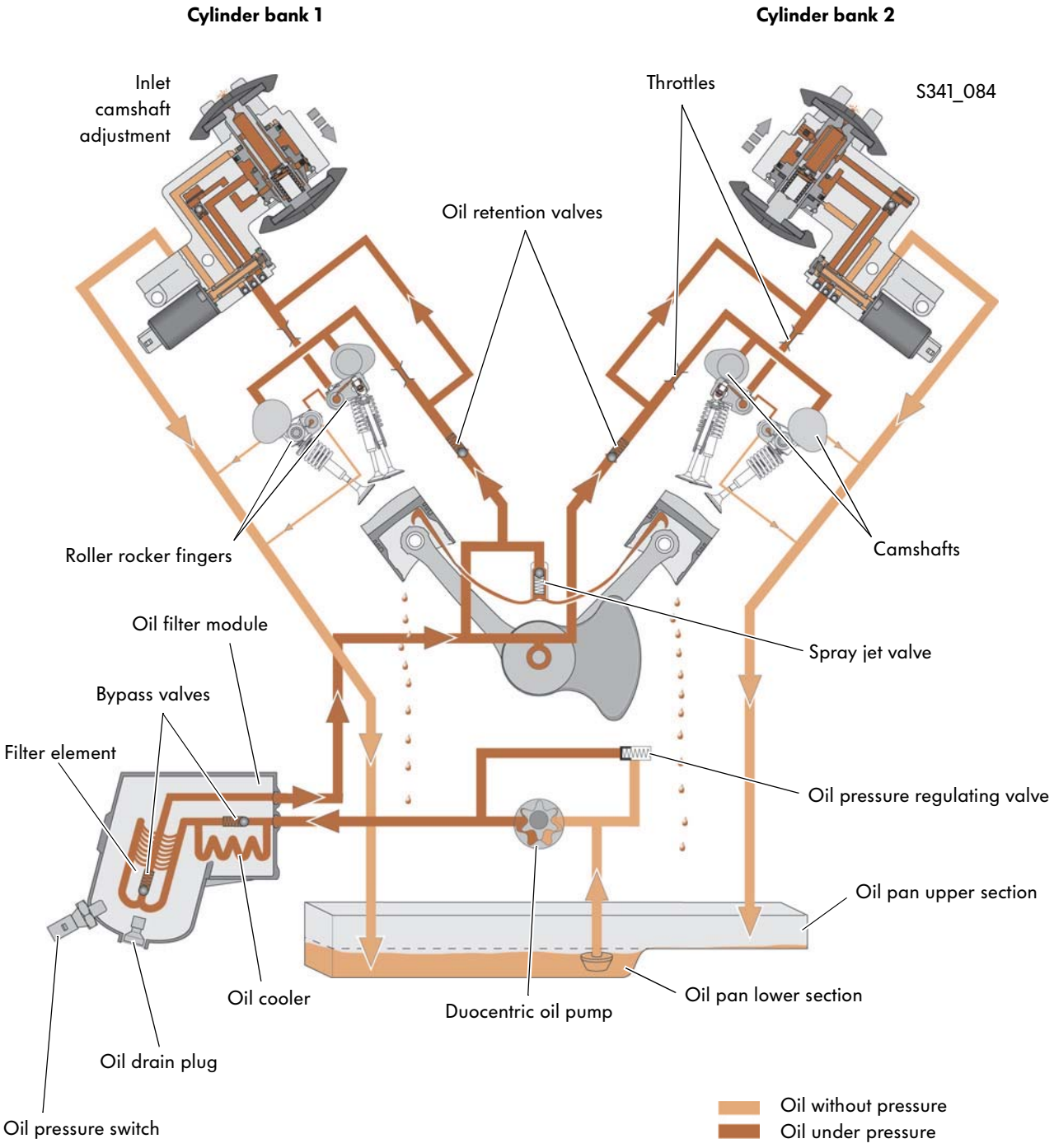
Oil circuit

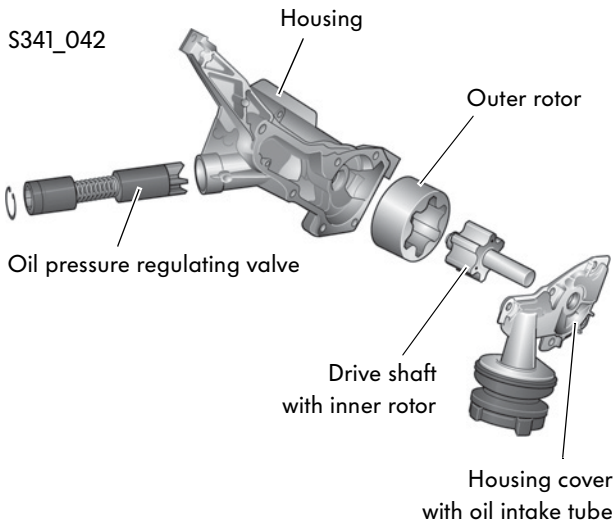
The oil circuit fitted in the 4.2l V8 5V engine in the Phaeton and the Touareg is primarily identical. However, the oil intake system differs due to the Touareg's off-road capability. The particulars of, and differences between, the oil circuits will be presented over the next few pages.

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



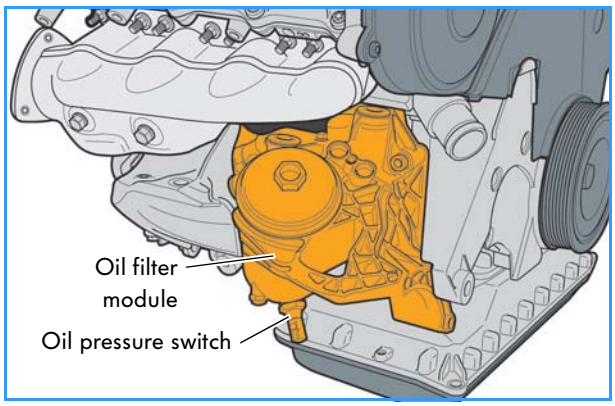
Duocentric oil pump

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.

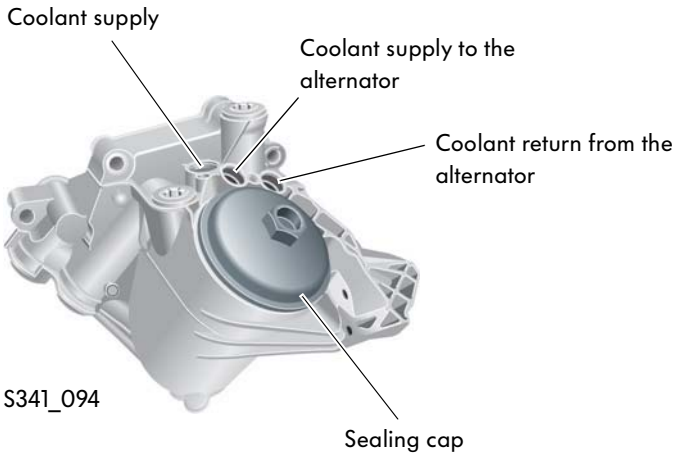


Oil filter module

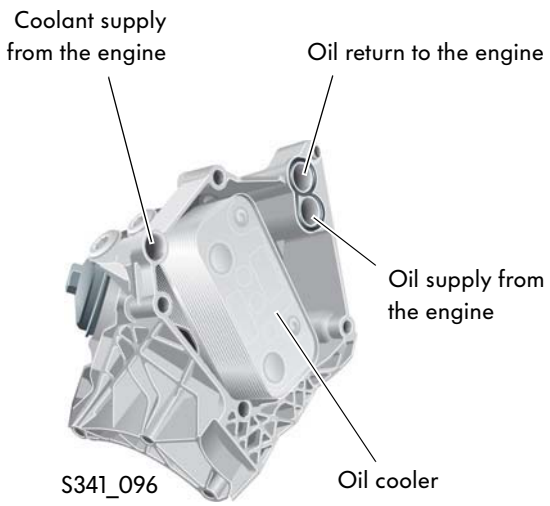
The oil filter module is bolted onto the side of cylinder bank 1. It contains the oil filter element, the oil pressure switch and an oil cooler. The oil cooler is bolted onto the oil filter module and is connected to the coolant circuit. The oil filter module also houses the connections for cooling the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



