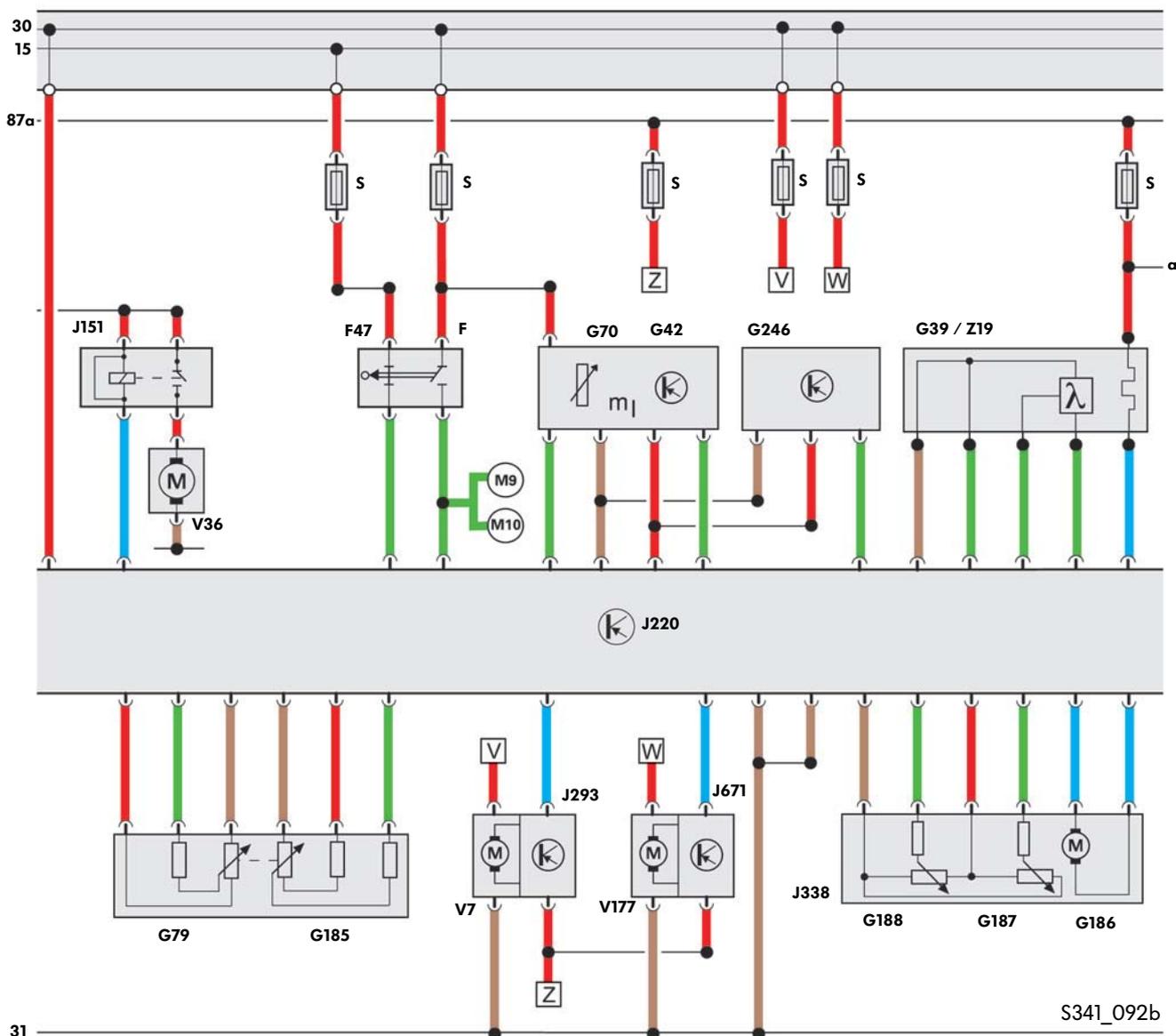


# Functional diagram

The functional diagram shows the 4.2l V8 5V engine fitted in the Phaeton.