S341_095



S341_094



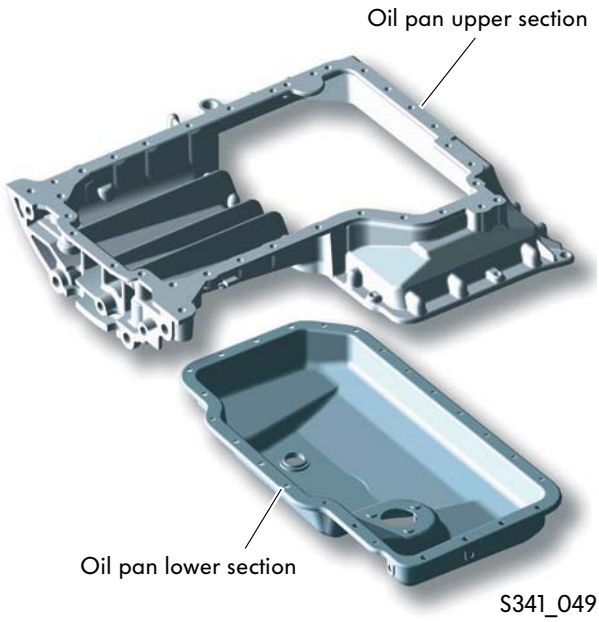
S341_096

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

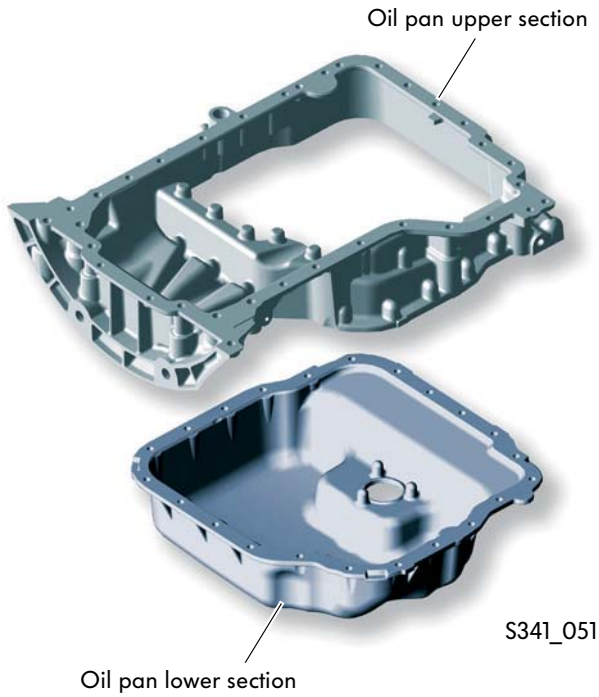
The upper section of the oil pan is manufactured from die-cast aluminium and the lower section of the oil pan from sheet steel.
Due to the installation space conditions, the oil pan lower section is designed very flat and broad.



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.

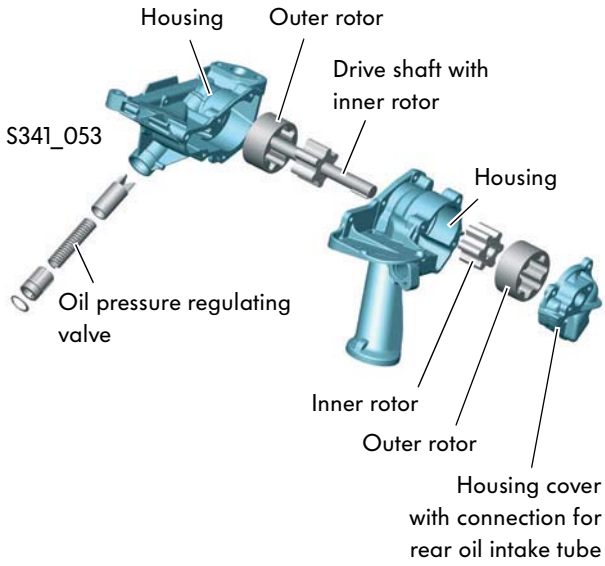


S341_051

Off-road capability measures

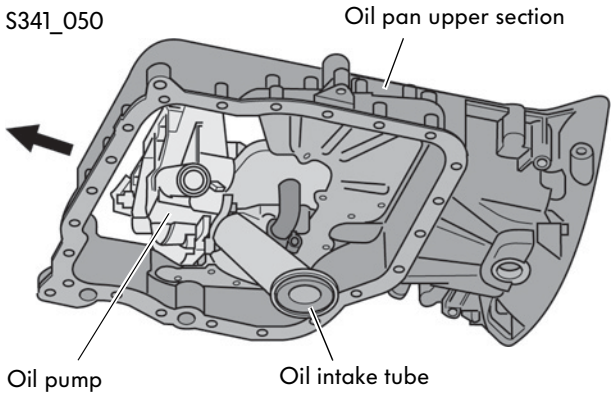
Oil pump

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.



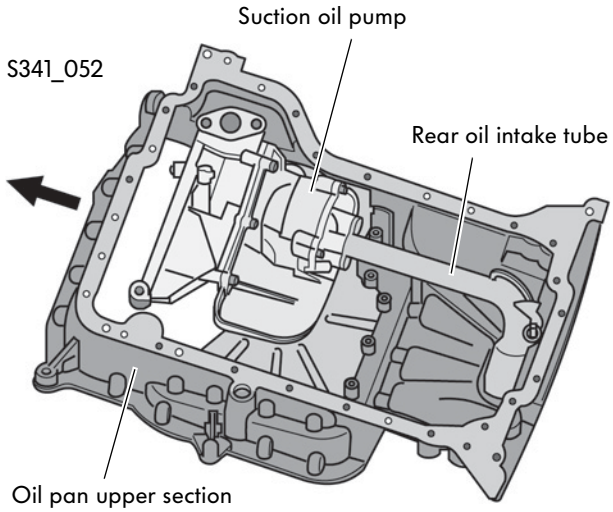
Normal travel and hill descent

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.



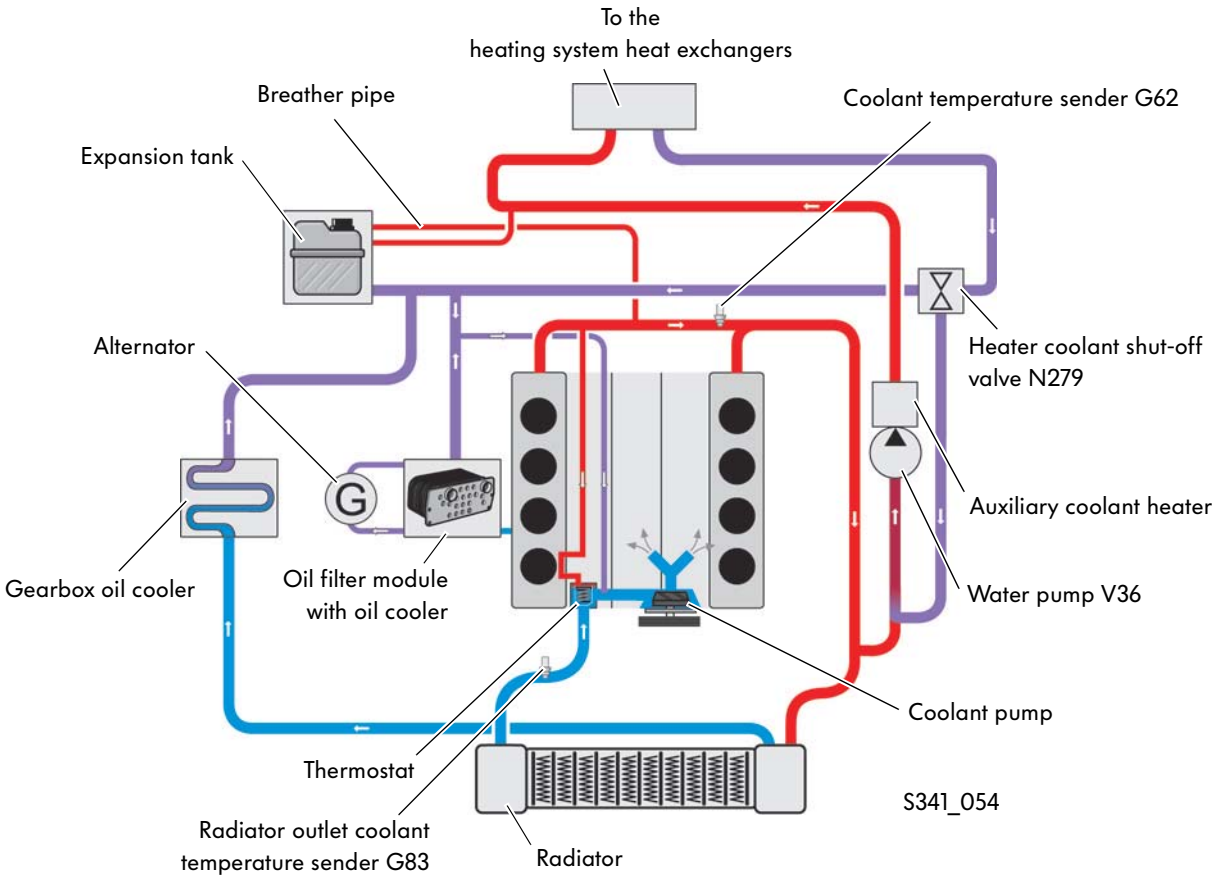
Hill ascent

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.



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.

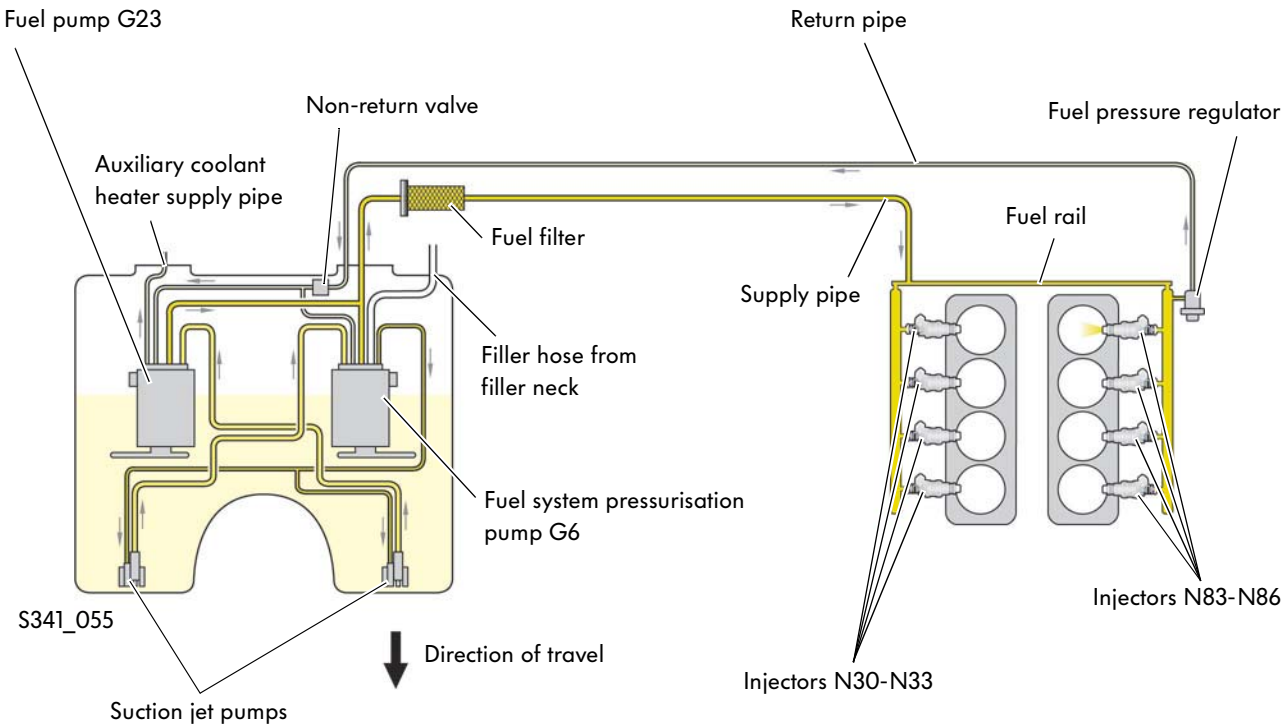
Radiator outlet coolant temperature sender G62 and G83
Comparison between the two coolant temperature senders forms the basis of actuation of the electric coolant fans.

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.

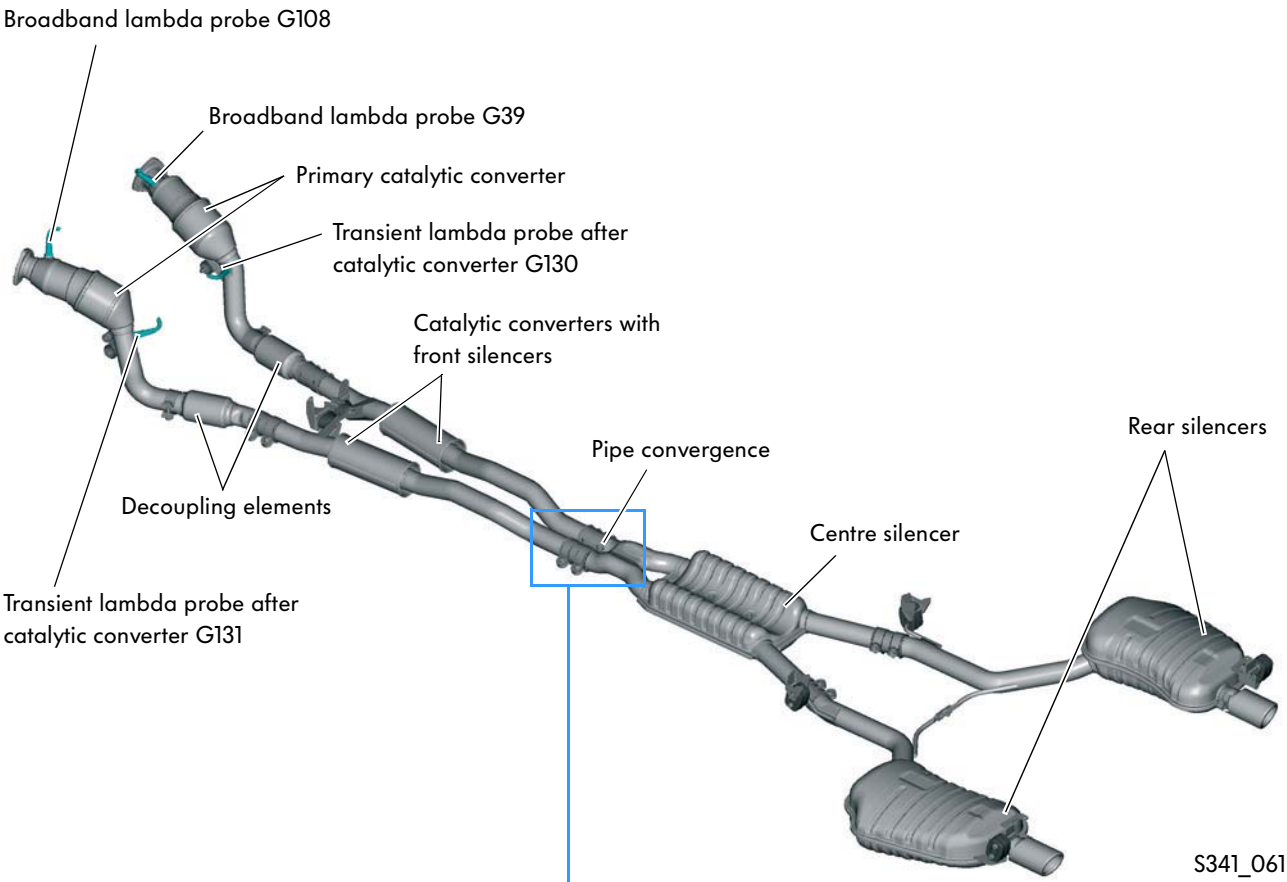
Suction jet pumps
These are supplied with fuel by the fuel system pressurisation pump G6. The suction jet pumps then pump the fuel to each of the fuel pumps positioned opposite them.