- |     |                                 |      |   |
|-----|---------------------------------|------|---|
| A   | Battery                         | G83  | Radiator outlet coolant temperature sender                |
| F   | Brake light switch              | G108 | Lambda probe 2  |
| F8  | Kick-down switch                | G130 | Lambda probe after catalytic converter                    |
| F47 | Brake pedal switch              | G131 | Lambda probe 2 after catalytic converter                  |
| G6  | Fuel system pressurisation pump | G163 | Hall sender 2   |
| G23 | Fuel pump                       | G185 | Accelerator position sender 2                             |
| G28 | Engine speed sender             | G186 | Throttle valve drive (electric power control)             |
| G39 | Lambda probe                    | G187 | Throttle valve drive angle sender 1 for electric throttle |
| G40 | Hall sender                     | G188 | Throttle valve drive angle sender 2 for electric throttle |
| G42 | Intake air temperature sender   | G246 | Air mass meter 2  |
| G61 | Knock sensor 1                  | J17  | Fuel pump relay   |
| G62 | Coolant temperature sender      | J49  | Electric fuel pump 2 relay                                |
| G66 | Knock sensor 2                  | J151 | Continued coolant circulation relay                       |
| G70 | Air mass meter                  | J220 | Motronic control unit                                     |
| G79 | Accelerator position sender     |      |   |



- J271 Motronic current supply relay
- J293 Radiator fan control unit
- J299 Secondary air pump relay
- J338 Throttle valve module
- J519 Onboard supply control unit
- J671 Radiator fan control unit 2
- K Diagnostic connection
- M9 Left brake light bulb
- M10 Right brake light bulb
- N30 Injector, cylinder 1
- N31 Injector, cylinder 2
- N32 Injector, cylinder 3
- N33 Injector, cylinder 4
- N70 Ignition coil 1 with output stage
- N80 Activated charcoal filter system solenoid valve 1
- N83 Injector, cylinder 5

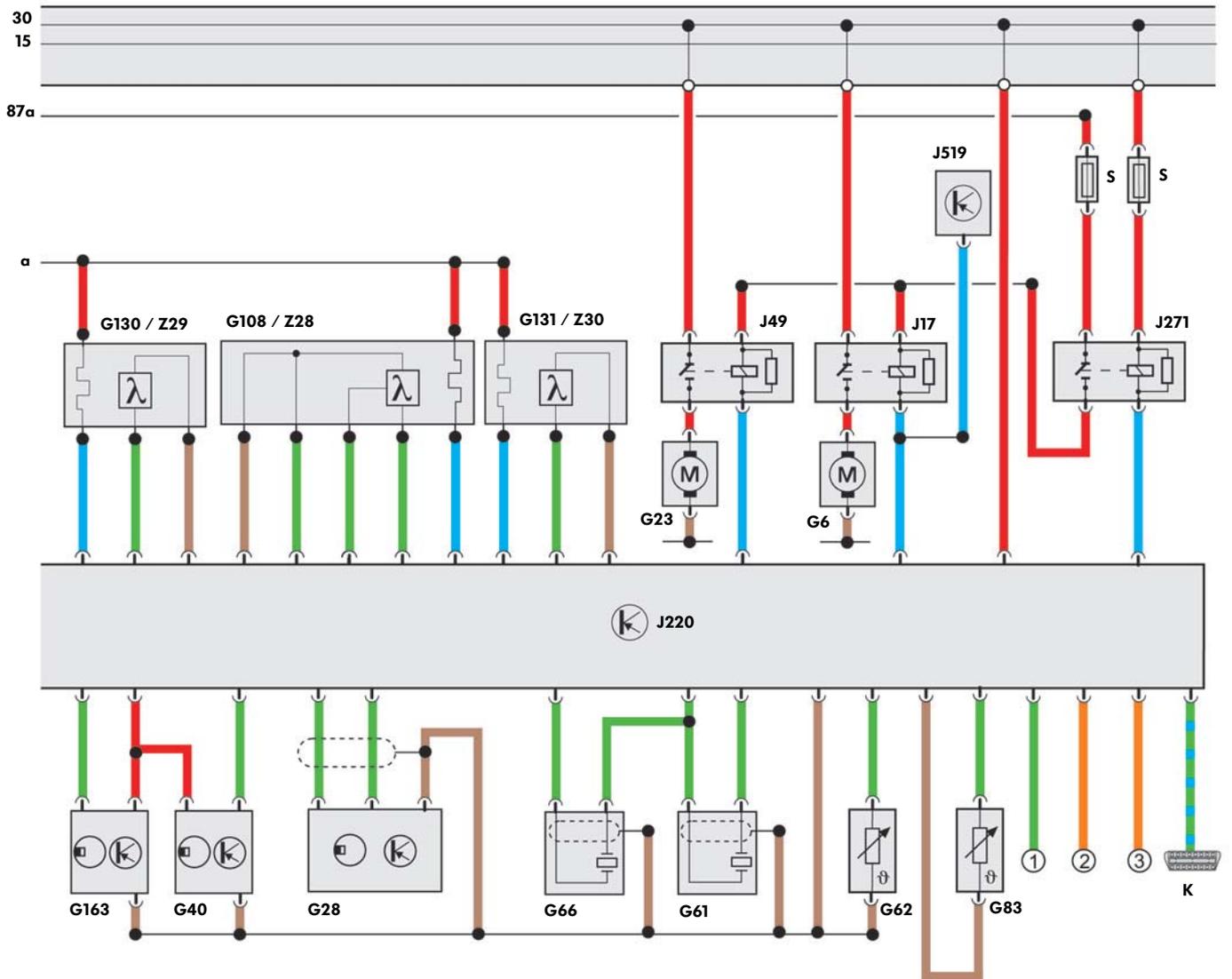
- N84 Injector, cylinder 6
- N85 Injector, cylinder 7
- N86 Injector, cylinder 8
- N112 Secondary air inlet valve
- N127 Ignition coil 2 with output stage
- N156 Variable intake manifold change-over valve