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.

Exhaust system

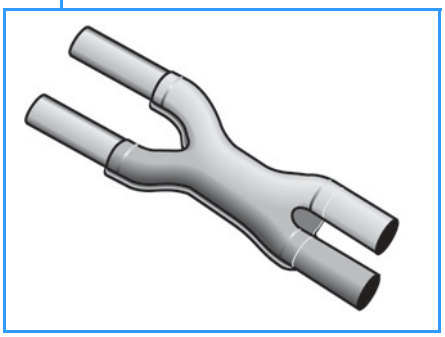
The exhaust system is a twin-branch design.
It is comprised of two catalytic converters beneath the bonnet, two flexible decoupling elements, two front silencers designed as baffled silencers, a centre silencer designed as an absorption silencer and two rear silencers designed as baffled silencers.
The catalytic converters' substrate material is comprised of ceramic.



S341_061

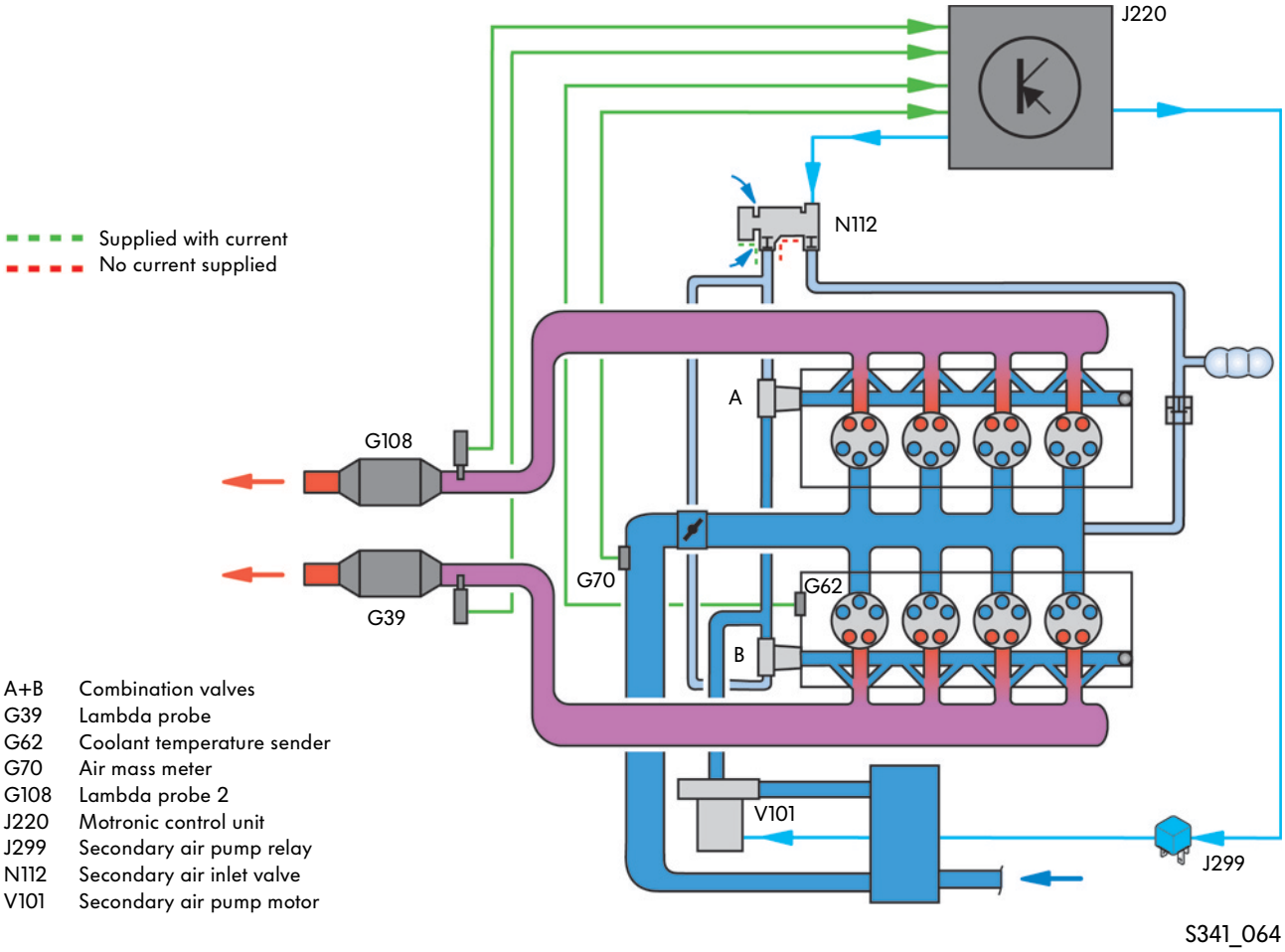
Pipe convergence

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



S341_062

Secondary air system



A+B Combination valves
G39 Lambda probe
G62 Coolant temperature sender
G70 Air mass meter
G108 Lambda probe 2
J220 Motronic control unit
J299 Secondary air pump relay
N112 Secondary air inlet valve
V101 Secondary air pump motor

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

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

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

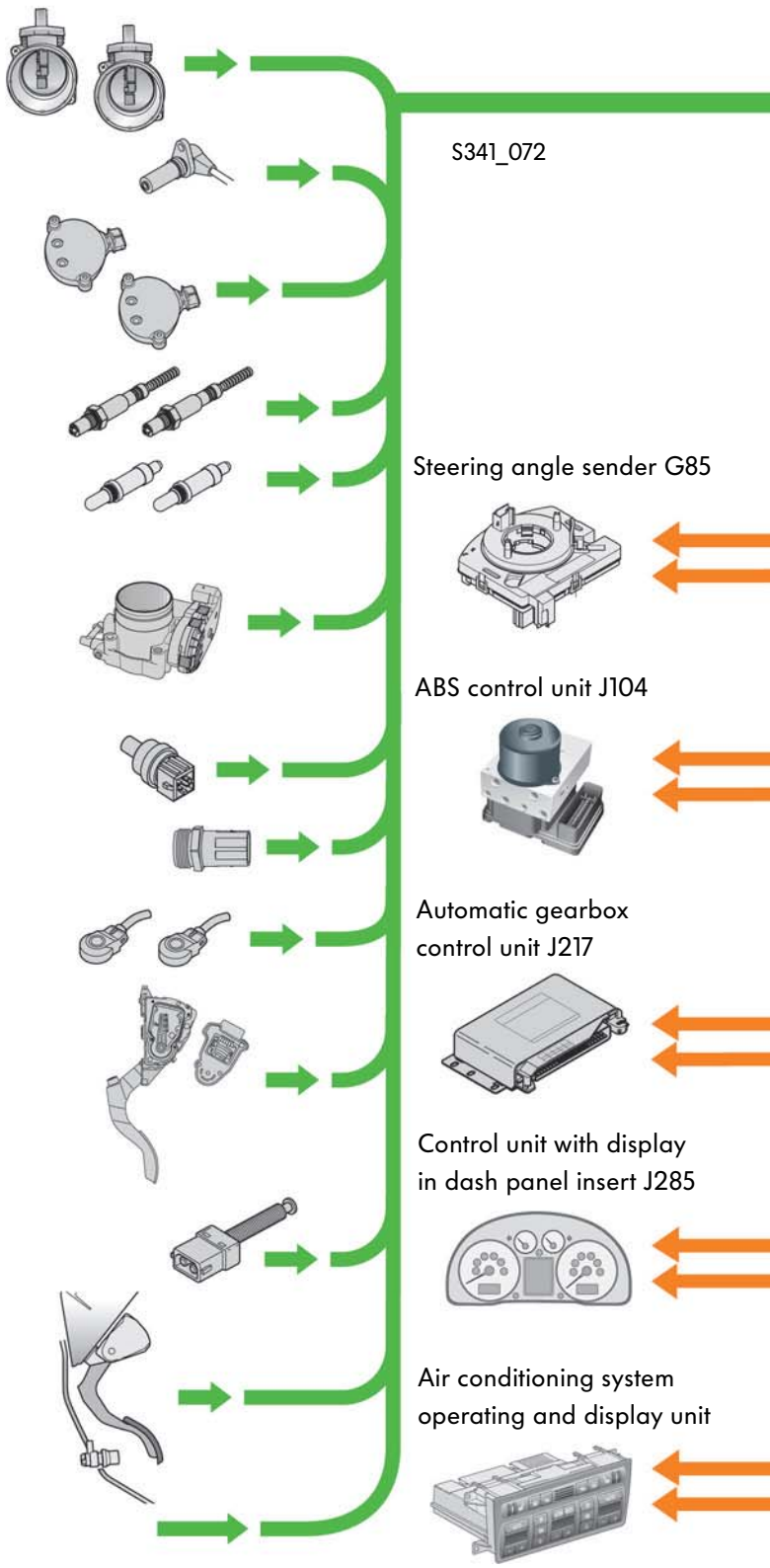
Knock sensor G61, G66

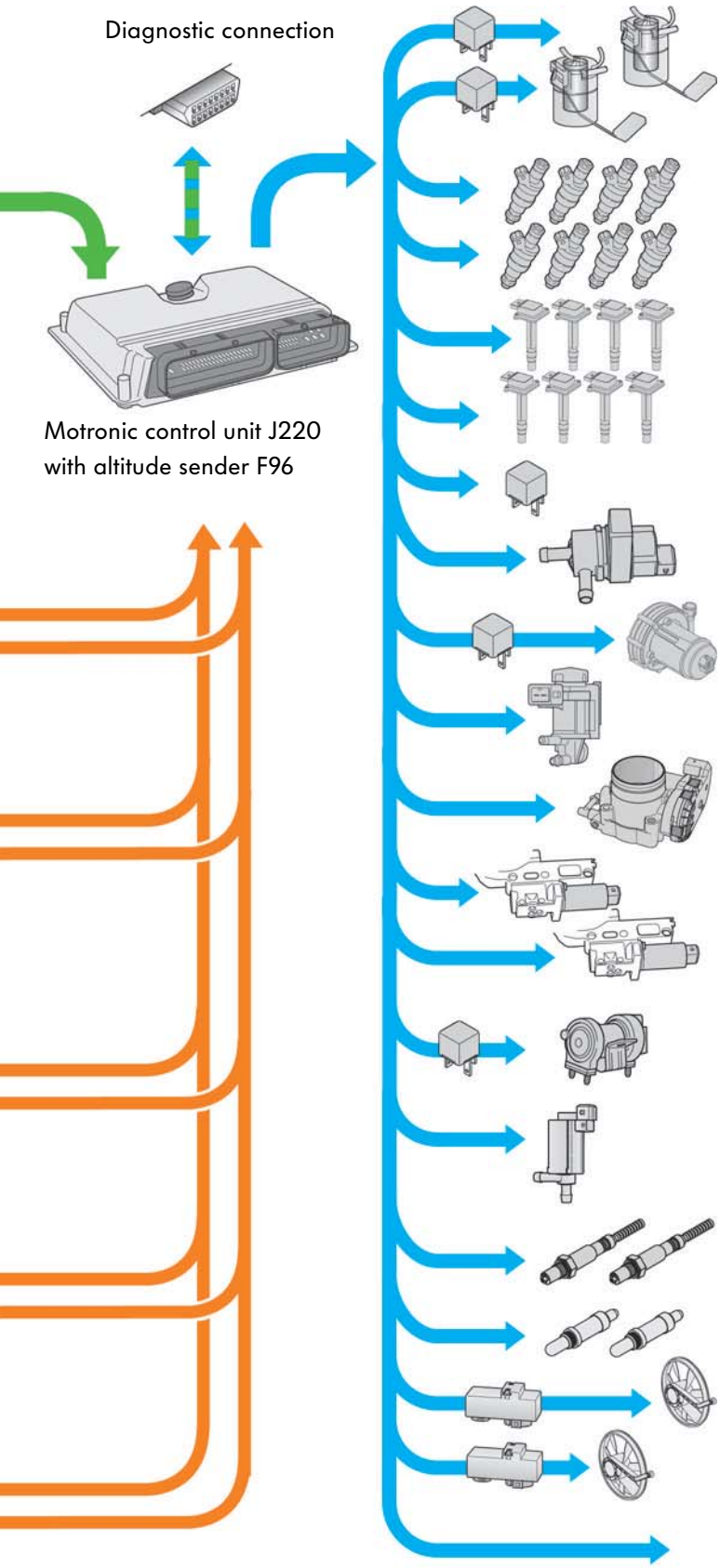
Accelerator position sender G79
Accelerator position sender 2 G185

Brake light switch F and
brake pedal switch F47

Kick-down switch F8

Auxiliary signals





Actuators

Fuel pump relay J17 and
fuel system pressurisation pump G6
Electric fuel pump 2 relay J49 and
fuel pump G23

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

Ignition coils with output stage
N70, N127, N291, N292
N323, N324, N325, N326

Motronic current supply relay J271

Activated charcoal filter system solenoid valve 1 N80

Secondary air pump relay J299
Secondary air pump motor V101

Secondary air inlet valve N112

Throttle valve module J338 with
Throttle valve drive (electric
power control) G186