**Colour code/legend**

- = input signal
- = output signal
- = positive
- = earth
- = CAN powertrain data bus



# Functional diagram



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S341\_092c

- N205 Inlet camshaft control valve 1
- N208 Inlet camshaft control valve 2
- N291 Ignition coil 3 with output stage
- N292 Ignition coil 4 with output stage
- N323 Ignition coil 5 with output stage
- N324 Ignition coil 6 with output stage
- N325 Ignition coil 7 with output stage
- N326 Ignition coil 8 with output stage
- P Spark plug connector
- Q Spark plugs
- S Fuse
- V7 Radiator fan
- V36 Water pump
- V101 Secondary air pump motor
- V177 Radiator fan 2

- Z19 Lambda probe heater
- Z28 Lambda probe 2 heater
- Z29 Lambda probe 1 heater after catalytic converter
- Z30 Lambda probe 2 heater after catalytic converter
- 1 Switch for CCS
- 2 CAN data bus
- 3 CAN data bus
- K Diagnostic connection

### Colour code/legend

- = input signal
- = output signal
- = positive
- = earth
- = CAN powertrain data bus

# Test your knowledge

## Which answer is correct?

One, several or all answers may be correct.

### 1. What are the differences between the ancillary unit drives in the Touareg and the Phaeton?

- a) Due to the Touareg's off-road capability requirements, some of its ancillary units are positioned higher than in the Phaeton.
- b) The Touareg is fitted with a 5-groove poly-V belt and the Phaeton with a 7-groove poly-V belt.
- c) There are no differences.

### 2. What has to be noted when changing the toothed belt?

- a) The notch on the belt pulley/vibration damper and the mark on the toothed belt guard must align.
- b) The large bores in the locating plates (camshaft sprockets) must be located opposite each other on the inner side.
- c) The small bores in the locating plates (camshaft sprockets) must be located opposite each other on the inner side.

### 3. In how many stages is the variable intake manifold fitted in the 4.2l V8 5V engine in the Touareg and the Phaeton adjusted?

- a) Both engines are fitted with a two-stage variable intake manifold.
- b) The Touareg is fitted with a three-stage variable intake manifold and the Phaeton with a two-stage variable intake manifold.
- c) Both engines are fitted with a three-stage variable intake manifold.



# Test your knowledge

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**4. What is the purpose of the suction oil pump fitted in the Touareg?**

- a) The suction oil pump supplies the cylinder head with oil.
- b) The suction oil pump supplies the camshaft adjustment system with oil.
- c) When climbing hills, the suction oil pump pumps oil from the rear area of the oil pan upper section into the oil pan lower section, thereby ensuring that oil is supplied.

**5. Where is the engine speed sender installed?**

- a) It is bolted centrally onto the cylinder block.
- b) It is secured to the gearbox housing, and samples a sender wheel on the drive plate.
- c) It is bolted into the cylinder block in the area of the toothed belt.

**6. What are the advantages of a camshaft adjustment system?**

- a) Camshaft adjustment is used to improve output in the upper engine speed range and torque in the lower engine speed range.
- b) The camshaft adjustment system is used to improve internal exhaust gas recirculation.
- c) Camshaft adjustment is used to improve output in the lower engine speed range and torque in the upper engine speed range.