Inlet camshaft control valve N205, N208

Continued coolant circulation relay J151
Water pump V36

Variable intake manifold change-over valve N156

Lambda probe heater Z19, Z28

Lambda probe 1 and 2 heater after catalytic
converter Z29, Z30

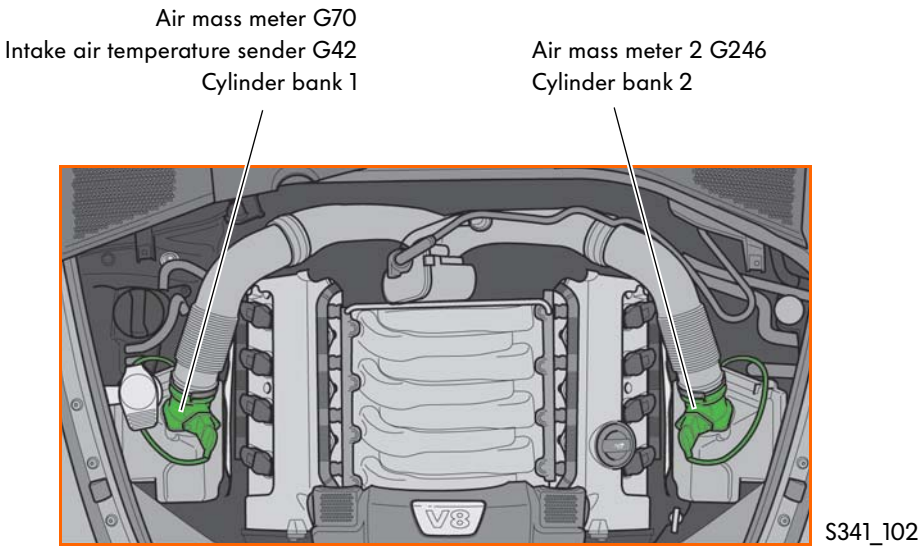
Radiator fan control unit J293, J671 with
radiator fan V7, V177

Auxiliary signals

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

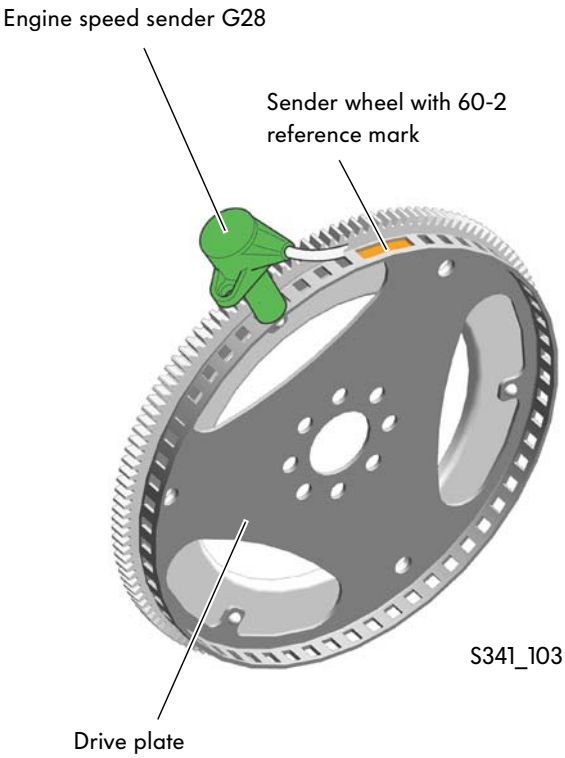
The engine speed sender is secured to the gearbox housing. It samples a 60-2 sender wheel, which is secured to the drive plate. Based on these signals, the engine control unit detects the engine speed and the position of the crankshaft. A segment gap on the sender wheel serves the sender as a reference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

Hall sender G40 and G163

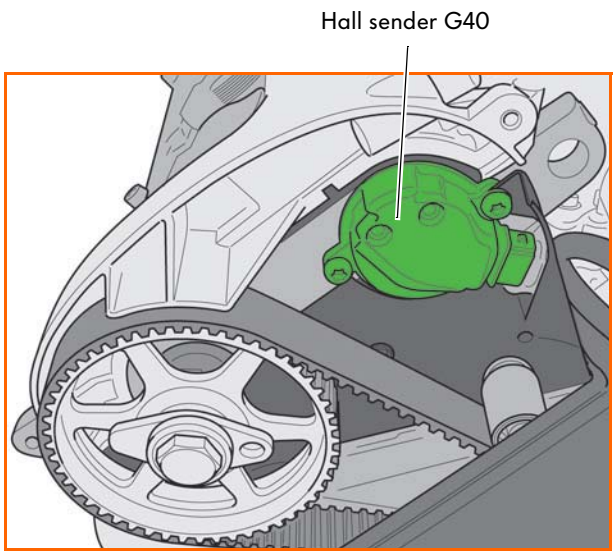
Hall sender G40 is located on cylinder bank 1, and hall sender 2 G163 is positioned on cylinder bank 2.

Signal usage

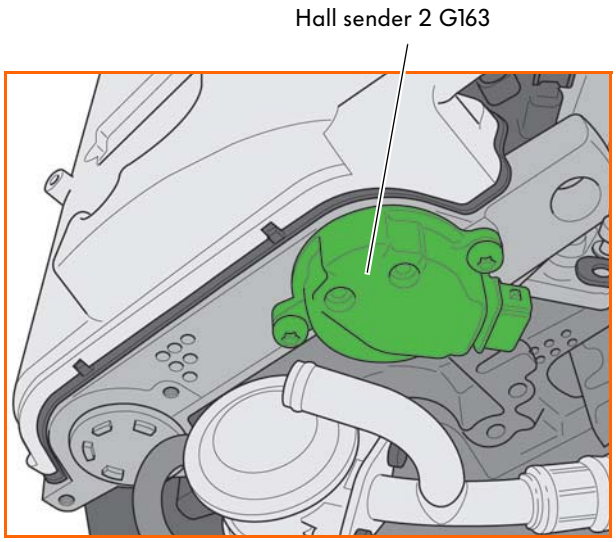
Thanks to the two hall senders, the engine control unit recognises the position of each cylinder bank's inlet camshafts. The signals are used for camshaft adjustment, and to calculate the injection point and the ignition timing.

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.



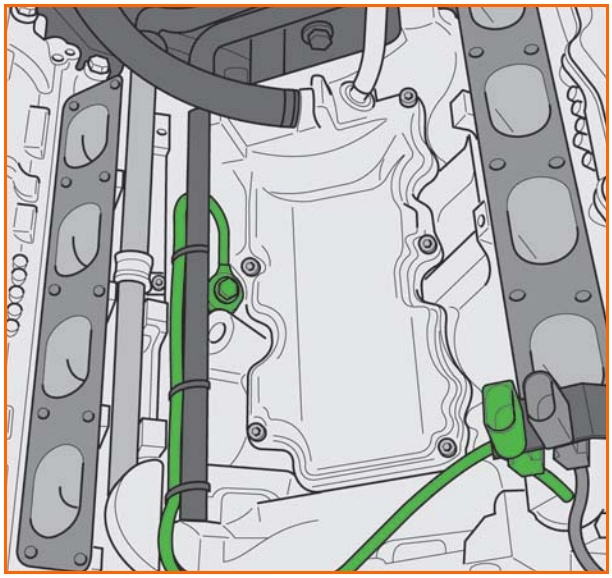
S341_099



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.



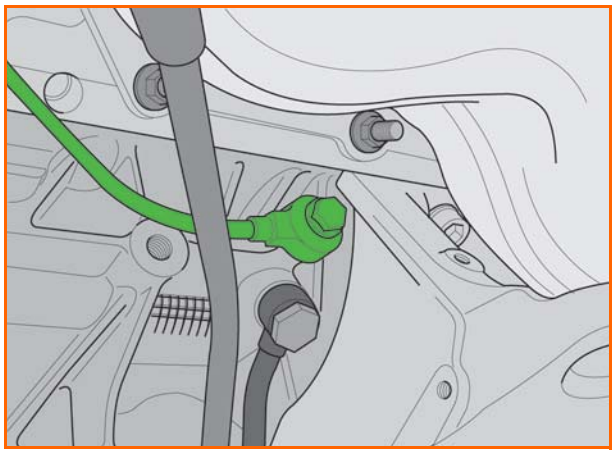
S341_083

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_079

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.

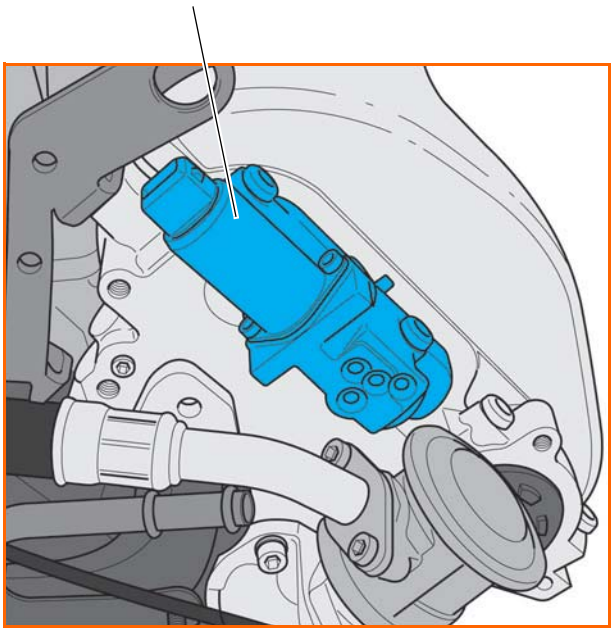
Task

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° in the "advance" direction.

Effects in the event of failure

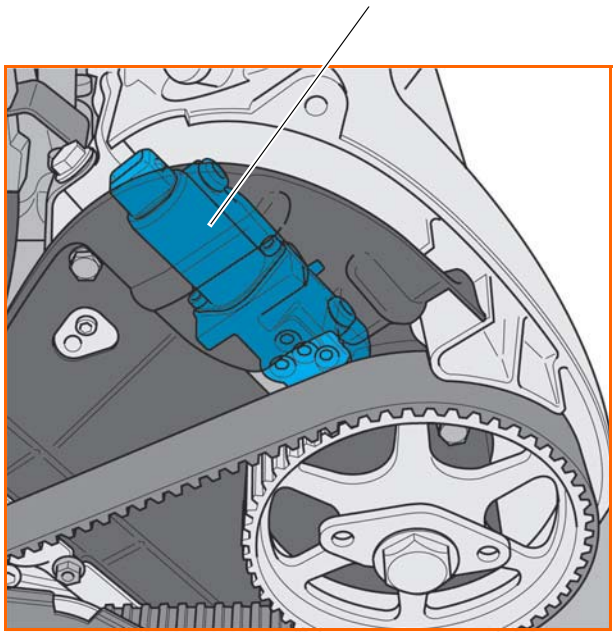
If an electrical cable to the camshaft adjusters is defective or a camshaft adjuster fails, no further camshaft adjustment is carried out.
Less torque is available.

Inlet camshaft control valve 1 N205



S341_100

Inlet camshaft control valve 2 N208



S341_101

Variable intake manifold change-over valve N156

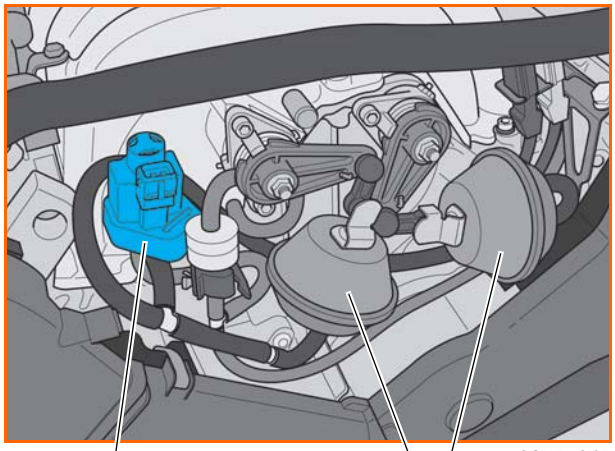
The variable intake manifold change-over valve is secured to the intake manifold on the toothed belt side.

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.