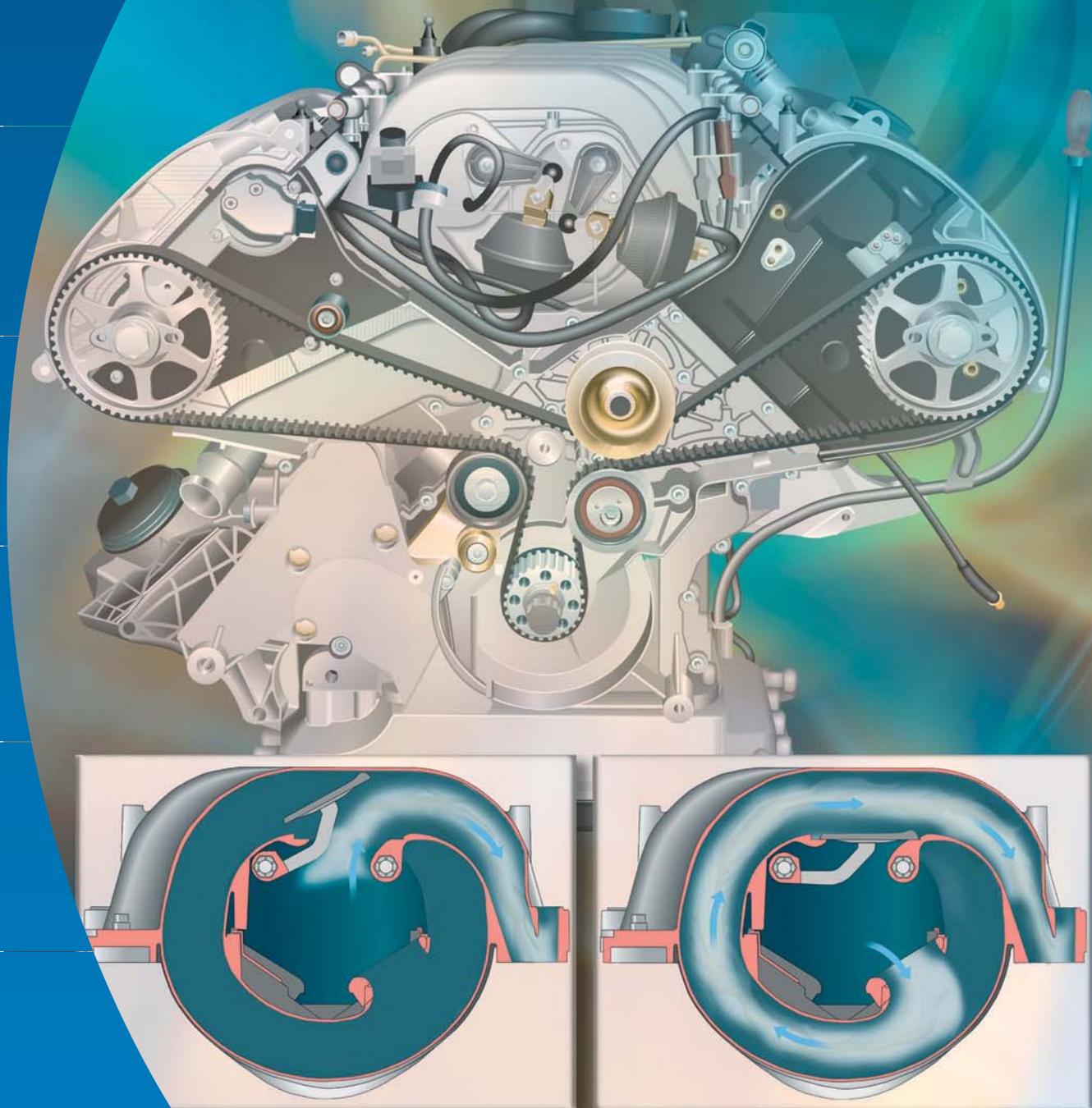
**7. What is the purpose of the secondary air system?**

- a) Secondary air injection serves to increase performance in the partial load range.
- b) Secondary air injection serves to reduce exhaust emissions in the cold-starting phase.
- c) Thanks to secondary air injection during the cold-starting phase, the catalytic converter reaches its operating temperature faster.





- Solutions**
1. a)
  2. a), b)
  3. b)
  4. c)
  5. b)
  6. a), b)
  7. b), c)



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