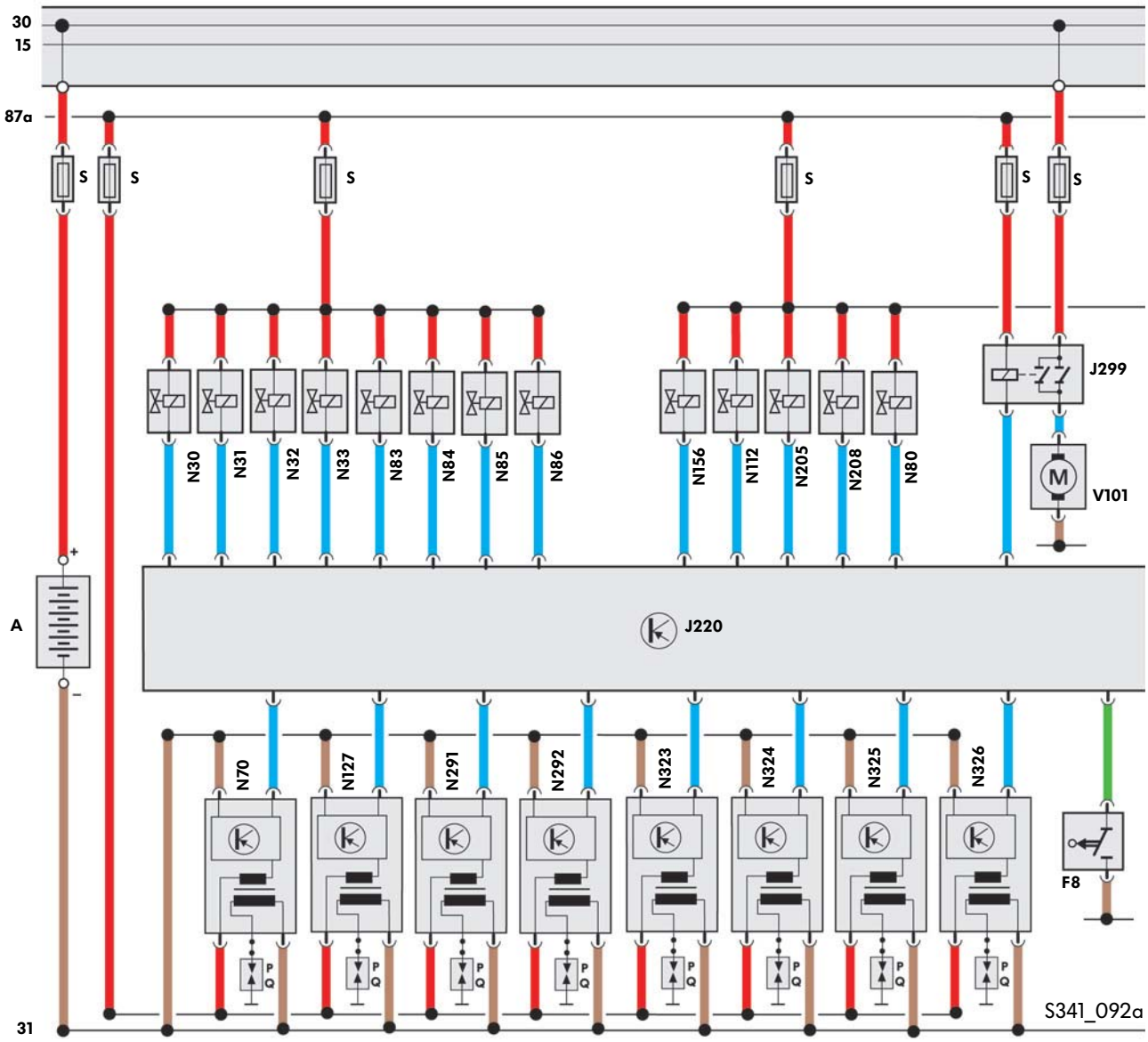
S341_081

Vacuum units

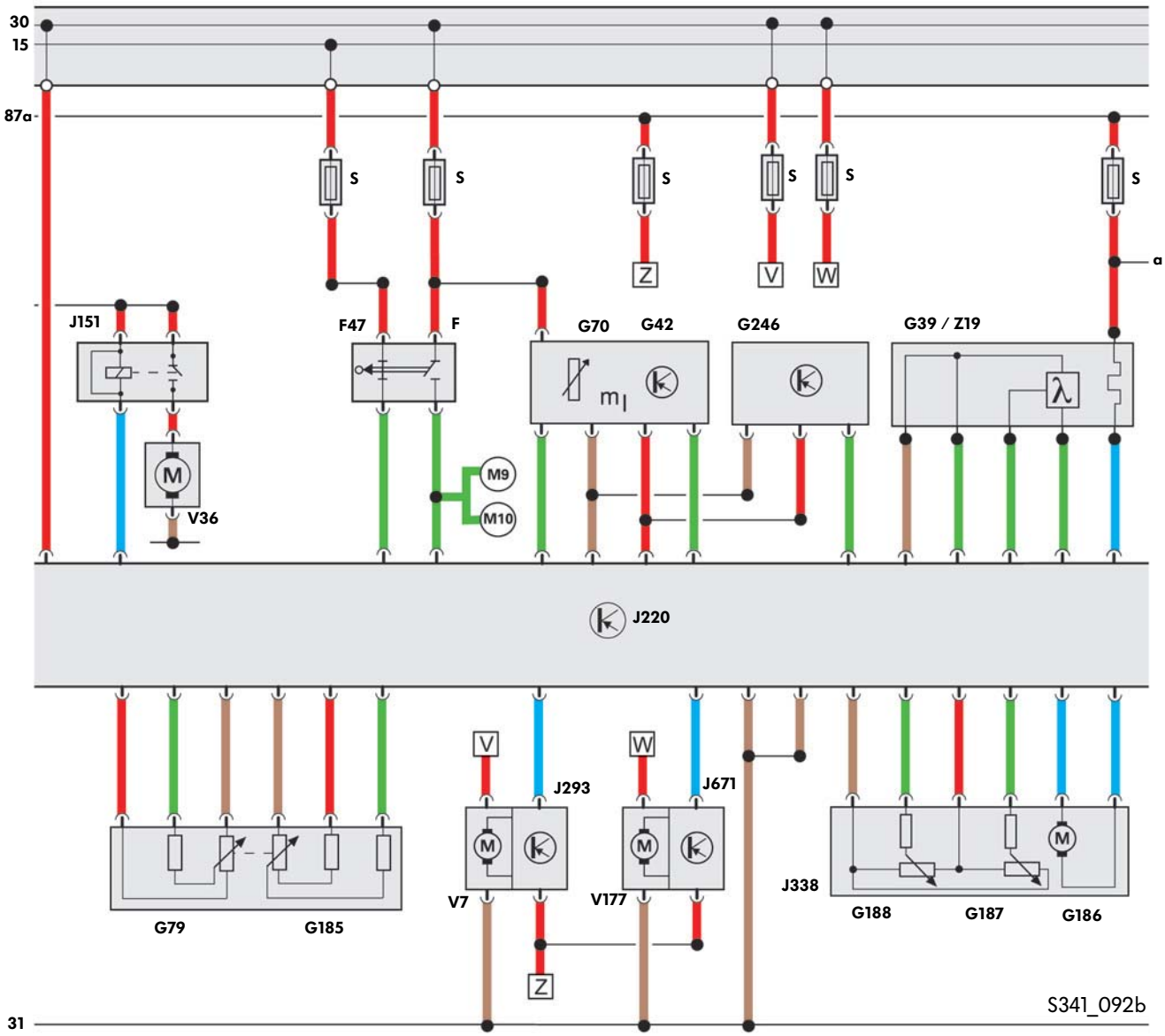
Variable intake manifold change-over valve N156

Functional diagram

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



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

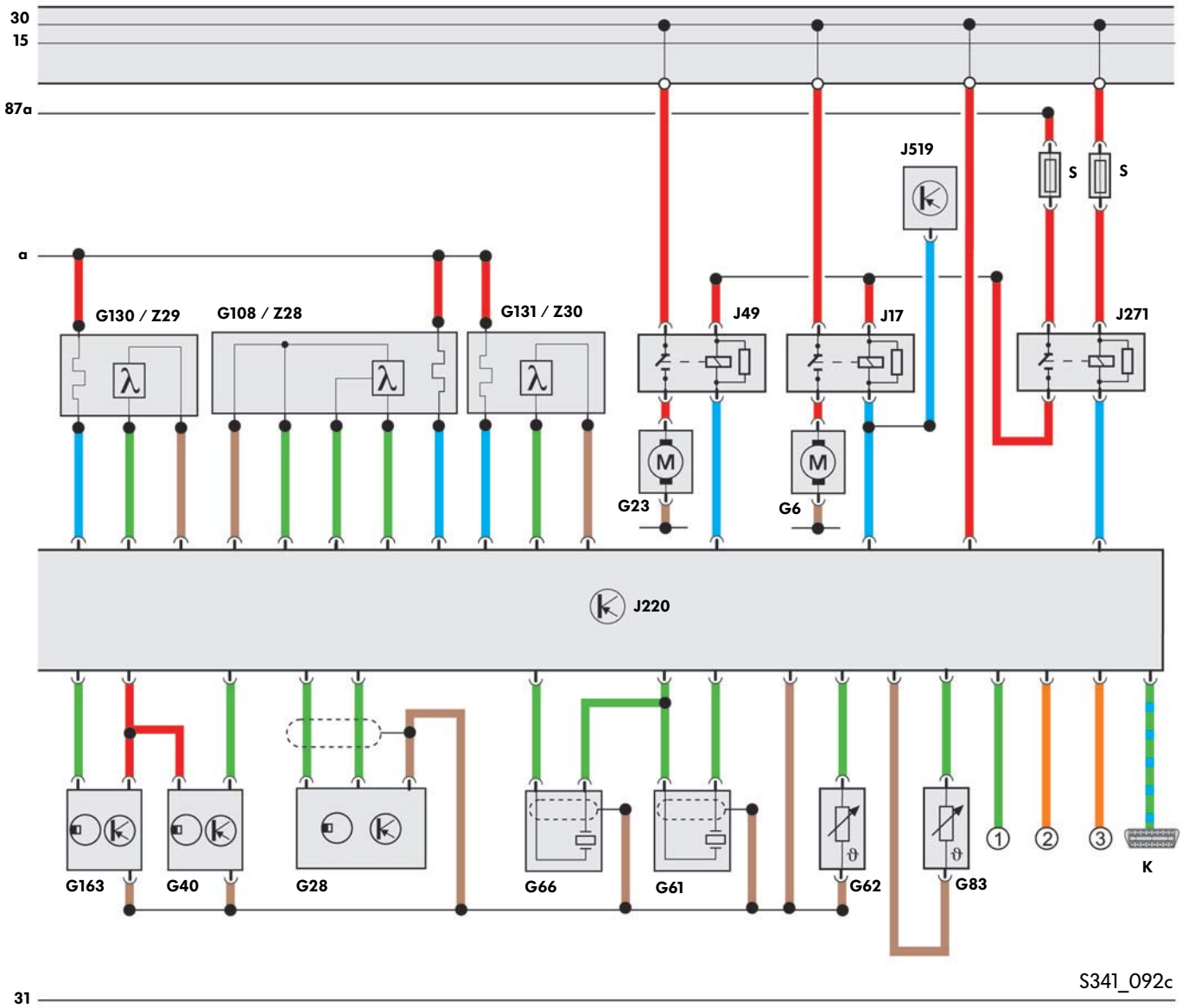


J271	Motronic current supply relay
J293	Radiator fan control unit
J299	Secondary air pump relay
J338	Throttle valve module
J519	Onboard supply control unit
J671	Radiator fan control unit 2
K	Diagnostic connection
M9	Left brake light bulb
M10	Right brake light bulb
N30	Injector, cylinder 1
N31	Injector, 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



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

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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